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GUIDELINES FOR Air and Ground Transport of Neonatal and Pediatric Patients

4th Edition

American Academy of Pediatrics

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GUIDELINES FOR Air and Ground Transport of Neonatal and Pediatric Patients

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Dedication

The editorial team for the 4th edition of *Guidelines for Air and Ground Transport of Neonatal and Pediatric Patients* is honored to present to the neonatal and pediatric transport community's work updating and revising our field's trusted reference. We are very appreciative of the numerous contributors, representing countless years of experience and wealth of knowledge. Reviewers and staff have worked tirelessly over 3 years to bring this revised edition to print. We would like to recognize the pioneers in neonatal and pediatric transport who persevered to establish the first unit-based or independent teams to bring transport services to critically ill children who benefited directly from their services. Although our specialty is still a relatively new field, it already has a rich history of accomplishments thanks to the efforts of everyday heroes and superstars. The editorial team has been devoted to ensuring that appropriate evidence-based conclusions and recommendations were included, when available, for the clinical and administrative subjects presented. We also dedicate this edition to transport personnel and patients who have been directly affected by tragedies and losses, hoping that we all learn from their legacies.

Mission Statement

There will always be enhancements to how the clinical outcomes of critically ill neonates, infants, and older children can be managed and improved. Ensuring that all children, regardless of where they live, have access to the latest and greatest offerings of specialized hospitals requires expert and timely interfacility transport.

The goal of neonatal and pediatric interfacility transport is to bring specialty hospital quality of care to the bedside of patients who are not in proximity to a tertiary care facility and to ensure safe transfer to the hospital that will provide their definitive care. Transport services must ensure patient, family, and staff safety while incorporating, whenever possible, state-of-the-art practices and technology. Many patients are at their sickest during transport. Transport providers often have a real opportunity to influence the course of illness of patients and to improve their outcomes.

On behalf of all who contributed, the editorial team hopes that the information and guidelines in this book will help enable health care professionals providing interfacility transport of children to complete this important work.

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CHAPTER 1

Organization of a Neonatal-Pediatric Interfacility Transport Service

Outline

- Background and principles of neonatal-pediatric interfacility transport
- Essential components of neonatal-pediatric transport services
- Impact of specialty neonatal-pediatric transport teams

Background and Principles of Neonatal-Pediatric Interfacility Transport

For many critically ill or injured patients, particularly those being treated at institutions that are unable to provide the level of care required, access to a skilled transport team is essential. Neonatal-pediatric transport is one component in the continuum of care in a system of emergency medical services for children (EMSC).

Regionalization of neonatal and pediatric intensive and specialty care services has driven the development of specialized transport programs that facilitate the safe transfer of infants and children between community and tertiary care facilities. In the United States, hospital-based neonatal transport programs were first created in the 1960s and 1970s, and similar programs for pediatric patients emerged in the 1980s. Whereas most neonatal and pediatric transport programs are affiliated with nonprofit tertiary care receiving institutions, there are a growing number of for-profit stand-alone aeromedical transport services with variable neonatal and pediatric expertise.

The period when a critically ill or injured infant or child is traveling between institutions represents a particularly vulnerable time for the patient. A qualified, highly trained, and well-prepared and equipped team is the key to providing optimal care during interfacility transport and to preventing deterioration or adverse events. All transitions of care must be seamless. The level of care and monitoring should not be significantly compromised by the need to travel between facilities. Ideally, the patient's condition may even improve because of therapies recommended by the medical command physician or initiated by the transport team, which might otherwise not be available until after arrival at the receiving hospital.

Before leaving the referring facility, thoughtful consideration must be given to the benefits and risks of specific interventions. This approach differs from the 'swoop and scoop' practice sometimes used during the prehospital transport of a patient from an accident scene to an emergency department (ED). Most neonatal and pediatric patients benefit more from a carefully coordinated and anticipated transport — with critical care therapies provided both before and throughout the transport, as necessary — than from a hasty transfer. The exceptions are patients with certain conditions, such as surgical emergencies, who require rapid access to services not available at the referring hospital or during the transport itself. An example is a child with an expanding intracranial hemorrhage who presents to an institution without neurosurgical capabilities.

Essential Components of Neonatal-Pediatric Transport Services

Like other parts of the emergency medical and critical care systems, a neonatal-pediatric transport program must be tailored to the specific needs and resources of the region served. Nevertheless, most of the larger transport services have certain organizational features in common. The most important is a dedicated team of trained health care professionals proficient at providing neonatal and/or pediatric critical care at the referring facility and in a mobile environment. Along these lines, there must be a sufficient number of critically ill and injured patients to enable team members to maintain their skills and to permit staff to be used optimally. Other key components include: (1) online (real-time) medical control by qualified medical command physicians; (2) well-equipped ground and/or air ambulances; (3) communications and dispatch capabilities; (4) prospectively written clinical and operational guidelines; (5) a comprehensive database allowing for quality and performance improvement activities; (6) medical and nursing direction; (7) administrative resources; and (8) institutional endorsement and financial support. Subsequent chapters discuss these components and other clinical and organizational factors in more detail.

In most programs, the transport team's composition is determined by preexisting policies and procedures, with modifications made depending on an individual patient's anticipated needs. For example, a neonatal team may typically dispatch 2 nurses but may add a respiratory therapist if inhaled nitric oxide therapy is likely to be initiated. Transport staff may include physicians, nurse practitioners, physician assistants, nurses, paramedics, and/or respiratory therapists. A team member's professional degree is less important than his or her ability to provide the level of care required in the transport environment. Providing critical care under transport conditions is significantly different from practicing in an intensive care unit (ICU) or ED. One cannot assume that a health care professional who is competent in the ICU will function equally well in the patient compartment of an ambulance or in an unfamiliar hospital ED.

In addition to their clinical expertise, team members must possess excellent interpersonal skills as well as the ability to improvise and solve problems. Moreover, additional training in transport medicine is mandatory. A senior member of the program who is experienced in transport and talented at teaching should oversee the training. The transport curriculum should include didactic as well as practical instruction in clinical and operational aspects of transport medicine. When supplementing the core transport team with staff who do not typically work with the team, some focused "just in time" training should be provided to orient the new personnel to the transport environment and familiarize them with essential safety procedures.

The referring physician is responsible for determining the resources needed during interfacility transport, according to federal regulations that govern the transfer of patients with emergency medical conditions. However, it is advisable that this decision be informed by input from the medical command physician, the transport team, and/or the vehicle operator, as appropriate. Ideally, a transport program should be able to provide or arrange transport by ground ambulance, helicopter, or fixed-wing aircraft. The recommendation for a specific mode of transport is based on factors such as patient condition and acuity; current and available levels of medical care; number of transport staff required; distance to the referring institution; traffic congestion; and weather conditions, among others. Although speed may be perceived as the highest priority, the safety of the crew and patient remains of paramount importance.

The number of team members dispatched for a transport is constrained by the size and spatial configuration of the vehicle used. Ground ambulances can typically carry up to 3 or 4 caregivers, helicopters can carry 2 to 4, and fixed-wing aircraft can carry 2 to 5. Whenever possible, the mode of transport should allow for the presence of at least 1 adult family member during the transport. Regardless of mode, the team must be able to mobilize and depart from its base quickly. Teams may be stationed at hospitals or strategic off-site locations.

A clear delineation of tasks performed by non-health care personnel from those performed by health care personnel optimizes safety, efficiency, and response time. The health care professionals on the team must be able to provide medical care without inordinate concern for the technical aspects of the transport. Similarly, the pilot or emergency vehicle operator must be permitted to function free of any distractions or emotive patient data that might impair his or her judgment. At the same time, adequate understanding of each team member's role can improve communication and teamwork.

Providing intensive care in a mobile environment can be challenging. Transport teams must function despite limitations in resources, mobility, and/or space. In addition, it may be difficult—sometimes even impossible—to assess a patient or perform certain procedures while working in a moving vehicle, especially a small helicopter. Therefore, major therapies needed to stabilize the patient's condition or to prevent decompensation en route should be considered or performed before departure from the referring facility. The provider's threshold for performing interventions, such as airway management, may be lower than if the patient were already at the tertiary care center because of the differences in environment and resources during transport.

Consideration should be given to establishing policies that support the transport of infants and children back to their referring facilities when further inpatient care remains necessary but the specialized resources of the tertiary center are no longer required. Transfer agreements specific to each referring institution can be useful, especially if these include criteria for patient acceptance and return transport. Reverse transport encourages efficient use of the region's neonatal and pediatric critical care resources and promotes cooperation among institutions. One potential problem with this practice is that third-party payers may challenge the necessity or benefit of back transport and deny payment for the cost of the return trip. Lack of insurance coverage can put undue stress on the referring and/or receiving hospital or ultimately become the nonreimbursed responsibility of the patient's family.

Impact of Specialty Neonatal-Pediatric Transport Teams

Regionalized neonatal and pediatric intensive care services improve patient outcome. Likewise, there is a potential benefit to infants and children from transport by teams with specialized neonatal-pediatric critical care training and experience who interact closely with experts at the tertiary care center.

As with other areas of pediatric health care, not all institutions or regions have access to a specialized neonatal-pediatric transport service. In locations where the available critical care transport team primarily serves adult patients, it may be desirable to have hospital-based neonatal or pediatric specialists accompany the team to provide additional expertise. Prior to the transport, however, hospital-based providers must be oriented to equipment and understand safety considerations. Such cooperative relationships should be extended proactively to include educational activities and case reviews, for the benefit of all parties involved.

In other regions, there may be multiple neonatal-pediatric transport services. In these locales, it is important that the services communicate and cooperate with each other. From the referring hospital's perspective, the use of common patient care protocols and procedures reduces variability and confusion and may improve customer satisfaction. Merging individual programs into a regional transport consortium should be considered, with the expectation that a regional consortium may be more efficient and effective.

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CHAPTER 2

Transport Program Administration

Outline

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Like other organizations, transport teams require a clear vision to achieve objectives and enable managers and administration to meet important organizational goals. Within this framework, administrators who are part of the team, within the sponsoring organization but not part of the team, and from referring hospitals must all understand the team structure and function. As with many businesses, transport systems must operate within justifiable and often relatively fixed budgets. In this chapter, we describe administrative issues important to successful administration of a transport team.

This chapter makes reference in general to transport team leadership, hospital administrators, and transport administration. Administrative roles, leadership qualifications, and responsibilities are discussed more specifically in Chapter 4. Reference to transport team administrative leadership in this chapter refers to titles such as *transport team program director, transport team medical director,* and *transport team coordinator*. Hospital or institutional administrative leadership refers to members of the hospital administrative leadership team responsible for program coordination, development, and monitoring.

What Is a Mission Statement? Will it Help?

Business authors suggest that mission statements are plans that allow an organization to direct efforts that address critical strategic objectives.[1–4] In other words, a mission statement helps an organization stay on track by creating a template for goals and objectives and a measure by which to judge success. Unlike vision statements that describe an organization's philosophy and aspirations, mission statements help an organization develop short-term objectives to meet immediate goals. The best mission statements are developed as part of a strategic planning process, and input is solicited from all stakeholders, perhaps even competitors. Ideally, a mission statement is created after an environmental or SWOT (strengths, weakness, opportunities, and threats) analysis has been performed and goals and objectives have been stated. A mission statement should be logical, clear, and concise. It will be a more valuable tool if it is simple enough to be understood, real enough to be practical, and able to be recited by all members of the organization. Ideally, the statement is short enough to be memorized and sincere enough to be believed by all levels of the organization. As a tool, the mission focuses organizational efforts on the tasks at hand. The mission statement should reflect the transport team goals but should also incorporate and support institutional goals. Once developed, the statement must be disseminated widely to reach all stakeholders. Because its scope is short-term, a mission statement requires frequent revision. Because organizations are unique, mission statements will reflect the unique aspects of the organizations that develop them. Similar to other organizations, transport teams can benefit from strong mission statements that reflect the goals of the institutions they represent. Although teams could develop independent statements, they would be less meaningful if not in concert with the mission of the sponsoring organization. Proposals for additional resources or programs should reference the sponsoring organization's mission statement and describe how the proposed change will help the sponsoring hospital meet its objectives. Similarly, core services must be consistent with the organization's and the team's missions.

Effective Administration

Although the transport team members might serve in administrative and clinical roles, the team also requires support from the sponsoring organization's administrators. Ideally, one person will be assigned as the administrative liaison to the transport program and will be responsible for managing and monitoring issues related to team functions that are under the purview of hospital administration. The administrative liaison supervises contracts, the financial impact of the transport team on the sponsoring institution, and other issues of institutional interest. Because the liaison may not have extensive clinical transport experience, it becomes important for the transport team leadership (ie, transport team program director and transport team medical director) to educate and partner with the liaison concerning issues related to clinical care. Effective communication with institutional administrators will improve the transport team's ability to gain additional resources when the need arises. In many hospitals, nursing resources are evaluated and allocated by nursing supervisors on a shift-to-shift basis. When transport team members also serve as staff nurses in the hospital, their patient assignments should be flexible enough to be easily and efficiently transferred should a call for transport be received. When staffing is limited and a transport nurse is without a patient assignment, justifying the down time to non-transport personnel or managers can be as challenging as reassignment without planning for a potential transport. Asking or expecting a transport nurse to take a patient assignment that cannot be easily transferred causes delays in departure when an urgent transport request arises. There may be creative opportunities to utilize transport personnel down time, such as using the procedural skills of the transport team elsewhere in the facility (eg, ancillary intravenous team). Because the transport team will not always be available, if these services are vital and expected by the hospital, the transport team can offer staffing assistance but should not assume total responsibility.

One way to mitigate the issues mentioned previously is to develop a dedicated transport team. The costs may be higher; however, mobilization times will be better, and in-house patient care will not be interrupted while the nondedicated team member transfers care to another hospital staff member to be freed up for transport-related responsibilities. In turn, the team members can assist the staff with components of care such as intravenous catheter insertions, intake evaluations, or procedures that allow them to leave quickly in the event transport services are needed.

It is important for the transport team's leadership personnel to have knowledge of the financial health of the program and its impact on the financial status of the sponsoring institution. They should be conversant about the team's finances and have recent data that describe the team's activity, referral base, and costs. Because the transport team's direct costs might be high, it is imperative that the team's leadership maintain an understanding of financial issues related to team operation and how the team affects the hospital's margin. Active involvement of the hospital's finance department can prove valuable. Appropriate financial information should be available to leadership of the hospital and the transport team to enable them to make the most appropriate fiscal decisions. When it becomes necessary to justify the cost of the team to the organization, it is extremely helpful to look at the downstream revenue that is provided by bringing that patient into the facility. In the event a facility completes third-party transports in which patients are picked up and delivered to other facilities independent of their own, appropriate contracting and procurement of all expenses are necessary to make this financially sustainable.

It is important to cultivate relationships with referral facilities to improve market share and the quality of patient care. In the current financial climate, many smaller hospitals are decreasing pediatric subspecialty services and referring more children to tertiary pediatric facilities. Transfer agreements that define the responsibilities of the referring and receiving hospital are being more frequently used. Typically, transfer agreements establish policies that clearly define administrative procedures, professional responsibilities, and patient care goals. Many transfer agreements determine the level of care expected at each facility and might also address reimbursement issues. These agreements might also guarantee or streamline acceptance of acutely ill patients by the receiving hospital and establish the expectation that chronically ill and recuperating patients will return to the referring facility in a timely manner. Transfer agreements must, however, comply with local, state, and federal mandates such as the Emergency Medical Treatment and Active Labor Act (EMTALA [42 USC §1395dd]).

Effective relationships between the administrative staffs of referring and receiving hospitals will improve the ability of each facility to monitor transfer activity and intervene when problems are at a manageable stage. Because negotiating authority might rest with nontransport administrative and the legal staff of referring and receiving hospitals, it is the responsibility of transport team leadership to educate and partner with those participants about neonatal and pediatric transport team services.

How to Manage

Management texts suggest that leaders identify and communicate a vision consistent with the direction of the organization. They understand where the organization is going and work to move the organization in an appropriate direction. Managers are responsible for implementing the leader's vision through a clearly articulated mission that is supported by goals and objectives. All managers must also be leaders and direct subordinates to accomplish goals and objectives that satisfy the organization's mission. An important feature of an organization's leadership is the degree to which managers and leaders are accountable for their performance. Both should be accountable to stakeholders for accomplishment of goals and objectives.

Adults are intrinsically motivated and invest in that which is valuable to themselves. The effective manager understands that employees seek work that is valuable, sustains an important self-image, and allows individual aspirations to be met. To negotiate successful assignments, managers must clearly communicate expectations, define the expected quality and quantity of the finished assignment, identify a deadline, and identify available resources. When justified, the manager may need to make additional resources available. An effective manager monitors progress and offers appropriate feedback. The successful manager is a good coach who supports and encourages team members while holding them accountable for their performance.

Cost, Quality of Care, and Staff Education and How They Interact

Transport teams are expensive. The cost to provide the service includes vehicle maintenance and repairs (these are significant costs even if the need is met by a vendor contract), the cost of durable equipment (eg, monitors, infusion pumps), the cost of disposable supplies (eg, syringes, tubing), medication costs, the expense to maintain a communications center (possibly its own cost center with component costs), marketing costs, insurance, staff continuing education, and personnel salaries and benefits. As in other areas of health care, personnel costs remain the largest share of a transport team's budget. Transport team staff might be more expensive than some other hospital departments' staff, because they tend to be more experienced and have greater seniority.

Transport equipment may have the same capital outlay of standard hospital equipment, such as monitors, infant incubators, and stretchers; however, the expected life span of most transport equipment is only about 75% the life expectancy of other hospital equipment. This is because of the manner in which it is used, getting it in and out of the ambulance or helicopter, tracking it over rough terrain, the vibration of sensitive electronic equipment during transport, and having it fall to the ground when not appropriately secured. In-house equipment that is permanently mounted to the wall for use has a much greater chance of reaching expected usefulness.

Transport team staff may require additional education to provide the level of care required in the field. Recent work published in the nursing literature suggests that the increased cost to educate transport staff members is a worthy investment. Prowse and Lyne[5] suggest that knowledge gained from literature and lectures becomes effective and clinically useful when placed into context by practice. Regardless of their personal knowledge base, the participants in that study were noted to improve effective (practical) knowledge through exposure to new information (study of the literature or participation in discussions regarding a topic of interest) and practical application. Furthermore, participants were motivated to improve knowledge by a significant clinical event and the desire to improve their personal practices.

Gaining and maintaining emergency skills that are high risk/low volume, such as endotracheal intubation, needle thoracotomy, intraosseous needle insertion, and umbilical artery (UA)/umbilical vein (UV) catheter insertion, is standard for most programs that conduct neonatal transports. Acquiring and maintaining these competencies can be challenging. The implementation of medical simulation centers is rapidly gaining popularity for the training of physicians, nurses, and emergency medical services (EMS) workers. When staff members do not have opportunities to perform these skills on a regular basis, using patient simulators can fill in the gap. The cost of this technology is expensive—a basic infant mannequin for intubation may run as low as $200; however, an infant simulator may start at $60 000. Research, however, demonstrates that simulation improves learning.[6] For teams that perform neonatal, pediatric, and young adult transports, an initial investment for simulators and the time investment to write and program scenarios with feedback mechanisms can easily run $500 000. And with such sophisticated equipment that is more labor intensive to set up, it is most beneficial to develop an entire simulation education center where the trainers are set up and ready to go for all clinical areas. Using such a center for the training of all critical care staff will help to spread the cost over many critical care units so that transport does not carry the increased financial burden. Using the simulator environment also helps improve team cohesiveness and communication.

Other work suggests that, in addition to improving personal and effective knowledge, elevating the level of staff education and the calibers of educational programs are associated with improved clinical outcomes. Aiken et al[7] noted that the risk of mortality was lower and patient outcomes were improved in surgical units staffed by bachelor-prepared nurses. White[8] demonstrated the ability of a nursing intervention program to directly impact patient care by improving pain assessment management by nursing staff for postoperative patients.

Medical transport leadership should have a systematic process that allows them to design and implement effective interventions to improve the quality of the services they provide. Transport team administrations have a significant level of readiness and action for quality improvement, but often, this action is carried out without the infrastructure of appropriate policies, procedures, and the development of a strategic initiative and environment. Managers and decision makers should decide the scope of the quality program they need to implement, which will depend on the structure and outcomes experienced by the transport program. Transport programs should develop robust quality improvement programs with the goal of providing the best possible clinical care while demonstrating fiscally responsibility and resulting in desirable outcomes for patients, their families, and transport personnel.

In today's health care environment, just as in the hospital or provider setting, the transport program must enhance its internal quality improvement and monitoring efforts to better plan and deliver care rendered to patients, thereby improving outcomes, yet be flexible enough to adjust accordingly in a constantly changing health care environment.

Time and money invested in transport team equipment, quality programs, and staff education is well spent. Orientation programs must develop a basic level of knowledge required to allow staff to care independently for patients in the field. Quality-improvement strategies must be embedded in each of the processes the transport team executes. Continuing education is clearly important to increase referential knowledge with the hope that it will become effective knowledge with increased experience. In the final analysis, hard evidence of quality improvement with measured outcomes and improved education of transport staff translates into improved patient outcomes.

Scope of Practice and Licensure and Certification Requirements

Licensure and certification are requirements used to encourage advanced education among staff members. Many transport teams require various certifications as a method of improving staff competence and ensuring a core knowledge base. Available courses include but are not limited to the following:

- Advanced Cardiac Life Support (ACLS)
- Basic Life Support (BLS)
- Pediatric Advanced Life Support (PALS)
- Advanced Pediatric Life Support (APLS)
- Neonatal Resuscitation Program (NRP)
- Trauma Nursing Core Course (TNCC)
- Emergency Nurses Pediatric Course (ENPC)
- Certified Pediatric Emergency Nurse (CPEN)
- Critical Care Emergency Medical Transport Program (CCEMTP)
- S.T.A.B.L.E. (Sugar, Temperature, Artificial breathing, Blood pressure, Lab work, and Emotional support)
- Advanced Care of the Resuscitated Newborn (ACoRN)
- Critical Care Registered Nurse (CCRN) Certification in Neonatal/Pediatric Transport (C-NPT)
- Neonatal/Pediatric Specialist Credential (NPS) (respiratory therapy)
- Pediatric Education for Prehospital Professionals (PEPP)
- Advanced Trauma Life Support (ATLS)
- Basic Trauma Life Support (BTLS)
- Pre-Hospital Trauma Life Support (PHTLS)

Each course exposes participants to issues important to the assessment, stabilization, and management of critically ill and/or injured pediatric and neonatal patients. Because the causes and manifestations of respiratory failure, shock, cardiopulmonary arrest, and arrhythmias in children differ from those in adults, it is imperative that teams transporting neonates, infants, and children thoroughly understand the principles of neonatal and pediatric resuscitation. One should not assume or promote competency in neonatal-pediatric transport based solely on personnel attendance and successful completion of certification courses. These courses must be accompanied by significant additional and ongoing education, exposure, and experience to maximize clinical competence and quality of care.

Transport team leadership should determine educational and certification requirements for team members. Teams that transfer only neonatal patients might require certifications specific to their patient population, whereas teams that transfer neonatal patients, pediatric patients, and adults will have additional requirements. Each organization and team member must be committed to the care of critically ill patients. Further education and certifications will provide team members with the necessary knowledge to provide the required care for critically ill children. Registered nurses, respiratory therapists, and paramedics enter their professional life through various educational routes (associate's degree, bachelor's degree, or master's degree); many teams are requiring staff to have bachelor's or master's degrees.

Attending physicians who provide medical control to the team must be licensed to practice medicine in the state where the base facility is located, and ideally, they will be trained and certified in pediatric emergency medicine, pediatric critical care medicine, pediatric cardiology, or neonatology. If physicians in training (fellows or residents) are part of the transport team, requirements for participation must be developed. Many programs require fellows who participate in transport to have advanced clinical experience in resuscitation and advanced airway skills. Compliance with fellowship training requirements and prerequisite training for clinical transport should be documented by the fellowship training director.

Licensure to practice is a state requirement, and transport team members must be licensed for their profession according to the regulations of the state in which they work. Individual states might require that health care professionals retrieving and treating patients in a state other than that of their base of operations maintain the same credentials as health care professionals practicing in that state or might request a copy of the credentials for the same health care professionals. Paramedics have the option of national certification, but state licensure is typically still required. Accreditation by The Joint Commission requires the base hospital to maintain records of licensure and certification as part of employment files. Similarly, physician-credentialing files should include evidence that medical licenses, board certifications, and other required endorsements are current.

Accrediting bodies such as The Joint Commission may ask hospitals to produce evidence that the programs with which they contract, such as transport services, possess appropriate credentials to provide this service. This typically occurs during their "patient tracer" process, in which they follow a patient through the system from start to finish. Given that it is the referring facility's responsibility to call an appropriate team, they may ask for evidence that the team a facility calls to perform this service is appropriate. They may ask for evidence of licensure of individual team members or proof that they are capable of caring for individual populations of patients (eg, NRP, PALS, ACLS). It is, therefore, prudent for transport programs to maintain accurate and current credentials of all team members in the event they are audited or one of the transports they completed is chosen for an "individual tracer" by The Joint Commission. Standard operating guidelines, protocols, and scope of practice should be defined for transport team members by the team's leadership. Protocols allow the team to function if there is a change in a patient's condition and the medical control physician cannot be immediately contacted. Because changes in condition can occur that require treatment but are not covered by a physician's orders, standard operating protocols provide consistent guidance until contact with the medical control physician can be reestablished.

The scope of practice defines a skill set for each team member. Periodic assessments of skill to determine competence should be performed and the results documented in personnel records. If the team is not able to provide an appropriate life-saving (ie, establishing an airway or providing cardiopulmonary resuscitation) intervention because specialty equipment, medications, or personnel is needed, the team should divert to the closest appropriate hospital. Transport team personnel should notify the receiving hospital of the diversion and the patient's status as soon as possible. No transport personnel should be placed in a position of monitoring, administering a drug, or performing a procedure outside their scope of practice or in an unstable environment.

According to the EMTALA, the referring physician has the final responsibility for the appropriateness of the transferring team and personnel (along with mode of transport; see Chapter 7 on legal issues). Ideally, this decision is accomplished in conjunction with the transport team and/or receiving personnel. These decisions must be made on the basis of the severity of the patient's illness, physical assessment findings, treatment requirements, and support requirements. To make the best decisions for patient and employee safety, knowledge of the transport environment and local options for transfer should be understood. At all times, the transport team should be well versed and trained in the care and support of critically ill neonatal and pediatric patients.

Transport in Support of Resident Education

Interfacility transport requires a unique set of skills, distinct from the traditional training of most hospital-based residency training programs. It is essential that personnel used to provide care during interfacility transport be properly trained, familiar with the unique demands of providing care during ground or air transport, and prepared to handle the variety of patient contingencies that might occur during transport. Providing an educational experience for residents in transport medicine is desirable but may present challenges in the service area. Because patient care must not be compromised, personnel in training who are not trained or capable of fully participating in the care of the patient should not replace experienced transport team members. Practically, space for inclusion of additional personnel in training during the transport process might be an issue with limited space vehicles. The Accreditation Council for Graduate Medical Education (ACGME) states that general pediatrics residency training programs must offer residents a minimum of two 1-month blocks of pediatric emergency and acute care medicine and exposure to emergency medical services. Given these requirements, it would seem that active participation of pediatric residents on transport teams is desirable, but this must be accomplished in a manner that ensures maximal quality and efficiency of the care provided. Furthermore, ACGME work-hour constraints might present programmatic challenges for programs interested in including a transport rotation or transport call to augment the emergency and acute care medicine requirements.

Residency and fellowship training programs that include transport medicine as a rotation should develop specific curricula for physicians in training. To be consistent with ACGME requirements, the syllabus should reflect specific educational goals, expectations, and measurable objectives. An assessment of the trainee's performance that measures the degree to which educational objectives were met is required at the completion of the rotation.

Finally, adherence to resident work rules, which limit the number of continuous hours house staff may work and the cumulative hours of work in a given week, is mandatory.

Because traditional rotations in the pediatric residency are geared toward managing inpatients and ambulatory care patients, pediatric residents might not be specifically educated about the management of critically ill transport patients. If pediatric residents are to be part of a transport team, specific transport, critical care, and neonatal medicine education should be developed and presented before these physicians are included in the transport process. Studies are warranted to determine whether pediatric resident involvement in a transport medicine rotation improves the resident's level of skill and confidence and adds value to the service.

To ensure the quality of patient care, scopes of practice, policies, and educational guidelines must be developed to outline duties of all personnel, including physicians in training (residents and fellows) who serve on transport teams. A separate training curriculum should be developed that includes instruction in pretransport evaluation, triage, communication, transport safety, and medical management of critically ill patients who require transfer. Specific educational needs can be identified by a thorough practice analysis. These analyses will be required to identify knowledge gaps and steer the development of bridging curricula.

Insurance Needs and Options

Participants

Because transport team members are exposed to activities that might place them at greater risk of injuries or death, program administrators are often asked to provide additional insurance coverage for them while in the transport environment. Team members must be adequately covered for the risks undertaken during transport on a daily basis. Unlike personnel who function solely in a hospital environment, transport team members are exposed to a higher risk of accidents during ground and air transports. Although it has been determined that collisions and crashes by pediatric and neonatal teams are uncommon, collective data suggest that 1 collision or crash occurs for every 1000 patient transports. Collisions or crashes involving injury or death are less common and occur at rate of approximately 0.546 per 1000 transports. Although death occurs most frequently as the result of aircraft crashes, ground collisions accounted for most transport-related injuries. Injuries sustained during ground collisions tend to be moderate to severe and in a category that can affect a victim's ability to work (see Chapter 10).

Patients

Hodge[9] stated that the growth of managed care has provided health benefits to millions of children while attempting to control the increase in health care costs. Transport team administrators find that third-party payers frequently require preapproval for transport coverage. Many programs have found it important to work proactively and partner with third-party payers and define groups of patients who will meet criteria for transport. Medicaid rules and notification requirements are different in each state, and, as new programs are developed, Medicaid reimbursement can be adjusted or denied. It is, therefore, important for transport team administrators to remain aware of Medicaid reimbursement rules and trends in their respective states to ensure optimal Medicaid reimbursement. Approval for transport is not synonymous with payment for that transport. Authorization is usually provided ahead of time for the physical transport itself, and payment is usually authorized after the transport is completed and may be based on the documentation provided to substantiate the need for the transport itself, the team involved, and the mode of transport selected. This is vital for programs that serve multiple states by virtue of location or specialty service. For those who currently, or foresee, transfer and care of patients with out-of-state government sources of reimbursement, anticipatory negotiations can reap significant dividends for patients, families, and transport and hospital services and can increase efficiency of the entire process.

Federal regulations protecting the right of patients to receive adequate emergency evaluation and care have been in effect for some time. It is important that transport personnel understand COBRA (Consolidated Omnibus Budget Reconciliation Act [Public Law No. 99-272]) and EMTALA regulations and requirements that must be met by referring and receiving facilities before a patient is transferred (see Chapter 7). Patients must be adequately evaluated in the facility from which they seek initial care, life-threatening conditions must be stabilized to the best of the providers' and facility's capabilities, and a facility that can provide an appropriate level of care for a patient's condition must be located and a receiving physician must accept care of the patient before transport to comply with EMTALA guidelines.

Stabilizing medical care for critically ill children must be provided regardless of the family's ability to pay or the patient's insurance status.

Relationships With Referral Personnel

It is not uncommon for neonatal-pediatric transport teams to coordinate patient care and transfer. Referral personnel and organizations can benefit from development of a professional working relationship with the receiving facility. It is not uncommon for facilities to refer patients because of managed care contracts. Transport teams can collaborate to facilitate transfer of patients to appropriate levels of care. It can be cost-effective for teams to work together when providing staff education opportunities and periodic tabletop transfer scenario drills.

Teams that perform only ground transports should develop a strong working relationship with services that provide rotor- and fixed-wing transports (and vice versa). This relationship will allow for optimal coordination of transport efforts when requests for critically ill children are time-sensitive or involve long distances. Patient transport care and options should not be limited to the services provided by a local or preferred vendor or service if that vendor or service has a limited array of transport staffing or transportation mode alternatives.

Patient Condition for Transfer

Stabilization of the patient before transfer should include adequate evaluation and initiation of treatment to ensure the transfer will not, within reasonable medical probability, result in death or loss or serious impairment of bodily functions, parts, or organs. It is recognized that there are times when complete stabilization is not possible because the referring facility does not have the personnel or equipment needed. In such cases, the patient should be stabilized to the best of the ability of the referring physician, staff, and facility and then promptly transferred by the most expert and available personnel. No transfer should be made without the consent of the patient and/or family and receiving physician and confirmation that there is a bed available and a named receiving physician at the receiving hospital's respective unit. Transfers from patient care areas of an acute care hospital require that the patient (when applicable) and the family be informed of the reasons for transfer and the destination proposed by the transferring facility. The family's (and patient's, when applicable) written consent for the transfer should be obtained, if possible. For patients who are wards of the state or cared for in areas where their guardian is not immediately accessible, anticipation of and potential for transfer and care in a local facility, as well as prospective transfer to a specialty facility, should be anticipated, authorized, and documented before a need arises. All patient records and copies of pertinent patient information, including diagnostic imaging and laboratory values, should be transferred with the patient. If not available at the time of transfer, test results may be faxed or telephoned as soon as possible to the receiving institution.

Communication Between Facilities

There must be clear communication between the sending and receiving personnel when a child needs to be transferred. The referring hospital must provide enough information about the child's condition for the receiving hospital to help determine the appropriate level and mode of transport, to advise on further care until the referral center is reached, and to arrange appropriate services at the definitive location. When a critical care transport team arrives at a referring facility, staff at the referring facility should be available and prepared to work with transport team members to the best of their ability, ensuring that the information flow, patient care, and handoff are complete, optimal, and seamless.

Once the patient has reached the receiving hospital, information about the patient's condition and care given during the transport should be sent back to the referring physician and staff in a timely manner. This information might be especially important when parents or other family members cannot accompany the child during the transfer or reach the receiving hospital promptly. Alternative methods and numbers for contacting family members about medical updates, changes in required therapies, and/or obtaining consents should be determined before the transport. It is important for all parties in the transfer process to communicate clearly to avoid misunderstandings that might adversely affect patient care. The receiving hospital should also inform the staff who cared for the child at the transferring hospital about the child's status during the hospital stay if permission has been granted by the patient and/or family and communications are within the scope of the regulations in the Health Information Portability and Accountability Act (HIPAA [Pub L No. 104-191]). The appropriateness of care given, timeliness of referral, and review of any problematic or exceptional issues that occurred should be provided to the referring personnel at a later time, in a constructive manner, to encourage thoughtful and joint evaluation of the care provided and the preparation for transport. Teams also should encourage and solicit feedback from referring personnel on their perceptions of the quality and delivery of the transport services.

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CHAPTER 3

Transport Team Clinicians, Health Care Professionals, and Team Composition

Outline

- Team composition
- Personnel selection
- Training

Team composition and educational processes vary between transport programs. The choice of personnel usually depends on the availability of professionals in the base (sponsoring) facility, the anticipated patient population, financial support for the program, and other practical considerations. A transport program might choose a standard team composition or vary the configuration depending on an individual transport request. Teams that transport a uniform population of patients (eg, neonates) are more likely to have a standardized team composition than teams that transport a more heterogeneous patient population, such as pediatric medical, surgical, and cardiac patients or patients with widely variable acuities. Training needs depend on the role of a specific professional group in the care of transported patients, their experience in neonatal-pediatric health care, and their familiarity with the transport environment. Guidelines for determining team composition, selecting personnel, and education and training needs are outlined in detail in this and the next chapters.

Team Composition

The patient population defined as *pediatric* is diverse and ranges from preterm newborn infants to adults receiving care for conditions developed during childhood. Pediatric transport can be limited to interfacility or might include prehospital medical and trauma locations. Various health care providers participate in the care of these patients and might be considered candidates for participating in the transport team (Table 3.1):

- Specialty-trained attending physicians (eg, intensivists, emergency medicine physicians, pediatric cardiologists, neonatologists)
- Transport physicians (eg, pediatricians with or without subspecialty training, hospitalists)
- Physicians in training (eg, fellows, residents [see Chapters 2 and 4])
- Advanced practitioners (eg, nurse practitioners, physician assistants)
- Critical care, emergency, or neonatal nurses

Table 3.1: Potential Advantages and Disadvantages of Various Personnel for Neonatal-Pediatric Transport Teams

Transport Personnel	Advantages	Disadvantages
Specialty-trained attending physician	Expertise; public relations; critical care training and skills	High salary cost; limited availability for full-time coverage; care and supervision limited to 1 patient at a time
Non–intensive care-, non–neonatology-, or non–emergency medicine-trained attending physician	Expertise; public relations	High salary cost; limited availability for full-time coverage; care and supervision limited to 1 patient at a time; critical care skill acquisition as needed
Fellow	Expertise; valuable training experience	Transport demands might overburden training availability; availability might be limited by ACGME work rules
Resident	Valuable training experience; salary cost may be built into the training program	Demands of transport compete with other aspects of training and education; limited clinical experience; availability might be limited by ACGME work rules
Advanced practice neonatal or pediatric nurse practitioner	Expertise; consistent quality of care, public relations, knowledge of ICU staff	High salary costs; usually limited to discipline for which they are trained (eg, neonatal nurse practitioner vs pediatric nurse practitioner); acceptance as specialized provider by referring care team can be an issue if community expectations are for physician-led team
Critical care nurse, physician assistant	Availability; expertise with appropriate training; uniform quality of care, continuity of care in ICU	Initial acceptance by referring care team can be an issue; requires intensive training to function independently in the transport environment
Respiratory therapist	Focused respiratory assessments; knowledge of respiratory equipment; advanced airway and ventilatory expertise	Focused airway training and experience; requires intensive training to expand to more global patient care
Paramedic or emergency medical technicians	Expertise in prehospital setting; availability; less costly than other team members	Lesser formal medical and pediatric training and perhaps experience; requires intensive training to assist with other areas of patient care

ACGME indicates Accreditation Council for Graduate Medical Education; ICU, intensive care unit.

- Respiratory therapists
- Paramedics
- Emergency medical technicians

The choice of a particular type of professional might depend on the level of responsibility one is credentialed for or routinely assumes in the inpatient setting and on the availability of specific types of practitioners and other factors. The responsibilities of individual team members should take into consideration licensure, education, training, experience, and program policies. Many dedicated pediatric (non–neonatal) transport teams traditionally include a resident or attending physician, although there is little published evidence that this configuration results in improved outcome compared with nonphysician teams. A survey of 229 unit-based and 106 dedicated neonatal transport teams in the United States found that 26 different team compositions were used to accomplish transport.[1] The 12 most common neonatal team compositions are summarized in Table 3.2. For both unit-based and dedicated teams, the most common composition was registered nurse (RN)-respiratory therapist (RT) (92 teams, 40.2%; and 47 teams,

Table 3.2: Twelve Most Common Team Compositions for Unit-Based and Dedicated Neonatal/Pediatric Transport Teams

Team composition	Unit-based		Dedicated	
	n	%	n	%
RN-RT	92	40.2	47	44.3
RN-RT-NNP (or PNP)	44	19.2	7	6.6
NNP (or PNP)-RT-physician	36	15.7	8	7.5
RN-RN	15	6.6	12	11.3
NNP (or PNP)-RT	10	4.4	4	3.8
RN-neonatologist	5	2.2	1	0.9
RN-RN-RT	4	1.7	1	0.9
RN-RT-EMT (basic or intermediate)	3	1.3		
RN-NNP	3	1.3	5	4.7
RN-RT-paramedic	2	0.9	3	2.8
RN-paramedic	1	0.4	8	7.5
RN-neonatal fellow	2	0.9		

RN indicates registered nurse; RT, respiratory therapist; NNP, neonatal nurse practitioner; EMT-basic or EMT-intermediate, emergency medical technician with basic- or intermediate-level national registration.

44.3%, respectively), followed by RN-RT-neonatal nurse practitioner (NNP) for 44 (19.2%) of the unit-based teams, and RN-RN for 12 (11.3%) of the dedicated teams. The third most common team composition for unit-based teams was RN-RT-physician (15.7%), with neonatologists participating in transport most often (23 teams), followed by pediatric residents (7 teams), neonatal fellows (6 teams), and pediatric hospitalist (1 team). Overall, physicians were regular members of unit-based teams 20% of the time and dedicated teams 9.4% of the time. Many programs that transport a significant volume of older pediatric patients have transitioned to the use of nonphysician transport team members while maintaining the option to include a physician on selected transports. Dedicated teams frequently combine to transport other patient groups, whereas 189 (82.5%) of the unit-based teams were exclusively neonatal. Fifty-three (50%) of the dedicated teams combined as neonatal-pediatric, 8 (7.5%) as neonatal-pediatric-adult, 4 (3.8%) as neonatal-maternal, and 2 (1.9%) as neonatal-adult. Only 39 (36.8%) of the dedicated teams were exclusively neonatal.[1]

Consideration must be given to the allowable scope of practice of transport team members and established state, local, and program standards when determining team composition. The choice of personnel also might be strongly influenced by the need to fill other workforce needs within the primary facility. For example, these might include the following:

- The need for care providers with advanced skills within intensive care units
- Other care demands within the primary facility
- The need of a particular service to use transport experience as an incentive for hiring personnel

Some pediatric and emergency medicine residency programs require trainees to participate in transport medicine. Most residents report that transport experience is valuable and provides them with an important perspective on differences in care resources and availability outside a specialty or tertiary facility. The intermittent incorporation of rotating trainees can be challenging for a busy critical care team, so it is important that there be discussions in advance about the roles and responsibilities of residents on the team. Limitations imposed by trainees' restricted schedules combined with the unpredictable nature of transport activities might make the residents less available for participation in transport. If residents are to work as members of the transport team, there should be a clear understanding and delineation of the educational goals of the rotation and the role of the trainee on the team (see Chapter 2). Please refer to the following resource for programs that are responsible for educating residents, fellows, and faculty on the various facets of prehospital care and transport: http://www.pemfellows.com/pem-fellowships/useful-sites.html.

Personnel Selection

Team member selection is critical to the success of a program. A primary determinant of the type of team members selected is the specific staffing requirements of the transport program in terms of roles and responsibilities. Team members should be selected on the basis of their experiences and competence in the care of children in the inpatient setting and on other personality traits required for success. Human resource colleagues can be invaluable in preparing the team managers and directors for the interviewing and decision-making processes. The team members should collectively have the ability to provide a level of care that is similar to that of the admitting unit. It is imperative for the team leader to have excellent assessment skills specific to the transport patient population. Beyond basic certification or licensure, some services require completion of one or more certification programs (see Chapter 2 and Appendix E). These certification programs can be provided as a component of the initial and/or recurrent training programs. The possession of personality traits that ensure a high level of performance in the variable and unpredictable transport environment is crucial. These include leadership, flexibility, independence, initiative, intelligence, inquisitiveness, and ability to solve problems and exercise good clinical judgment. Transport personnel must demonstrate excellent interpersonal and communication skills. Team members must have good crisis management skills, with the ability to negotiate, defuse stressful situations, and safely improvise as needed.

Training

Preparing a team of professionals, particularly a multidisciplinary team, to reach the level of expertise required to transport critically ill infants and children can be a daunting task. The guidelines in Chapter 4 include suggested content and format for training programs. By necessity, they are generic but are intended to be adaptable to the wide variety of professionals who participate in neonatal-pediatric transport. They have been developed under the assumption that trainees will have had considerable experience in the care of critically ill neonatal and/or pediatric patients in the inpatient setting, acute care setting, or both. Reaching proficiency in all areas may not be necessary for all team members, as long as at least one team member during each transport has achieved the requisite level of expertise. For example, programs that include intensivists on every transport need not train nonphysician personnel to be the primary providers of advanced airway intervention. However, it is preferable that all members understand the principles and typical process of every technique so that they are best able to offer assistance and complement each other during the transport. The team should also have general medical and trauma stabilization and emergency response skills in the event that these are needed during a transport.

Although the specific requirements of initial training depend on the professional background of team members, their experience, and roles in patient care, the goals and general content of training are the same, regardless of the type of personnel. The team transporting a critically ill pediatric patient should include at least one member who is experienced in assessment, diagnosis, and treatment of life-threatening illnesses or injuries in neonates and children. This team member must understand pathophysiology, pharmacology, and the usual clinical course and complications of common neonatal and pediatric illnesses and the nuances of the transport environment. Ideally, all personnel have sufficient knowledge, training, skills, and ability to assume the team leader role as required. Cross-training of personnel in this regard will improve the ability to understand roles and should enhance a coordinated team approach. The team leader must also understand the use of appropriate laboratory and radiographic tests as diagnostic aids and have experience in managing neonates and children who require intensive pharmacologic intervention. Other team members must be familiar with pediatric and neonatal critical care so as to provide effectively appropriate support to the team leader.

The team should be capable of performing all standard emergency and stabilization interventions, management, and procedures required in the care of critically ill neonates and children. A high level of expertise in performance of and confidence in procedural decision making and implementation is necessary, because those interventions are often performed under less-than-optimal conditions (in a moving vehicle, with limited lighting and space, and without redundant personnel). Even a low failure rate may be unacceptable if the procedure is potentially lifesaving.

All transport team members should be adept at communication during transport. An essential aspect of communication is an understanding of the milieu of the referring hospital and the sensitivity surrounding a transport. Team members must have finely tuned public relations skills, because they are the "ambassadors" of the receiving facility. Clear, thoughtful, and collegial communications with the referring personnel are essential and occasionally challenging during the stressful situations surrounding the transport of a critically ill child. Open and direct communication among team members also is important. It is essential for all team members to function together as a group to provide safe, competent care. Team members must be clear and precise when discussing actions and plans. They also must communicate well with families under stress. The team members are often the first representatives from the receiving (definitive) care location that the family will meet and might be the first medical professionals encountered with specific pediatric or neonatal skills. The impressions made at this time will carry forward throughout the patient's hospitalization and beyond.

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CHAPTER 4

Transport Program Personnel, Training, and Assessment

Outline

- Personnel and training
- Transport qualifications, performance expectations, and assessment
- Transport team training and program orientation
- Training strategies
- Skills development for neonatal-pediatric transport
- Continuing education and assessment

Personnel and Training

As noted in Chapter 3, many types of providers serve on neonatal-pediatric transport teams (Table 4.1). Although many teams include physicians, nurses, and respiratory therapists, prehospital (emergency medical technicians and paramedics) providers, nurse practitioners, and physician assistants are also commonly included. In addition, there may be differences in the level of training or experience among providers of the same general classification. For example, the term *physician* can refer to an attending or resident physician or to a fellow. Likewise, a *nurse* might be a nurse practitioner, a clinical nurse specialist, a nurse with specific advanced practice skills, or a staff nurse. No one team configuration is ideal for every situation, although there are minimum requirements that must be met for transport. The type of providers used is best determined by the team's mission(s) and clinical needs. Teams that respond to out-of-hospital emergencies will need personnel with prehospital experience, and those whose mission is restricted to the transport of critically ill neonates will need providers with extensive experience in neonatal medicine. In some cases, team configuration might be influenced by local statutes that, for example, might restrict the performance of procedures to certain licensed personnel. As a guideline, transported infants and children should receive the same level of care en route as will be provided in the unit to which they will be admitted, within the constraints of a transport environment.

Table 4.1: Transport Program Personnel: Potential Roles and Responsibilities (see Appendix A)

Program director
• Organization of the transport system • Liaison between team and hospital administration • Budget development • Develop and implement quality improvement and safety programs • Oversight of day-to-day transport team and supervisors • In conjunction with transport team medical director, sets employment criteria and devises methods for continuing education to maintain and enhance skills
Transport team medical director
• Specialist in pediatric critical care, pediatric emergency medicine, or neonatology • May function as program director and medical director • May require codirector or other available expertise regarding specialty issues for combination neonatal-pediatric teams • Partners with transport team coordinator regarding transport planning and operations • Ensures consultation is available for pediatric trauma, surgical emergencies, and other required services • Medical director or designee is available to transport team coordinator 24 hours a day, for online clinical expertise • Participates in program fiscal planning and management • Oversees and participates in design of the team training programs • Oversees and participates in the selection and training of team members • Develops and/or approves all transport policies and protocols • Assists in development and implementation of outreach and follow-up programs • Reviews transport cases, providing feedback to team personnel • Conducts morbidity and mortality reviews with team members • Reviews data and team statistics • Designs research initiatives • Serves as liaison with administration (base and referring facilities) • Oversees and participates in quality reviews, and designs resulting education for staff
Transport team coordinator
• Health care professional (eg, nurse practitioner, registered nurse, respiratory therapist, paramedic) • Coordinates day-to-day program activity • Holds position equivalent to a manager for the transport team • Partners with medical director regarding transport planning and operations
Transport team coordinator, continued
• Participates in design and implementation of the team training programs • Develops and/or approves all transport policies and protocols, in conjunction with the medical director • Oversees transport data collection • Is responsible for equipment selection and maintenance • Is responsible for budget management • Is responsible for team scheduling and scheduling staff meetings and in-service offerings • Participates in teaching and quality improvement reviews • Assists the medical director in conducting morbidity and mortality reviews with team members

Table 4.1: Transport Program Personnel: Potential Roles and Responsibilities (see Appendix A), continued

Medical control physician
• Designated medical control physician(s) (sometimes known as medical control officer) or designee available 24 hours a day • Responds promptly to transport or consultation requests for medical management of individual patients • Reports to the medical director or may hold both positions • Is competent in acute and critical care, including pediatric critical care, pediatric emergency medicine, pediatric surgery, neonatology, cardiology, and other specialties as appropriate • Has demonstrated experience with medical and logistical aspects of transport services • Triages transport requests and activates backup system when necessary • Assists in determining team composition and mode of transport • Provides medical management suggestions before the arrival of the transport team • Communicates with team via online (eg, telephone, radio) and offline (eg, using written protocols) methods during transport • Is kept informed of patient's clinical status • Relays pertinent information to receiving unit for preparation for patient arrival • Documents or ensures documentation of patient-related information and advice given • Is knowledgeable of (or has immediate access to) available care resources (eg, area bed capacity, other transport team configuration, and therapy treatment options) • Has the authority to accept transferred patients without further consultation • Assists in admission to alternative receiving hospitals in region • Has access to subspecialty consultation (eg, cardiology, nephrology, endocrinology, surgery) • Is involved in quality improvement and safety programs (development and implementation)
Transport physician
• Licensed physician (attending, fellow, or resident status) • Has the defined skill level for treatment of patient population • Participates in the training program designed by the medical director and transport team coordinator using defined, established criteria
Transport physician
• Collaborates in stabilization and management of patient's condition during transport • Documentation reflects assessment and required interventions during the transport • Participates in teaching and quality improvement reviews
Transport nurse
• Licensed registered nurse • Has the defined skill level for treatment of patient population • Has specific experience and training in neonatal, pediatric, acute, intensive, and emergency care medicine • Participates in training program designed by medical director and transport team coordinator using defined, established criteria • Is responsible for coordinating stabilization and management of patient's condition; documenting assessments, communication, and care provided; and monitoring during transport • Participates in teaching and quality improvement reviews

Table 4.1: Transport Program Personnel: Potential Roles and Responsibilities (see Appendix A), continued

Transport respiratory therapist
• Licensed respiratory therapist • Has additional specific training and experience of seriously ill patients • Has specific experience and training in neonatal-pediatric patient management during interfacility transport • Participates in training program designed by medical director and transport team coordinator using defined, established criteria • Assists team leader with stabilization and management of the patient's airway, pulmonary care, ventilator management, and other care according to license and privileges during transport • Participates in teaching and quality improvement reviews
Transport paramedic
• Licensed paramedic • Has additional specific training and experience with seriously ill pediatric patients • Has specific experience and training in neonatal-pediatric patient management during interfacility transport • Participates in training program designed by medical director and transport team coordinator using defined, established criteria • Assists team leader with stabilization and management of the patient's condition during transport within scope of licensure and practice • Participates in teaching and quality improvement reviews
Transport emergency medical technician (EMT)
• Licensed EMT • Has additional specific training and experience with pediatric patients • Has specific understanding of and training in neonatal-pediatric patient management during interfacility transport
Transport emergency medical technician (EMT)
• Participates in training program designed by medical director and transport team coordinator using defined, established criteria • Assists team leader with stabilization and management of the patient's condition during transport within scope of licensure and practice • Participates in teaching and quality improvement reviews

There is considerable debate about the role of physicians on the transport team. At one time, many, if not most, transport teams included a resident or attending physician. However, recently, several factors have conspired to alter the resident's role in transport medicine. First, resident work hours are now closely regulated. Training programs effectively have fewer resident hours available for noncore rotations. Second, subspecialty training program growth continues to accelerate. Tertiary care centers often have the option of including a neonatology, critical care, or emergency medicine fellow with the transport team rather than a resident. Not only are these individuals more experienced than resident physicians, they also occupy one of the limited number of available spaces in ambulances or helicopters, effectively eliminating the resident from the team. Finally, billing regulations force attending physicians to closely supervise residents in order to bill for patient care services. Advanced care providers, such as nurse practitioners and physician assistants, can often bill independently, making them more economical choices for the team and the hospital administration. Furthermore, limited research has demonstrated that well-trained nurses, respiratory therapists, and other professionals can function safely and effectively in the transport environment without the direct presence of a transport physician. Although this evidence suggests that the resident physician might not be a necessary member of the transport team, there is also evidence that participating in transport medicine provides an important educational experience for the resident. As previously mentioned, attending physicians and subspecialty (acute care) fellows can augment the skills of the transport team by providing additional expertise. Their technical and cognitive skills might be helpful in the care of certain critically ill infants and children. In addition, as members of the team, they can educate other team members and perform a quality assurance–quality improvement role.

Regardless of the type of practitioner, certain characteristics are vital for the effective practice of transport medicine. Team members must meet certain physical requirements (see Chapter 9 and Appendix A). Transport personnel might be asked to perform procedures and tasks not usually associated with their roles. They must be able to function relatively independently and as part of a multidisciplinary team.

When team members have been selected, they must be trained thoroughly. The scope of training will be largely dictated by law, the experience and background of the candidates, and the mission of the team. Some providers will require extensive initial cognitive and procedural training, but even highly experienced providers require significant orientation to the transport environment. Likewise, teams with a more restricted mission may need less extensive training than those with a broad mission. In many cases, transport personnel will be drawn from the ranks of experienced nurses and respiratory care practitioners. These staff members will need to undertake training designed to enhance their knowledge base and will need to learn and interpret certain assessments, techniques, studies such as laboratory and radiographic analyses, and procedures not usually expected in their standard positions. Initial cognitive training of large groups of providers can be conducted in a classroom environment. However, this approach might not be practical when training the 1 or 2 people needed to fill a periodic vacancy. Therefore, teams should consider alternative teaching methods. Examples include prerecorded lectures and self-learning modules. All candidates should be required to demonstrate that they have acquired the basic functional knowledge needed for the role (Table 4.2).

Most providers will need training to efficiently, expertly, and safely perform technical procedures in the transport environment. Suggested methods for acquiring these skills include actual practice with patients, use of manikins and simulators, and use of models.

Basic skill acquisition is only the first step. Continuing education is an essential component of team development for several reasons. First, advances in knowledge and changes in technology are likely to make some therapies less desirable or even obsolete. Second, certain vital technical skills are likely to be used only occasionally, if ever, in actual practice. Prudence dictates that teams should always be prepared to use these skills, making competency and proficiency assurance mandatory. Finally, some important disease entities are rare. Practice sessions and continuing education allow team members to rehearse the management of unusual conditions in advance of need.

Some programs or their sponsoring organizations may require that team members be licensed or credentialed to perform their transport role. These requirements can be different for different providers. For example, attending physicians are likely to be board certified in a primary specialty (usually pediatrics) and may also have subspecialty certification in neonatology, critical care medicine or another discipline. They will also almost certainly have hospital privileges that delineate a scope of practice. Such privileges can easily be structured to include interfacility patient transport. On the other hand, nurses will have passed state licensure and nursing board examinations, and many will have additional credentials such as “Certified Critical Care Nurse” (CCRN). Specialty certification like CCRN might be mandatory for participation on some teams. The National Certification Corporation (NCC) offers a certification examination in Neonatal Pediatric Transport. The examination is open to physicians, nurses, nurse practitioners, physician assistants, respiratory care professionals, and paramedics. Although the organization recommends that candidates have a minimum of 2 years’ experience before attempting the examination, any of the aforementioned providers may apply for the examination as long as they have an active license. Successful

Table 4.2: Sample Diagnosis-Based Educational Checklist for Neonatal Transport

Neonatal Diagnosis	**Date Learning Module Completed**
Cardiac	
Cardiac arrhythmia	
Congenital heart disease (ductal-dependent defect)	
Congenital anomalies	
Ambiguous genitalia	
Bladder or cloacal exstrophy	
Choanal atresia	
Cleft lip and/or palate	
Down syndrome	
Genitourinary (renal, hydronephrosis, prune belly)	
Hygroma	
Multiple congenital anomalies	
Myelomeningocele	
Syndrome (enter specifics)	
Teratoma	
Metabolic, Medical	
Infant of diabetic mother	
Hydrops	
Hyperbilirubinemia	
Sepsis	
Neurologic	
Hematoma (epidural, subdural, subgaleal); skull fractures	
Intraventricular hemorrhage	
Neurologic defect other than meningomyelocele (encephalocele, hydrocephalus, anencephaly)	
Neuromuscular defect	
Seizures	
Respiratory	
Long-term ventilation or tracheostomy	
Prematurity, RDS	
Term RDS (TTN, pneumonia, PPHN, MAS, asphyxia)	

Table 4.2: Sample Diagnosis-Based Educational Checklist for Neonatal Transport, continued

Surgical	
Bowel obstruction (abdominal distension, bilious emesis, malrotation, pyloric stenosis, volvulus)	
Diaphragmatic hernia	
Gastroschisis or omphalocele	
Esophageal atresia or tracheal-esophageal fistula	
Imperforate anus	
Intestinal perforation	
Masses (chest, abdominal)	
Necrotizing enterocolitis	
Skills used	
Arterial puncture, blood gas analysis	
Venous access, antibiotic administration	
Intraosseous access, fluid bolus, resuscitation medications	
Intubation, ventilator management, inhaled nitric oxide	
Needle aspiration, chest tube insertion and management	
Umbilical artery or vein cannulation	
Surfactant administration	

RDS indicates respiratory distress syndrome; TTN, transient tachypnea of the newborn; PPHN, persistent pulmonary hypertension; MAS, meconium aspiration syndrome.

candidates can also participate in the maintenance of certification process through the NCC.

Finally, teams may wish to have their own internal credentialing, certification, and skill maintenance program. Teams that perform these functions are strongly encouraged to keep careful records and to insure that criteria are applied uniformly and fairly.

In addition to initial training and continuing education, all teams should incorporate a program of quality improvement into their educational offerings (see Chapter 8). Such programs can take many forms, but most include several basic components. All sentinel, serious, and adverse events and near misses, as defined by the by The Joint Commission, and critical incidents, including death during transport, medical errors, compromised care, injury or death of personnel, and care conflicts, should be carefully reviewed, as should all unexpected outcomes and procedural complications. In addition, most programs include mandatory review of certain types of transports, such as of patients with certain diagnoses or patients with a certain degree of illness as assessed by objective parameters.

Transport Qualifications, Performance Expectations, and Assessment

Assessment of the applicant's qualifications for team membership is based on but not limited to the following characteristics:

- Educational and experiential background
- Clinical and technical competence
- Leadership skills
- Critical thinking skills
- Communication and interpersonal skills (team approach, adaptability)
- Skill in public and community relations

The transport team member will successfully complete an orientation program. The program is based on a specific job description and set responsibilities and is of sufficient scope and duration to ensure competency. It is based on a curriculum and identified individual learning needs of the transport team member. Successful completion is appropriately documented in the employee's record and personnel file and is required before performance of independent transport care activities.

Collectively, transport team members should demonstrate competency in at least the following transport and medical content areas, as indicated for their patient population (see Chapter 3):

- American Heart Association and American Academy of Pediatrics pediatric and neonatal curricula
- Maternal physiologic and pharmacologic factors affecting the neonate
- Pediatric and neonatal assessment
  - — Physical examination
  - — Gestational age assessment
  - — Interpretation of clinical, laboratory, radiographic, and other diagnostic data
- Thermoregulation
- Oxygen monitoring
- Fluid and electrolyte therapy
- Pharmacology, including drug dose calculations

- Anatomy, pathophysiology, assessment, and treatment of
  - Acute and chronic respiratory diseases
  - Cardiovascular abnormalities
  - Surgical emergencies
  - Infectious diseases
  - Musculoskeletal abnormalities
  - Neurological and spinal cord injuries
  - Prematurity and postmaturity
  - Gastrointestinal emergencies
  - Hematologic disorders
  - Metabolic and endocrine disorders
  - Disorders of the head, eyes, nose, and throat
  - Congenital and genetic disorders, congenital heart disease
  - Injury (trauma, poisoning, child abuse)
  - Aviation and transport physiology
  - Psychosocial and bereavement support and crisis intervention
  - Mechanical ventilation techniques during transport
- Management of pain and agitation
- Provision of developmentally supportive care
- Transport relations and communication
  - With the referring hospital
  - With the receiving hospital
  - Within the hospital
  - Within the team
  - With parents, siblings, and significant others
- Problem solving, crisis management, and priority setting
- Medical-legal and ethical issues
  - Scope of practice of all team members
  - State and federal regulations regarding transport and advanced practice
  - Informed consent
  - Documentation guidelines and requirements
- Continuous quality monitoring and improvement
- Advanced practice protocols, if applicable
- Transport safety issues
- Orientation to the transport vehicles
- Transport equipment, including troubleshooting and backup systems (Table 4.3)

Table 4.3: Sample Transport Equipment Review and Competency Checklist

By completion of the transport team orientation and yearly thereafter, the transport provider will satisfactorily have demonstrated proper equipment use and patient care skills as listed.		
	Date Initial Demonstration	**Date Return Demonstration**
Ambulance		
Campus vehicle location; extra keys		
Hydraulic lift override		
Power inverter		
Incubator mounting options: single vs dual installation		
Infant seat policy		
Cell phone and contact numbers		
Use of priority status and seatbelt policy		
Oxygen, air, nitric oxide: cylinder storage; system 1 and 2 supply ports		
Suction, continuous vs low intermittent		
Patient care supplies: cupboard inventory; examination gloves; goggles; hand sanitizer		
Point-of-care meter supplies		
Specimen and human milk coolers		
X-ray viewing board		
Medication refrigerator: inventory and daily log		
Pharmacy formulary		
Forms: cupboard inventory		
Policy manuals: transport procedures; infection control; point-of-care testing		
Transport incubator operation		
Power sources: A/C and battery		
Battery percentage of charge; battery operation meter		
Temperature control: digital panel; warmer; Mylar wrap		
Skin temperature probe		
Incubator alarms		
Observation light		
Patient seatbelt restraint system		
IV pumps		
Power sources: A/C and detachable cord; battery		
Pump operation; syringe options, rate, bolus volume over time, volume limit		

Table 4.3: Sample Transport Equipment Review and Competency Checklist, continued

IV pumps, continued		
Pump alarms		
Quick-release clamp vs screw release		
Cardiorespiratory–BP–SaO2 monitor		
Power sources: A/C and battery		
Vital sign setup menus: ECG/respirations; lead options		
Respiration		
Pulse oximetry		
Thermometer		
Invasive BP: transducer calibration		
Noninvasive BP: transducer calibration		
$ETco_2$		
Alarm limits		
Recorder: setting VS chart; record function; changing recorder paper		
Pulse oximeter		
Power sources: A/C and battery		
Backlight screen operation		
Alarms: preset limits; alarm reset		
Transport ventilator		
Power sources: A/C and battery		
Gas supply: minimum cylinder psi		
Specific adapters		
Low-flow blender: options with ventilator, nasal cannula, manual ventilation		
Hand ventilation: humidified vs nonhumidified gas, manometer		
Ventilation modes: CMV; SIMV; CPAP; PS; IAC		
Humidification system vs vent adapter		
Ventilation circuit assembly; system test		
Nitric oxide transport ventilator and delivery system		
Power sources: A/C and battery		
Rail mounting bracket		
Tubing; supply bag; spare cylinder		
Inhaled nitric oxide transport delivery regulator		

Table 4.3: Sample Transport Equipment Review and Competency Checklist, continued

Portable suction		
Power sources; A/C and battery		
Mode of operation: low continuous		
Medication bag		
Controlled drug use policy: locking mechanism; medication sign-out form		
Inventory: medications; IV fluids; supplies		
Drip calculation charts		
Inventory sheet: patient charges		
Restocking responsibilities		
Refrigerated medications pouch		
Controlled drug use policy: locking mechanism; medication sign-out form		
Inventory sheet: patient charges		
Restocking responsibilities		
Supply box		
Inventory		
Restocking responsibilities		
Patient transport and admission records		
Forms: referring patient records; transport documentation; consent; X-rays; billing sheet		
Transport restocking policy		
Completion of restocking: equipment; medications; supplies		
Ambulance repairs; incidents		
Processing laboratory samples: specimens (including point-of-care testing materials)		
Trauma supplies		
Cervical spinal stabilization equipment		
Spinal immobilization equipment		
Splinting equipment		

A/C indicates alternating current ventilation; IV, intravenous; BP, blood pressure; SaO_2, arterial oxygen saturation; ECG, electrocardiogram; $ETco_2$, end-tidal carbon dioxide; VS, vital signs; CMV, controlled mandatory ventilation; SIMV, synchronized intermittent mandatory ventilation; CPAP, continuous positive airway pressure; PS, pressure support ventilation; IAC, interposed abdominal compression.

Specific cognitive knowledge should include the ability to recognize and manage the following potentially life-threatening conditions, as appropriate for the transport population. A clear and direct path to obtain immediate medical knowledge and direction for unusual or medical issues that fall outside the team's usual scope is required.

- Cardiopulmonary arrest
- Upper airway obstruction
- Respiratory failure
- Air-leak syndromes
- Congenital malformations and associated diseases
- Anatomic abnormalities
- Metabolic disorders
- Birth injuries
- Prematurity
- Status asthmaticus
- Shock
- Congestive heart failure
- Cardiac arrhythmias
- Seizures and status epilepticus
- Altered mental status
- Intracranial hemorrhage
- Increased intracranial pressure
- Multiple trauma and burns
- Toxic ingestions
- Hematologic emergencies
- Metabolic disorders, including diabetic ketoacidosis
- Near-drowning and other global hypoxic-ischemic injuries
- Sepsis, meningitis, and other life-threatening infections

The transport team should have the combined expertise and legal scope of practice to perform at least the following procedures with respect to the anticipated patient population and established program guidelines and protocols, and organizational polices:

- Oxygen administration
- Bag and mask ventilation
- Application of nasal continuous positive airway pressure (CPAP), endotracheal intubation, laryngeal mask airway
- Surfactant administration

- Needle aspiration of pleural air or surgical placement of a chest tube
- Initiation and maintenance of mechanical ventilation, including high-frequency ventilation and inhaled nitric oxide if indicated
- Intravenous and intra-arterial access, which might include
  — Peripheral venous puncture and cannulation
  — Umbilical arterial and venous catheterization
  — Central venous access
  — Percutaneous arterial catheter placement and puncture
- Intraosseous access
- Venipuncture for laboratory specimen collection
- Cardiopulmonary resuscitation
- Medication preparation and administration
- Hemorrhage control
- Initiation and maintenance of cervical spine and general spinal precautions
- Initiation and maintenance of general immobilization and splinting techniques

At regularly scheduled intervals and on completion of orientation, knowledge and clinical competency will be evaluated and documented. Evaluation methods might include the following:

- Written examinations
- Simulated practice skills laboratories
- Transport faculty–supervised skills and transports
- Case presentations
- Oral examinations conducted by the course faculty, transport team coordinator, and transport team medical director
- Medical record review

Mechanisms to evaluate continued competency of transport team members might include periodic and recurring practice review sessions in the following:

- Cardiopulmonary resuscitation and stabilization
- Respiratory emergencies and ventilation
- Radiographic interpretation
- Management of suspected infection and infection control
- Fluid and electrolytes
- Monitoring equipment and techniques
- New equipment orientation and training
- Transport and client safety issues

- Public relations
- Advanced procedure laboratories for identified low-volume, high-risk proficiency
- Other topics based on annual learning needs survey or practice deficiencies
- Update on policies affecting functions of transport personnel
- Methods of communication with referring facilities, accepting facilities, and families

Transport Team Training and Program Orientation

The goal of transport team training is to develop a program that ensures that members will have the combined expertise to assess effectively and manage actual and potential problems, in addition to demonstrating their ability to plan, implement, and evaluate ongoing stabilization and interventions during transport. The depth and scope of an individual orientation program regarding initial interhospital or return transport and scene and prehospital response when applicable is determined based on job descriptions and specific transport responsibilities. An orientation period should include a training format such as outlined below. During this time, the trainee should participate in transport under the supervision of an experienced team member. This period should end when the training program director and the trainee are confident of the trainee's abilities. Formal evaluation regarding newly acquired and expected skills should be a standard part of the transport curriculum and provider assessment process.

Departmental Overview

- Department orientation plan and objectives
- Scope of service
- Mission and goals and objectives
- Department structure
- Patient flow and workflow
- Related departments
- Tour of facilities
- Department quality improvement activities

Job Responsibilities

- Work content description and responsibilities
- Performance standards and skills checklist
- Reporting and working relationships
- Patient and family relationships
- Customer service
- Information management

Safety Responsibilities

- Incident reporting
- Infection control
- OSHA (Occupational Safety and Health Administration) guidelines
- Latex precautions
- Material Safety Data Sheets
- Safety guidelines
- Utilities management
- Waste disposal
- Disaster plan
- Patient safety awareness

Departmental Policies and Procedures

- Dress code
- Identification badge
- Locker assignments
- Work schedules
- Attendance and punctuality
- Vacation and holiday requests
- Policy and procedure manuals
- Disciplinary process
- Department meetings
- Education in-service offerings
- Competency review
- Quality management review

Training Strategies

Each program should define the cognitive and technical skills required for each professional group and should include methods to document the acquisition and quality of these skills. Procedural capabilities of the providers should be sanctioned and approved by the base facility and, where appropriate, by the state regulatory agencies that govern the activities of each professional group. In addition, members of each professional group should become familiar with the care typically provided by members of other professional groups on the team so that they will be prepared to assist with procedures or provide care when necessary (see Chapter 23).

Instruction during training may be provided by professionals who are knowledgeable and skilled in the required area of interest. Instructors in the pediatric critical care transport curriculum might include pediatric intensivists, anesthesiologists, emergency physicians, cardiologists, critical care registered nurses, critical care nurse practitioners, respiratory therapists, pediatric surgeons, traumatologists, clinical pharmacists, and other experienced transport personnel. Instructors in the neonatal critical care transport curriculum might include neonatologists, neonatal nurse practitioners, pediatric surgeons, respiratory therapists, clinical pharmacists, and other experienced transport personnel. For certification in some subspecialty transport services, instruction by a specifically credentialed professional might be required by the base facility or a governing agency.

Educational sessions designed to assist personnel to acquire, refresh, and update knowledge can be provided in several formats, including didactic lectures and audiovisual-assisted and computer-assisted interactive self-study programs.

Skills Development for Neonatal-Pediatric Transport

Considerable resourcefulness is required to create optimal procedural training opportunities for pediatric transport personnel. Potential sites of actual patient care training experiences include the pediatric and neonatal intensive care units, the emergency department, delivery rooms, and operating room. In addition, laboratory and facsimile simulations are available for some procedures. The use of electronic, computer-linked simulators is a promising training adjunct for transport and other health care personnel. This modality is currently limited by availability and the expense to purchase and maintain an educational program. Creative financing and management solutions, such as partnering with other departments, personnel, and institutions, could be considered when approaching how to make simulators cost-effective.

Examples of skills appropriate to specific resource locations might include the following:

1. *Anesthesia and operating room experience*
   - Airway assessments
   - Identification of airway complications
   - Bag-valve-mask ventilation (self-inflating and anesthesia bags)
   - Airway management and endotracheal intubation
   - Use of laryngeal mask airway and other supraglottic airway devices
   - Vascular access, central catheter placement
   - Endotracheal intubation under pharmacologic control, including rapid-sequence intubation
   - Difficult airway management and rescue airway techniques, including video laryngoscopy.
2. *Pediatric intensive care experience*
   - Critical care patient assessment
   - Airway management, endotracheal intubation, and tracheostomy management
   - Aerosol treatment
   - Oxygen therapy
   - Ventilator and ventilation management
   - Arterial puncture
   - Needle thoracostomy
   - Vasoactive infusions
   - Central catheter placement (including ultrasonography-guided catheter placement)
   - Interpretation of laboratory test results and radiographs
   - Thoracentesis and thoracostomy tube placement
   - Team approach to resuscitation
3. *Emergency department experience*
   - General patient assessment
   - Fluid resuscitation
   - Medication administration
   - Procedural opportunity (intravenous catheters, urinary catheters, nasogastric and orogastric tubes, airway/tracheostomy management, and oxygen therapy)

- Aerosolized medications
- Intravenous and intraosseous access
- Spinal immobilization
- Fracture splinting
- Basic, bedside ultrasonography (FAST [focused a*ssessment* with sonography in trauma], cardiac assessment, vascular access and assessment, identification of pneumothorax)
- Burn and wound care
- Interpretation of laboratory results and radiographs
- Team approach to resuscitation

4. *Neonatal intensive care and delivery room experience*
   - Neonatal patient assessment
   - Bag-valve-mask ventilation (self-inflating and anesthesia bags)
   - Nonintubated positive-pressure assistance and ventilation
   - Airway management and endotracheal/nasotracheal intubation
   - Delivery room resuscitation
   - Arterial puncture and peripheral arterial catheter placement
   - Needle thoracostomy
   - Vasopressor infusions
   - Umbilical venous and arterial catheter placement
   - Thoracostomy tube placement
   - Peripheral intravenous catheter placement
   - Ventilator and ventilation management
   - Paracentesis
   - Surfactant administration
   - Interpretation of laboratory test results and radiographs
5. *Laboratory experience (facsimile training)*
   - Endotracheal intubation
   - Intraosseous catheter placement
   - Central, including umbilical, catheter placement
   - Thoracostomy tube placement
   - Cricothyrotomy
   - Pericardiocentesis
   - Resuscitation management
   - Spinal immobilization

Competency testing of academic knowledge and clinical decision-making skill might include the following:

- Written examinations
- Transport and clinical case presentations and reviews
- Oral examinations
- Simulator assessment
- Medical record review
- Periodic performance appraisals
- Criterion-based performance evaluation
- Self-assessment instrument

Documentation of satisfactory performance of advanced practice skills, as defined by the transport medical director or other supervisors and assessors, might be based on the following:

- Simulated practice skills laboratories
- Transport faculty–supervised skill sessions
- Outsourced skills assessments (anesthesia staff supervising in the operating room)
- Documentation of the transport team member's review of practice guidelines
- Adherence to accepted standards of care, standards of practice, policies, procedures, job description, and certification requirements
- Quality improvement management findings
- New and updated policy dissemination

Continuing Education and Assessment

Continuing education for the transport team member will be based on:

- Sufficient scope and duration to ensure continued competency;
- Performance and findings from quality improvement activities and changes in technology and pharmacologic interventions;
- Identified or stated education requirements of the transport team member;
- Input and involvement of the transport team medical director; and
- The educational content identified by state or national organizations.

Continuing education will be appropriately documented in the employee's record and personnel file with regard to the content and scope of the program and the transport team member's successful completion of required annual competency.

All or a representative subset of transport cases should be reviewed routinely by the medical and program directors of the transport team. This review should also include presentations during team meetings with participation of all team members. A minimum number of neonatal-pediatric transports should be required to maintain skill levels. Periodic and recurrent experiences through instructional sites such as the delivery room, operating room, and simulator suite should be considered to maintain skills for use in the transport environment. Expectations for students and instructors regarding exposures and learning experiences should be elucidated before those experiences. Student and teacher should be aware of the specific purposes of the process and have an objective method to document experience, progress, and deficiencies and to enact required corrective training.

Transport team members should be encouraged to validate competency through local and national professional certifications.

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CHAPTER 5

Communications and the Dispatch Center

Outline

- Emergency medical communications systems
- Models for communication systems
- Development of a communications center
- Communications specialists
- Integration of centralized communications systems into practice
- Medical control
- Information processing and documentation during transport
- Cost/benefit of various communication systems
- Follow-up communication with referring providers
- Role of the communications center during disasters and with EMS

Emergency Medical Communications Systems

Effective communication is a critical component of an emergency transport service. Communication is defined as a "connection allowing access between persons or places."[1] By its very nature, interfacility transport presents the need for coordination among multiple parties: referring providers, medical control physicians, transport team staff, receiving facility staff, ground and/or flight crews, public safety and administrative personnel. Communication centers today serve as a "hub" for all transport activity, encompassing safety, data gathering and management, coordination, and collaboration. An efficient communication system should ultimately streamline the process for access to services by referring providers: notification and mobilization of the transport team; response to the referring facility; and coordination between and among the transport team, medical control physician, and receiving health care providers. Depending on the size and resources of the transport program, a communication system may be formally structured or may function as a component of a larger network. Nonetheless, all communication system models should incorporate the principles of a directed and efficient communications template. Ultimately, effective communication optimizes the utilization of the transport team, improves service to the referring providers and most importantly, ensures a safer and more efficient transport process for critically ill neonatal and pediatric patients.

Models for Communications Systems

There are multiple models for emergency medical communications systems: (1) 911 dispatch centers, responsible for public safety and emergency dispatch; (2) centralized, hospital-based communications centers (also known as dispatch centers), usually affiliated with an emergency department; (3) freestanding communications centers dedicated to one or more transport programs; and (4) decentralized communications sites, typically within a hospital unit that uses on-duty nursing or medical staff to coordinate transport services. Each model has advantages and disadvantages that should be considered when a transport program is designing a communications system (Table 5.1). For example, 911 dispatch centers are usually governed by agencies such as law enforcement and fire services. Therefore, they might not be as responsive to the needs of an interfacility transport program. Stand-alone communications centers are often desirable, but they are costly to equip, staff, and operate unless multiple programs or users are interested in combining resources. Unit-based communications centers use clinicians to coordinate the transport process, which could save money, but may interfere with patient care responsibilities and potentially delay the transport team's response. Additionally, this model may pose safety risks if the caregiver is too busy to continually track the status of their transport teams.

There is no standard formula to determine the volume of calls necessary to justify the development of an independent communications center. Justification is typically a challenge, because many times there is no revenue associated with a communications center unless the center is managing communications and dispatch for other services that contract with them to do so. Additionally, most expenses are fixed, such as personnel salaries, equipment, and facility. Therefore, qualitative and quantitative metrics including a business plan that optimizes its use will help to achieve the most favorable cost-benefit ratio. For instance, justification for a centralized communications/

Table 5.1: Advantages/Disadvantages of Various Communication Systems Models

Communication Systems Option	Advantages	Disadvantages
911 emergency center	• Personnel specifically trained in emergency dispatch, information gathering • Dedicated to dispatch • Usually have up-to-date dispatch soft and hardware • Link to real-time weather, community resources	• May not have the medical background necessary to dispatch critical care teams • Priority may be 911 calls • May be regulated by EMS, therefore limited quality control • Usually off-site location
Centralized hospital based	• Dedicated to dispatch center • Control maintained by hospital • Personally know transport personnel, medical control, etc • Familiar with policies and procedures of their facility • Utilize technology that interfaces with their facility	• Expense • Requires dedicated space and resources • Personnel frequently not trained as communication specialist, but come from other professions such as EMT, RN
Free standing	• Can be located central to bases, satellites • Opportunities to service multiple transport organizations • Distractions typically minimized	• May be viewed as a totally separate function • May seem impersonal • May not be familiar with the region the transport team services
Decentralized hospital based	• Cost efficient; little expense • Productivity tends not to be an issue • For a small team, may be the only way to keep dispatch internal	• Various personnel may be assigned to dispatch • Usually little training in dispatch • Typically requires decisions around prioritization of tasks • May be easily distracted • May pose safety risks to the transport team

EMT indicates emergency medical technician; RN, registered nurse.

dispatch center may be strengthened by identifying other areas in an institution that would benefit from coordination of communications, especially in emergency and/or disaster situations.

Establishment of a freestanding or centralized communications center has certain fixed expenses for hardware and software, in addition to necessary renovations. A list of equipment and representative estimate for equipping a communications center is shown in Table 5.2.

Table 5.2: Estimated Technical Equipment Costs for a Communications Center

Item	Estimated Cost
Dispatch database (may including associated licenses and management fees)	$30 000 + monthly fees for vendor licenses/management per computer
Dispatch software (global positioning system, maps, flight following, telemedicine)	$500 month per workstation
Recording system	$13 500
Radio system and console	$21 500
Computers (hardware)	$10 000 per workstation
Fax machine, copier, printer	$2500
Telephone (multiline)	$4000
Telephones (wireless base)	$1500
Total	**$89 000 +**

Development of a Communications Center

A communications center should coordinate all activities related to an interfacility transport request and should have the following essential features:

1. Operations 24 hours a day, 7 days a week
2. Communications specialty-trained personnel
3. Administrative transport policies and procedures; including a post incident accident plan
4. Information about local and regional emergency care resources
5. Communications technology and equipment, including the ability to record all transport-related calls
6. Communications space that is designed with consideration of security, acoustic, ergonomic, and equipment positioning needs

Space for the dispatch center should be chosen to permit operations 24 hours per day. Secure access and proximity to cafeteria and restroom facilities are important, because the center might be staffed by only one communications specialist during low volume times. The location of the dispatch center should take into account the need to monitor ambulance and helipad activity, either directly or indirectly. If indirect observation is favored, video monitoring of the remote areas should be available in the dispatch center. Furniture should be chosen with the understanding that the communications specialist may be seated for the majority of a shift and needs ready access to manuals and reference materials. Ergonomics is an important consideration, especially when there are multiple communication specialists using the same space. Systems and equipment that allow variability in chair height and maneuverability, the ability either sit or stand while working, adequate and adjustable lighting, adjustable temperature control, access to food and drinks and adequate workspace, will help the communication specialists maintain healthy work habits. Opportunity for periods of rest away from the communication center throughout the work shift can also support the communication specialist's ability to perform expertly his or her duties.

Security of the communications center is also an important consideration. In the event of an emergency or disaster situation, the communications specialist must be able to lockdown the communications center. Flow through the center must be controlled, as the communication specialist may be overwhelmed with emergency calls and implementation of any disaster or emergency policies and procedures. Even everyday considerations include management of high volume of calls while dispatching and tracking transport teams while coordinating calls with medical control and other administrative personnel. Therefore, it is not a good idea to locate a communication center in the middle of a busy or chaotic department.

A phone system is a critical component of any communications system. The plan for the phone system must be comprehensive and organized. It is best to have not only a plan A but also plans B and C. The decision of customers to use or not use a service is many times based on how they are treated and their calls are managed over the phone. Most hospital-based programs can link to existing digital phone services. Headset and speaker phone capabilities give the communication specialist ergonomic options in which to communicate. Multiline units are a necessity, as is the ability to conference three or more parties at a time. It is imperative that a plan is developed to manage calls the dispatcher is unable to answer during high volume times. An example is call-park or transferring the call to a backup number or person. A unit that is capable of programming frequently dialed numbers improves efficiency. A toll-free number can be established for in-state or multiple-state calls. If possible, request a phone number that is easy for the referring providers to remember (eg, the last 4 digits represented by "KIDS" or "HELP"). The communications center should be included in the institution's emergency plan for phone system outages.

Many emergency medical services (EMS) systems use 2-way radios in addition to cellular phones. Radios permit instantaneous contact without dialing and can serve as a backup in case there are problems with the phone system. Many bands are available, including UHF (ultra high frequency) and VHF (very high frequency). Many hospital services (eg, engineering) already might be using 2-way radios; the hospital's vendor will likely offer the use of another rented frequency to suit the transport system's needs. Alternatively, the transport program can apply to the Federal Communications Commission for a license to operate its own frequency (http://www.fcc.gov). Radios are linked to the dispatch center by use of a console, which can also monitor other frequencies such as local emergency medical services (EMS) providers, fire and police agencies, and the local C-MED (central medical emergency dispatch) system. The console will usually permit the radio operator and the phone user to be patched into the same call. Many hospitals are equipped with a radio system that is part of the nationwide Hospital Emergency and Administrative Radio, or HEAR, system. This could be monitored in the communications center as well.

It is strongly recommended that all communications pertaining to an interfacility transport be recorded. There are many advantages of recording, including the opportunity to review intake conversations for educational and quality improvement purposes, the ability to review conversations when there are questions or concerns related to the transport process or patient management, and the availability of recorded information in case there is a regulatory or legal inquiry about an emergency transport. Many facilities already have a means to record calls, so this may not pose added expense to the communications center. In this model, calls are readily accessed through the hospital's intranet. If not, a digital recording device is preferred. Most recording devices need to be kept within a certain range of the main phone system, although some can be remote. The advantage of having recording hardware located within the communications center is that tapes or digital video discs (DVDs) from previous periods can be easily accessed for review. A disadvantage is the need for physical space for recording equipment. Computer-based digital recording alleviates the need to have equipment other than a personal computer in the communications area and eases distribution of recorded conversation for quality review. A variety of media are available for recording and storing conversations and sources of communication, including cassette tapes, VHS (video home system) tapes, and

DVDs. DVDs have the advantage of holding the most data per disc and are easy to store. All stored copies should be remotely located from the originals in case of fire, flood, or other catastrophe. Although the time for retaining recorded materials is not mandated, it is important to have a policy that is similar to the institution's policy for storage of medical records and images. The hospital's legal counsel should be consulted to develop a clear policy. Software to operate the recording system can be loaded directly onto the communications center's computers, and most systems will allow for supervisor or manager access from the desktop. Separate software can be purchased to permit last message or last time interval playback for use by the communications specialist during a call.

Policies and procedures pertaining to the communications center should be comprehensive with consideration to related hospital or agency policies and procedures. A postaccident incident plan (PAIP) is a critical resource for the communication specialist in the management of the transport team in an emergency or disaster situation. This plan outlines specific procedures to be followed in the event of a transport incident. Because the plan is rarely initiated, it is important to perform frequent drills with transport and dispatch personnel. Also, when drafting policies, it is important to know state and federal regulations that may pertain to the communications center. Certain states, such as Indiana, have regulations surrounding emergency medical dispatch. Section 3 of the Indiana code states, "After December 31, 2009, a person may not furnish, operate, conduct, maintain, or advertise services as an emergency medical dispatcher or otherwise be engaged as an emergency medical dispatch agency unless certified by the commission as an emergency medical dispatch agency" (IC 16-31-3.5). In Ohio, the State Board of Emergency Medical, Fire and Transportation Services enforces regulations surrounding documentation by dispatch personnel such time of call, dispatch time, arrival at referral, etc (http://codes.ohio.gov/orc/4766). Related to recording of calls, federal regulations permit the recording of telephone conversations as long as at least one party consents; in other words, recording conversations by third parties is illegal. The Federal Communications Commission has more specific requirements for interstate and foreign calls, during which recording can be performed only under one of the following circumstances:

- Preceded by verbal or written consent of all parties to the telephone conversation

- Preceded by verbal notification that is recorded at the beginning and as part of the call by the recording party
- Accompanied by an automatic tone warning device, sometimes called a beep tone, which automatically produces a distinct signal that is repeated at regular intervals during the telephone conversation when the recording device is in use

For in-state calls, regulations vary by state and might require 1-party or 2-party consent. A list of state-by-state regulations can be found at http://www.callcorder.com/phone-recording-law.htm.

Communications Specialists

Communications specialists are often the first people with whom the referring provider has contact, so a professional and service-oriented demeanor is essential. They must be skilled at managing multiple tasks under stressful circumstances. They should not have concomitant duties that might delay the transport process. They must be familiar with institutional resources and procedures. Communications specialists are trained to follow guidelines or protocols established by the transport program's leadership. The National Association of Air Medical Communication Specialists (NAACS) certification course was developed to further the education and development of the Air Medical Communication Specialist. This certification equips the Certified Flight Communicator (CFC) with the knowledge and skills to effectively and efficiently manage and coordinate specialty care transport requests via air (fixed or rotor wing) and/or ground vehicles (www.naacs.org).

It is recommended that the communications specialist have experience in EMS or in a hospital setting. Although it is an expensive option, staffing RNs to dispatch critical care transport teams is an effective way to obtain comprehensive patient assessments from referral facilities that are often adult facilities not familiar with disease management modalities of the neonatal and pediatric population. RNs are then able to elevate the urgency of a transport on the basis of recognition of a potentially life-threatening condition. RNs can also expedite flow of medical information between referring and receiving physicians and transport nurses. Familiarity with dispatch procedures, radio communications, and computer data entry are also important considerations when hiring a communication specialist. Excellent verbal and listening skills and are required. A working knowledge of medical terminology, if not a nurse, is highly desired. The specialist must be able to function independently and make decisions and recognize when additional resources are needed. Attention to detail is extremely important given the nature of neonatal-pediatric transport and the importance of accurate medical records and logs. A sample job description and performance evaluation for an emergency communications specialist are included in Fig 5.1 and 5.2.

Figure 5.1: Job Description: Transport Team Dispatcher

JOB TITLE: Transport Services Dispatcher

DEPARTMENT: Critical Care Transport

SUPERVISOR:

SALARY GRADE/JOB CODE:

EXEMPT/NONEXEMPT: Nonexempt

General Summary

As an integral part of the emergency transport system, ensures and participates in coordinating the timely and efficient management of patient transports. Enters information into department databases as necessary.

The incumbent works alone and must possess and demonstrate, at all times, ability to make sound judgment with life-support alarms, ability to be versatile to handle multiple crises at once, and ability to maintain composure, and must possess good communication and customer service skills.

Principal Duties and Responsibilities

1. Receives and triages calls as a member of a 24-hour transport communications center. Obtains information from caller required to assess urgency of request and initiate appropriate response.
2. Enters all appropriate information into department databases as necessary.
3. Coordinates community outreach.
4. Assists in orienting and training new staff.
5. Keeps work area neat and orderly and free of fire and safety hazards.
6. Furthers knowledge and skills through attendance and participation at conferences, seminars, and in-service and continuing education programs.
7. Performs other related duties as assigned or requested.

Minimum Knowledge and Skills Required by the Job

1. Work requires a high school level of educational development and at least 1 to 2 years of previous experience, preferably in dispatch operations. Work requires some understanding of medical terminology through training or experience. EMT preferred.
2. Work requires the analytical skills to gather and interpret data in situations in which the information or problems are relatively routine.
3. Strong computer skills preferred.

Certification, Registration, or Licensure Required by the Job

Physical Requirements of the Job

1. Must be able to sit for extended hours.
2. Work requires occasionally stooping and bending.
3. Work requires regularly reaching and grasping objects below shoulder level, frequently reaching and grasping objects at shoulder level, and regularly grasping and fine manipulation with hands.
4. Work requires regularly proofreading and checking documents for accuracy and inputting/retrieving words or data into or from an automated/computer system.
5. Must be able to hear conversations and speak clearly.

Figure 5.1: Job Description: Transport Team Dispatcher, continued

Bloodborne Pathogen Category
No Potential Exposure: Job requires performance of duties that involve no potential for exposure to blood, body fluids, or tissues. Tasks that do involve exposure are not an expectation of employment.

Job Document Attributes

Human Resources Approval	[Click **here** and type name] [Click **here** and type job title] Human Resources Department]	**Last Modified Date**	05/09/2006
Manager Approval		**Dates Reviewed Revised**	

Revision Notes

Document actions taken when reviewed or revised.

Date	Review/Revision Action	Reviewer

Figure 5.2: Transport Team Dispatcher Performance Evaluation

Employee Performance Evaluation Form

EMPLOYEE NAME:

DEPARTMENT: Critical Care Transport

JOB TITLE: Transport Services Dispatcher

PERFORMANCE PERIOD:

Policy, Procedure, and Work Rule Compliance
Please mark each statement where the employee has complied with hospital and departmental policies, procedures, and standards of conduct. Mark nonapplicable standards N/A. Please comment on items not in compliance.

Always conforms to hospital's standard of conduct as detailed in the hospital's personnel policy manual. Adheres to ethical and legal standards of practice.

- ☐ Complies with position-specific work schedule, arrives at work on time, starts promptly, works scheduled hours.
- ☐ Uses earned time per departmental and hospital policy; requests time off in advance; calls supervisor to explain unscheduled absence in a timely manner as defined in the departmental policies.
- ☐ Always complies with all job-specific safety and infection control standards. Follows departmental/hospital universal precaution and infection control policies and procedures.
- ☐ Displays hospital identification badge at all times while on hospital premises. Dresses appropriately for work assigned.
- ☐ Always treats patients, coworkers, and staff with dignity, courtesy, and respect.
- ☐ Follows departmental/hospital policies and practices to protect patient and employee confidentiality.

Figure 5.2: Transport Team Dispatcher Performance Evaluation, continued

Employee Performance Evaluation Form, continued

☐ Complies with and enforces hospital's visitation policy.
☐ Complies with hospital procedures for responding to and reporting incidents involving patient or personal injury. Reports work-related injuries immediately to supervisor.
☐ Attends safety training sessions and/or reviews manuals for fire and disaster procedures provided by the hospital annually. Knows fire and emergency procedures for the area. Follows departmental/hospital procedures regarding handling and disposal of infectious and/or hazardous materials. Completes mandatory annual review documentation.
☐ Completes Human Resources and Employee Health requirements.
☐ Completes required training.
☐ Maintains up-to-date licensure/certification/registration/visa in departmental file.

Comments

Employee Self-Evaluation
If applicable, please attach the employee's self-evaluation and make any comments about this self-evaluation here.

Goals, Objectives, and/or Accomplishments
If applicable, please attach the employee's goals, objectives, and/or accomplishments for the past and upcoming year and make any comments about these goals here.

Principal Duty and Responsibility
Receives and triages calls as a member of a 24-hour transport communications center. Obtains information from caller required to assess urgency of request and initiate appropriate response.

Performance Standards
1. Receives incoming calls, and arranges for immediate and scheduled transfers.
2. Receives calls from an outlying institution requesting patient transport, and triages the call to the appointed medical control physician and transport nurses (if applicable).
3. Coordinates patient placement with bed control nurse.
4. Obtains patient demographics (name, diagnosis, and name of hospital, location within hospital).
5. Notifies ambulance company and/or drivers.
6. Calls referring hospitals with expected time of arrival and updates if known deviation is greater than 5 minutes.
7. Maintains immediate contact capability with team, referring or receiving hospital.
8. Contacts consultants if requested.
9. Monitors other radio frequencies (helicopter, fire rescue, 911).
10. Participates in debriefs for patient transports.
11. Acts as trouble-shooter for the transport communication system equipment.
12. Coordinates information among ambulance, helicopters, fixed-wing service, referring hospitals, and receiving hospital personnel for expedient and efficient transports.
13. Maintains up-to-date information on bed availability, physician and team member's coverage, and contact numbers.

Figure 5.2: Transport Team Dispatcher Performance Evaluation, continued

Employee Performance Evaluation Form, continued

Rating
[ ] Exceeds job performance standards
[ ] Meets job performance standards
[ ] Does not meet job performance standards

Comments

Principal Duty and Responsibility
Enters all appropriate information into department databases as necessary.

Performance Standards
1. Able to use spreadsheets and databases for data entry.
2. Generates statistical reports from computer programs.

Rating
[ ] Exceeds job performance standards
[ ] Meets job performance standards
[ ] Does not meet job performance standards

Comments

Principal Duty and Responsibility
Coordinates community outreach.

Performance Standards
1. Ensures that form letter to referring physician is sent within 2 days.

Rating
[ ] Exceeds job performance standards
[ ] Meets job performance standards
[ ] Does not meet job performance standards

Comments
Not a responsibility at this time

Principal Duty and Responsibility
Assists in orienting and training new staff.

Performance Standards
1. Effectively assists in the training of new staff, following departmental policies and procedures.
2. Maintains accurate and thorough documentation of skill levels and makes appropriate suggestions for progression.

Rating
[ ] Exceeds job performance standards
[ ] Meets job performance standards
[ ] Does not meet job performance standards

Figure 5.2: Transport Team Dispatcher Performance Evaluation, continued

Employee Performance Evaluation Form, continued

Comments

Principal Duty and Responsibility
Keeps work area neat and orderly and free of fire and safety hazards.

Performance Standards
1. Work area is left clean, neat, and orderly at end of shift.
2. Doorways are not blocked, and fire and safety hazards are reported to the appropriate person.

Rating
[ ] Exceeds job performance standards
[ ] Meets job performance standards
[ ] Does not meet job performance standards

Comments

Principal Duty and Responsibility
Furthers knowledge and skills through attendance and participation at conferences, seminars, and in-service and continuing education programs.

Performance Standards
1. Pursues opportunities to advance knowledge of materials management through attendance at relevant programs, seminars, or academic course work.
2. Regularly attends department-specific in-service programs as offered.
3. Identifies when help or instruction is required, and seeks it appropriately.

Rating
[ ] Exceeds job performance standards
[ ] Meets job performance standards
[ ] Does not meet job performance standards

Comments

Principal Duty and Responsibility
Performs other related duties as assigned or requested.

Performance Standards
1. Demonstrates ability to complete additional tasks in a timely manner.
2. Responds quickly to situational or assignment changes.
3. Demonstrates flexibility and adaptability in work assignment.
4. Identifies and suggests areas of opportunity for quality improvement.

Figure 5.2: Transport Team Dispatcher Performance Evaluation, continued

Employee Performance Evaluation Form, continued

Rating

[ ] Exceeds job performance standards
[ ] Meets job performance standards
[ ] Does not meet job performance standards

Comments

Employee Development
(In completing this section, the evaluator should review information from the department's continuous improvement activities.)

In what ways would you suggest the employee could improve and/or enhance his/her performance?

Agreed-upon action for improving and/or enhancing performance:

What job knowledge/skills might you suggest the employee acquire or further develop to improve his/her performance and/or prepare for changes in the patient population and/or other career opportunities?

Agreed-upon action plan for acquiring and/or further developing job knowledge and/or skills:

Performance Summary

Overall Performance Summary

[ ] Exceeds job performance standards. Performance that exceeds performance standards for assigned job duties or responsibilities. This is a level infrequently achieved even by very experienced incumbents.
[ ] Meets job performance standards. Performance that is consistently strong in all job duties. The incumbent makes a contribution to the hospital that demonstrates a commitment to patient care, support services, o research.
[ ] Does not meet job performance standards. Performance that does not meet standards for one or more job duties. A performance improvement agreement is necessary, or if performance is significantly below standard, disruptive, or inhibiting the unit's productivity, immediate disciplinary action may be necessary.
[ ] Deferred Overall Rating/Merit Increase. Performance that needs improvement in some responsibility areas. No merit increase will be given at this time. Areas that do not meet standards are documented in this review, as well as expectations and plans for performance improvement. Performance will be reviewed again on __________________ (date within the next 6 months), and merit increase may be given at that time if performance has improved and meets standards. The merit increase will not be retroactive.

Employee Comments and Signature

Do you feel your job description is still current? Yes _________ No _________

If no, indicate below what changes you feel need to be made.
Have your questions about career opportunities been answered? Yes _________ No _________

If no, indicate below what opportunities you would like to know more about.

Figure 5.2: Transport Team Dispatcher Performance Evaluation, continued

Employee Performance Evaluation Form, continued

Confidentiality Statement
In signing your employee evaluation form, you are indicating that you have received and understand your evaluation. In addition, your signature indicates that you understand and agree with the following statement:

I understand that in the performance of my duties as an employee of the Hospital, I may have access to and work with confidential information such as

a. Patient medical, social, financial, and demographic information.
b. Sensitive and personal information of or about employees, including medical and personnel information, private correspondence, etc.
c. Hospital business information, such as financial and payer information, strategic planning, fundraising and reporting information, and internal memoranda.
d. Research information, including information describing or relating to inventions and discoveries.
e. Information concerning outside companies with which the Hospital does business, including data the Hospital is contractually obligated to keep confidential.

I understand that I must maintain the confidentiality of these data at all times, both at work and off duty. I will access, use, and disclose such information only in accordance with Hospital policies related to privacy and the scope of my job and recognize my responsibility to become familiar with those policies. I understand that a violation of these confidentiality considerations may result in disciplinary action, including termination. I further understand that I could be subject to legal action.

In addition I acknowledge that the Hospital policy states that Hospital computer resources may be used only for clinical, research, and other legitimate Hospital purposes and only in a responsible, ethical, professional, and courteous manner. I have read and agree to comply with the *Guidelines for Ethical Use of Computers and Computer Information*. These guidelines describe requirements and obligations of accessing and using Hospital computer resources, accessing sensitive or confidential information stored on Hospital computer resources, and the copying and use of software.

I certify by my signature below that I have read and understood the above statements concerning privacy, confidentiality, and information access at the Hospital. My supervisor has discussed the contents of my evaluation with me. I understand that this form will be filed in my personnel file and that I may have a copy of it.

Employee's signature **Date:**

Supervisor and Manager Signature and Comments
The contents of this form have been discussed with the employee. I will follow up with Human Resources on any changes the employee and I agree need to be made to the employee's job description.

Supervisor's signature **Date:**

Manager's signature **Date:**

The communications specialist is responsible for coordination of all aspects of the emergency transport process. Specific duties of communications specialists include the following:

- Initial point of contact with referring providers and facilitation of prompt access to the medical control physician (MCP)
- Appropriate documentation of all incoming and outgoing information
- Team notification; ground or flight service dispatch; updates on team status for the referring and receiving facilities; facilitation of the acceptance and admission process; contact with security or public safety personnel; and for some programs, coordination with discharge planners and/or third-party payers
- For flight services, coordination of landing zones, flight position monitoring, weather reports and advisories, and communication with law enforcement, air traffic control, and other aeromedical programs
- Maintenance of logs for all transport requests, referrals, and missed or cancelled transports
- Maintenance of logs for equipment and vehicle tracking when in and out of service
- Input of demographic and transport-related data into the program's database
- Monitoring and maintenance of communications center equipment
- Attendance at safety and staff meetings
- Maintenance of on-call schedules and contact information for clinical services, MCPs, and transport team staff
- Monitoring of neonatal and pediatric intensive care bed availability and trauma center status internally and for other area institutions
- Consultation with transport program leadership for unusual circumstances or critical incidents
- Demonstration of exceptional customer service skills

Integration of Centralized Communications Systems Into Practice

Establishment of an emergency communications center might represent a significant change in procedure for referring providers and MCPs. Educating the principal parties involved will hasten acceptance and promote cooperation among services. For example, a referring provider might believe that directly contacting the potential accepting physician will result in the most expedient transport, when in fact the dispatch center might be able to simultaneously facilitate mobilization and contact with the appropriate physician so the transport team can be en route before the intake conversation is completed. For referring providers not familiar with the institution, a “one call does it all” approach can prevent the caller from being routed to multiple people when making an emergency referral. Ideally, a transport program will have a policy in which the transport team can be dispatched before formal physician acceptance. Because there invariably is time during travel to the referring institution, bed assignment and notification of the receiving clinical team can be accomplished while the transport team is responding. A unit-based program may be concerned about yielding control of its communications with referring providers. Demonstration of the decrease in administrative time spent by busy clinical personnel involved with a transport is usually a persuasive argument in favor of a centralized dispatch center.

Finally, an emergency dispatch center should perform self-evaluation by surveying its “customers” to ensure that referring providers and receiving staff are satisfied with the ability to refer patients, including ease of initial call through transfer of patient responsibility to the transport team. Because the dispatch center represents an institutional expense and is not a direct source of revenue, hospital leaders must be provided data demonstrating the unmeasured value of well-coordinated communications and improved satisfaction of referring physicians.

Medical Control

The MCP is an essential component to the success of the communication center. The MCP should have extensive knowledge of the transfer process. Ideally, the MCP should have input into the development and design of the center as well as ongoing involvement in the evaluation of the quality of the service provided. The MCP’s involvement in the hiring process, along with the continued education of communication staff, will result in exceptional service. Oversight of quality-improvement activities, protocol development, and chart reviews are additional responsibilities of the MCP. The MCP is available during all hours of operation, giving medical direction to teams providing direct patient care. Communication center conversations are performed on voice logging phone lines; however, MCPs may have additional responsibilities throughout the hospital while performing the task of medical control physician, and may not have immediate access to these recorded lines. The availability of cellular phones and radios makes direct communication with the MCP possible. MCPs work closely with transport personnel, offering advice and guidance during stabilization and transport of the patient.

When communication with the MCP cannot be achieved or maintained, protocols should be in existence to dictate appropriate medical care until contact can be established or the patient is admitted. Follow-up communication with the MCP regarding care rendered during transport and patient response are essential when a loss of communication has occurred.

With advances in video telecommunication systems, MCPs may be able to establish both visual and audio contact with the patient, either prior to transfer (if both referring and receiving hospitals are equipped to communicate) or with the transporting team (if equipment is portable). This technology enables the MCP to not only "see" the patient (skin color, injuries, abnormalities, etc) but may allow for listening to lung and heart sounds.

MCP involvement in preplanning for disaster management ensures the communication center is adequately prepared and equipped for emergency situations. Development of a PAIP, along with scheduled testing of the plan, ensures a communication center can manage necessary arrangements as events unfold. In addition, new billing codes may be used to report the MCP's supervision of a specialized transport team for a critically ill patient 2 years or younger.

Information Processing and Documentation During Transport

Administrative Protocols

Each transport system differs in the policies and procedures used to guide operations and decision making. Examples of topics that should be covered in a comprehensive set of administrative protocols for the dispatch center include the following:

- Identification of the MCP
- Notification tree for specific types of patients (eg, trauma, surgical emergencies, suspected child abuse)
- Criteria for ground versus rotor-wing versus fixed-wing transport

- Procedures to follow when the primary or preferred transport team is unavailable
- Weather-related policies and procedures
- Patient triage and disposition

Several sample flow diagrams for communication and decision-making are included in Fig 5.3 and 5.4.

The Intake Process

Essential information that should be obtained by the communications specialist at the time of a transport request is as follows:
- Name of caller and referring provider and facility
- Patient's name, age, date of birth, allergies, and weight
- Call-back phone numbers, including the unit where patient is located and the referring provider's pager, if indicated
- Landing zone information, if indicated
- Name of receiving facility and destination within the receiving facility, if known
- Name of accepting physician, if known
- Patient's presenting condition and preliminary diagnosis
- Differences in time zones between the referring and accepting facility
- Time sensitivity (eg, emergency, urgent, nonemergency, elective)

Additional information that should be exchanged during contact between the MCP (or medical intake provider if a registered nurse or other professional) and the referring provider is as follows:
- Concise description of the current problem and pertinent medical history
- Patient's physiologic status, including full set of current vital signs
- Pertinent laboratory and radiologic data
- Current treatment (eg, vascular access, mechanical ventilation, medications)
- Interventions and response to interventions
- Special equipment, medications, or personnel requested (eg, incubator, inhaled nitric oxide, perfusionist)
- Infection control issues
- Family or social considerations, including custody issues
- Ability of family to accompany the team (with appropriate identification, weight restrictions, if present)

Figure 5.3: Sample Dispatch Intake Record Cincinnati Children's Hospital Medical Center

Cincinnati Children's

Neonatal Referral Form

Patient's Name__________
MR # __________ Sex □ M □ F
Gestational age __________
DOB ____/____/____ Wt. ______kg

D-Deferred
Date____/____/____ Time __________ Referred from __________ Phone __________

MD __________ Patient location __________ Admit to __________

Allergies: □ No Drug/Contrast Allergy □ No Food Allergy □ No Product/Latex Allergy □ Unable to Obtain Allergy Information

Specifics:

Time of birth __________ Route of delivery __________ Apgars __________ Rom __________

Chief Complaint/Pertinent Past Medical History__________

VITAL SIGNS: Temp __________ HR __________ RR __________ BP ________( ) O_2 Sat __________

NEURO:
- □ Alert
- □ Active
- □ Lethargic but arousable
- □ Tone: □ Good □ Floppy
- □ Seizure Activity
- □ Anterior Fontanel: □ Soft □ Flat □ Full □ Bulging

GI/GU:
- □ Abdomen: □ Soft □ Non distended □ + Bowel sounds
- □ Abdominal girth __________
- □ Voiding
- □ Vomiting
- □ Diarrhea
- □ Assistive Device

IV FLUIDS: □ Yes □ No
IV Type __________
D10W __________
Ns __________
Bolus Amount __________

RESPIRATORY:
- □ Unlabored □ Equal
- □ Clear □ Grunting
- □ Stridor □ Flaring
- □ Retractions □ Room Air
- □ FiO_2

Delivered by: □ ETT □ Head Hood □ CPAP __________
□ Other __________

Intubated:
FiO ________ PIP ________
PEEP ________ Rate ________

SKIN:
- □ Warm/Dry
- □ Rash
- □ Lesions
- □ Abrasions
- □ Bruising
- □ Petechaie

CXR: __________

CARDIOVASCULAR:
- □ Pink
- □ Pale
- □ Dusky
- □ Other __________

Perfusion/Cap refill:
- □ Good □ Poor
- □ + ________ Seconds
- □ Pulses strong
- □ Pulses weak
- □ Pulses absent
- □ Extremities warm
- □ Extremities cold
- □ Murmur □ All extremities BP

LABS: □ Pending □ None
CBC: __________
Renal: __________
Glucose: __________

ABG/CBG:
pH ____ CO_2 ____
O_2 ____ HC O_2 ____
BE ____ Blood Culture ____

MEDICATIONS:
1. __________ 2. __________
3. __________ 4. __________
5. __________ 6. __________

ADDITIONAL: __________

Medical Control: __________ Phone/pager number: __________

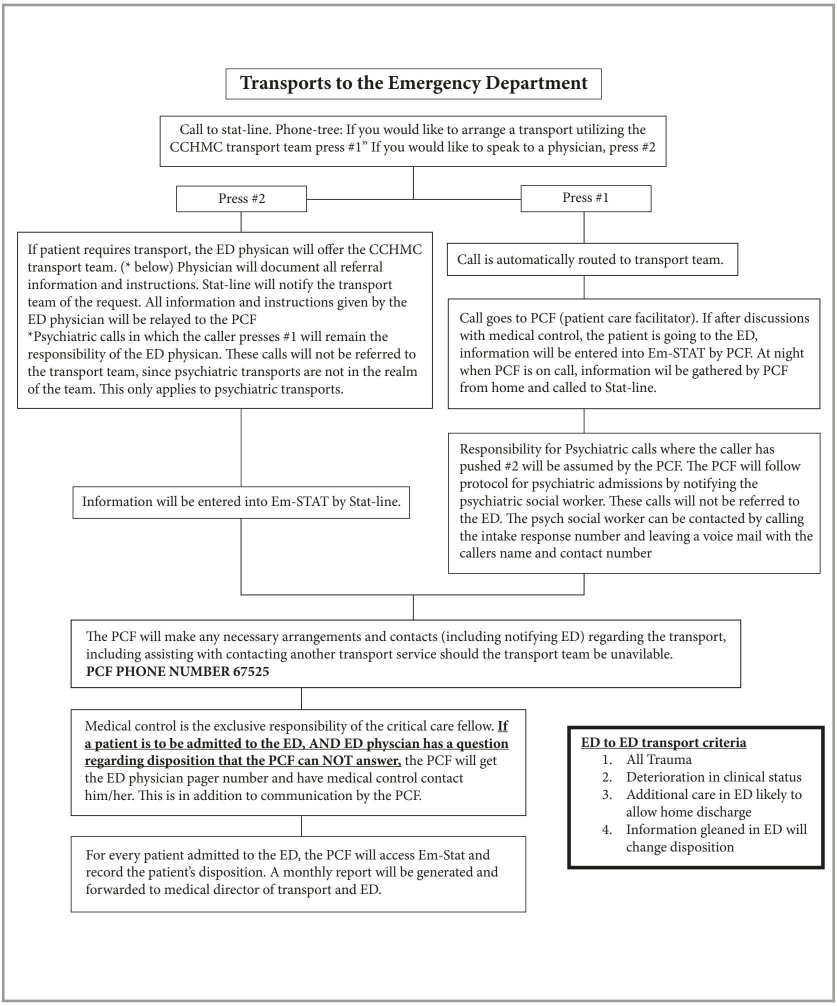
____
Taken by: (Signature/Credentials)

Form Number Original – CCHMCC Medical Record Yellow Copy – Transport Office Bar Code

*Cincinnati Children's uses RNs to dispatch, also known as Patient Care Facilitators (PCFs).

**Pediatric Referral Form used for intake information for pediatric patients.

Figure 5.4: Sample Flow Sheets



Reproduced with permission from Cincinnati Children's Hospital Medical Center.

CCHMC Transport Team Log Sheet

Date	Call Time Team notified	PCF	Patient Name	Run Type	Unit #	Facility	Confirm Hospital	Team RN/RT/Tech/MC	MD name/paged/arrive	Depart	Arrive	Return	At CCHMC	Reason For Delay Comments	Pt ID#	MPS	Admit To
			Last________ First________			Hospital________ Phone#________											
			Last________ First________			Hospital________ Phone#________											
			Last________ First________			Hospital________ Phone#________											
			Last________ First________			Hospital________ Phone#________											
			Last________ First________			Hospital________ Phone#________											
			Last________ First________			Hospital________ Phone#________											
			Last________ First________			Hospital________ Phone#________											
			Last________ First________			Hospital________ Phone#________											

It is essential that the MCP provide recommendations for evaluation and management during the time that the transport team is mobilizing and responding to the referring facility. The transport team should be advised of these recommendations so as to anticipate a possible change in the patient's status on arrival. If the referring provider indicates that he or she plans *not* to follow such recommendations, the transport team should be notified.

After the transport team has been mobilized, the communications specialist should contact the referring facility to obtain additional demographic information that might be necessary to process the admission. In general, access to insurance information is not necessary when ground or rotor-wing transport is being requested under emergency circumstances. For elective or scheduled transports or for long-distance fixed-wing transports, preauthorization of payment by third-party payers might be required for the transport program and/or the receiving facility to be reimbursed for their services.

To facilitate an expeditious departure from the referring facility, the communications specialist should remind the referring personnel of the need for copies of medical charts, laboratory results, and results of imaging studies (eg, radiography, computed tomography, magnetic resonance imaging, ultrasonography) to accompany the patient.

The Call-Back Process

Once the transport team has had the opportunity to assess the patient and begin the stabilization process, there should be contact with the MCP. This contact updates the receiving institution about the patient's status and provides an opportunity to discuss management issues and patient disposition with the responsible physician. Essential data points are as follows:

- Patient's current condition
- Interventions and results of interventions performed prior to arrival of the transport team and following arrival of the transport team
- Special needs on arrival to the receiving facility (eg, high-frequency oscillatory ventilation, vasopressors, blood products, an isolation room) or immediate availability of the operating room, surgeons, diagnostic imaging (eg, computed tomography scan), or the resuscitation or trauma team
- Estimated time of arrival

Documentation

A standardized transport form (paper or electronic) can be used to distinguish care provided during interfacility transport from subsequent inpatient care. The form should concisely summarize interventions the patient has already received, the condition in which the patient is found by transport personnel, events and interventions during stabilization at the referring facility as well as care rendered throughout the transport process. This form should also provide a place to document information that the transport team might be in a unique position to obtain (eg, primary care physician, parent, or guardian contact numbers).

Cost/Benefit of Various Communication Systems

Determining the best option for the orchestration of patient transfers is a complicated process that must involve a cost/benefit analysis. Physical space, phone and computer equipment, and human resource costs are a few aspects to consider. As hospitals merge, duplication of services may confuse the transfer process, necessitating the combining of the 2 communication centers into 1 united program.

Outsourcing of services may be required for short periods of time during transitional periods or may be considered a permanent option for some programs. Services that lack the necessary resources or facilities with limited transfer of patients may determine that the cost of having a communication center outweighs the benefits. Ensuring the quality of the service is essential when this responsibility is entrusted to an outside organization.

Hospitals committed to having a communication center recognize the opportunity for attention to customer needs as well as the potential complexity of their systems. Communication centers identify opportunities for growth and for improved customer satisfaction necessitating change

Follow-up Communication With Referring Providers

The communications center can support the transport program as well as the admitting unit, by serving as a source for follow-up information for referring providers. Consideration should be given to sending a written or electronic communication at the completion of each transport to inform the referring physician of necessary interventions during transport, the patient's safe arrival and subsequent disposition. Although Health Information Portability and Accountability Act (HIPAA [Pub L No. 104-191]) regulations might prevent sharing of certain medical information without the explicit written consent of the patient or parent, the practice of providing follow-up for referring physicians is important to education, quality improvement processes, and perhaps, financial aspects of patient transports. When communicating in writing with referring physicians, the receiving facility must take appropriate safeguards to ensure that a patient's personal health information is protected. An alternative is to provide the referring physician with contact information for the receiving unit and/or attending physician for follow-up. The Air Medical Physician Association has published a position statement on the issue of patient follow-up letters and HIPAA. A sample of correspondence for a referring physician is shown in Fig 5.5.

Role of the Communications Center During Disasters and With EMS

For the same reasons that prehospital EMS dispatch systems might not be ideally suited for coordination of interfacility transports, a transport dispatch center is often not designed to manage EMS communications. Inbound ambulance staff might request medical control from an authorized emergency physician or nurse; this requires familiarity with state and regional prehospital care protocols and the capabilities of individual systems or

Figure 5.5: Sample Follow-up Correspondence

Date: 00/00/00

Dear Dr. ______________________:

Thank you for referring your patient, Johnny Doe, for transport to Children's Hospital on 00/00/00. Johnny was admitted to the pediatric intensive care unit with a preliminary diagnosis of bronchiolitis.

For further information, you may contact the PICU attending physician through the hospital's page operator at (555) 555-5555. If you have difficulty contacting the appropriate physician, please contact Dr Ambulance, medical director for the neonatal-pediatric transport team, at (555) 444-4444.

Thank you for the opportunity to serve you and your patients. If you have questions or comments about our transport services, please contact us at the following numbers or e-mail addresses:

Emergency Communications Center: (800) 888-KIDS (5537)

Medical Director: Dr Ambulance (555) 444-4444
E-mail address: dr.ambulance@childrens.transport.edu

Transport Team Coordinator: Teresa Transport, RN/EMT (555) 333-3333
E-mail address: teresa.transport@childrens.transport.edu

Communications Center Supervisor: Terry Telephone, EMT (555) 222-2222
E-mail address: terry.telephone@childrens.transport.edu

We would appreciate your completion of the enclosed brief survey about our service and return in the enclosed self-addressed envelope.

Sincerely,

Children's Hospital Neonatal-Pediatric Transport Team

enclosure

ED indicates emergency department; EMTs, emergency medical technicians; RN, registered nurse; EMS, emergency medical services; OR, operating room; ETA, expected time of arrival.

services. Nevertheless, the transport dispatch center can be used to coordinate communications and to notify receiving providers of a patient's imminent arrival.

In a disaster, hospitals are frequently overwhelmed by phone calls and inquiries from families, friends, employees, and the media. Incorporation of the dispatch center into the institution's disaster response system can provide additional resources for fielding such phone calls. In addition, the dispatch center can notify other hospitals and ambulance services that "routine" emergency patients should be diverted to other institutions during the time standard resources are limited. The dispatch center often has valuable information about other facilities, including bed capacity and contact persons and phone numbers.

Consideration for alternative forms of communication may be vital in preparing a communication center for the potential loss of land- based telecommunications. Satellite-based communication capability allows communication centers to assist with patient movement during local or national disasters. Having the ability to continue the functions of the communication center from alternate locations may be necessary depending on the disaster. This requires advanced preparations on the part of those responsible for the coordination of the communication center to ensure that the systems in place are periodically tested to ensure their functionality. Back-up sources of power (battery) may maintain communication ability for short periods of time until complete switching of phone lines and services is achieved.

Reference:

1. WordNet [database]. Princeton University. Available at: http://wordnetweb.princeton.edu/perl/webwn?s=communication. Accessed April 23, 2013

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CHAPTER 6

Equipment and Medications

Outline

- Overview
- Equipment
- Medications

Overview

The interfacility transport of critically ill neonates and children requires basic and specialized equipment and medications geared toward the needs of pediatric patients. Transport teams should be self-sufficient, with dedicated, organized supplies for quick, efficient access. Storage packs especially designed for neonatal-pediatric transports are commercially available and can be manufactured to be resistant to water and bloodborne pathogens. These packs and equipment containers should be organized, maintained, and verified by members of the transport team on a routine and documented basis. If any equipment needs to be shared among transport programs, local hospitals, or emergency medical services teams, plans and checklists should be developed to ensure that equipment is available and properly maintained. It is not advisable to rely on or plan to borrow equipment or medications from a referring hospital on a routine basis to serve a transport team's needs.

Transport equipment needs to be lightweight, portable, rugged, and easy to clean; to meet or exceed all hospital, local, state, federal and Federal Aviation Administration (FAA) requirements; and to have been tested in the transport environment. Use of a single universal equipment pack to treat patients ranging from preterm neonates to adults is not recommended. There are too many age-specific tools, medications, delivery devices, and techniques to enable efficient use of this type of equipment organization. The weight of stocked packs should be documented for air transports. All medical packs should be checked before and after each transport as well as daily. All electrical equipment must have independent, rechargeable power sources that can easily connect to power outlets in ground and air transport vehicles. These issues can be especially troublesome in the international transport arena, and the use of international travel electrical adapters should be considered. Compatibility of all mechanical equipment is critical (eg, the oxygen and air connectors must be compatible with all such connectors on all vehicles to be used) to avoid potentially disastrous interruption of therapy. Routine, scheduled equipment maintenance should be performed by competent, well-trained biomedical technicians.

The safety of all equipment used in transport is mandatory. Approved methods must be used to secure all equipment inside all transport vehicles and aircraft, whether equipment is portable or a permanent part of the vehicle. Techniques for securing patients, incubators, ventilators, stretchers, and equipment and drug packs need to be reviewed rigorously, and all personnel should be trained in these vital aspects of transport safety (see Chapter 9, 10).

Changes in weather and environmental conditions encountered during transport may affect performance of equipment. The real effects of vehicle vibration, temperature swings, and barometric pressure changes with altitude or sudden decompression must be determined before equipment is used. If this has not been accomplished by the manufacturer or by another organization, local biomedical testing services may be helpful in simulating transport conditions while testing proposed equipment.

Proper storage and dispensing of medications is essential for providing safe, effective care. Medications such as prostaglandins and surfactant require special procedures for refrigerated storage, shelf-life adjustment when not refrigerated, and additional training regarding their use on transport. A clinical pharmacist can be a valuable resource for identifying specific issues related to medication use during transport. Most transport teams carry controlled substances; institutional, state, and federal regulations should be consulted for security and documentation requirements. Additional regulations may be applicable for the international transport of controlled substances. The Joint Commission has mandated the use of standardized medication concentrations in hospitals and intensive care units (ICUs) but has not specifically required this change for interfacility transport. It is recommended that each transport program, however, consult its compliance experts to determine how to interpret standards of The Joint Commission within the transport environment.

Equipment

The essential features of equipment used in neonatal-pediatric transport are listed in Table 6.1, and a specific equipment list is shown in Table 6.2. Packs may need to be tailored to the needs of the individual transport service, and all team members should be facile in locating all supplies. Specialized teams (eg, neonatal, cardiac, extracorporeal membrane oxygenation, nitric oxide, and trauma) need additional equipment and medications to support these particular services.

Various transport incubators (eg, Isolette [Draeger Medical Inc, Telford, PA]) are available commercially. The type selected must provide regulated temperature, oxygen, and humidity and allow visibility and easy emergency access to the infant during transport. Transport incubators can be assembled in many different configurations for a multitude of transport vehicles. Often, incubator design will allow for the internal mounting of monitors and ventilators. Review and approval of the FAA are required if the incubator is to be used on rotor- or fixed-wing aircraft.

The choice of ventilators requires careful consideration and should be based on projected use, cost, team skill level, and team configuration to ensure proper operation. The availability of a respiratory therapist may influence the range of ventilator options during transport. Modes of ventilation for infants and children range from pressure-limited, time-cycled to volume-cycled or flow-triggered pressure support. Most ventilators are

Table 6.1: Essential Features of Equipment Used in Neonatal-Pediatric Transport

- Lightweight and portable
- Durable, able to withstand 4*g* acceleration and deceleration forces
- Easily maintained and cleaned
- Portable power (twice the expected mission time as minimum)
- AC/DC capable (use vehicle or hospital power source when possible)
- Production of no electromagnetic interference
- Resistant to electromagnetic interference
- Well-labeled (including return address of transport team)
- Audible and visible alarms
- Completely securable
- Compatible with all other equipment
- Able to meet all local, federal, state, and Federal Aviation Administration codes, including hazardous material regulations
- Able to tolerate altitude and temperature changes, sudden decompression, and vibration without performance change
- Able to fit easily through standard hospital doors and doors of transport vehicles
- Loadable in vehicles by 2 transport personnel

Table 6.2: Specific Equipment Used in Neonatal-Pediatric Transport*

- Transport incubator (patients <5 kg) or stretcher
- Ventilator, humidification and oxygen delivery equipment; capable of delivering continuous positive airway pressure (CPAP)
- Cardiovascular, blood pressure (invasive and noninvasive), pulse oximetry, and end-tidal carbon dioxide (CO_2) (invasive and noninvasive) monitors
- Portable transilluminator, chest tubes, and Heimlich valves
- Portable glucometer (essential)
- Point-of-care testing equipment, including blood gas analyzer (optional)
- Temperature monitoring probes and devices
- Airway equipment (endotracheal tubes, laryngoscopes, resuscitation bag and mask, laryngeal mask airways, tracheal cuff manometer, and video-assisted intubation devices)
- Portable suction
- Air-oxygen blender capable of delivering fraction of expired oxygen (Fio_2) 0.21 to 1.0 with flow meter up to 15 L/min
- Infusion pumps with low (0.1 mL/h) to high (1000 mL/h) capability
- Intravenous, central venous, and umbilical catheters. Intraosseous device (manual or battery-powered)
- Focusable portable light/transilluminator
- Defibrillator-cardioverter/pacer (see text)
- Intracranial pressure monitor (for certain pediatric patients)
- Nitric oxide administration equipment
- Neonatal/pediatric drug and clinical handbooks
- Trauma packs (for selected pediatric teams) including bandages, splints, chest tube kits, large-bore venous access, and cervical spine immobilization equipment
- Chest tube water-seal drainage systems

*All electrical equipment must have an independent (battery) power source. The batteries should have power for at least twice the anticipated mission time when vehicles to be used have no power source.

capable of delivering positive end-expiratory pressure. Some ventilators can perform multiple functions and can be adjusted for use with patients ranging from neonates to adults; other ventilators are ideally suited to a more limited patient population. Most neonates are ventilated using a pressure-limited, time-cycled mode. However, data support the use of CPAP, assist-control, or high-frequency oscillatory or jet ventilation modes on transport. It is important to note that the equipment providing these newer ventilation modes in a mobile environment may be in the development phase, and most data are team-specific and have not been thoroughly reviewed. If the ventilator is to be used in a rotor- or fixed-wing aircraft, consideration should be given to altitude compensation to prevent excessive changes in tidal-volume delivery. The use of untested or uncertified custom-built ventilators is not recommended unless approved by local institutional review boards for research purposes. If transporting a patient using a home ventilator that has not been tested in the transport environment, special considerations should be made, such as transfer to a transport ventilator before transport to ensure adequate transition and support or ensuring availability of a backup transport ventilator in case problems are encountered with the home ventilator.

As the use of cuffed airway devices becomes more prevalent in both neonatal and pediatric populations, the risks associated with tracheal mucosa damage should be proactively managed by monitoring and adjusting tracheal cuff pressures during the transport process. Because gases in enclosed spaces will expand with decreases in ambient barometric pressure (increasing altitude), the intracuff pressures of airway devices should be monitored and adjusted routinely throughout both rotor- and fixed-wing transports. Consideration for the use of incompressible fluids, such as saline, could be considered to avoid excessive intracuff pressure changes during air transports, but further research is warranted.

In addition to traditional laryngoscopy equipment, video-assisted intubation devices have gained increasing popularity in the management of difficult airways in the neonatal and pediatric transport environments. Although the use and specifics of each type of system varies, some potential options include visualization of the intubation on an LCD screen, recording for teaching purposes, and disposability of parts. Consideration should be given to training and competency requirements, costs, cleaning, durability, and disposability of these devices. Other airway management adjuncts, such as laryngeal mask airways and oro- and nasopharyngeal airways, should be considered essential equipment.

The use of inhaled nitric oxide to treat severe, persistent pulmonary hypertension in term and near-term neonates is standard of care. Teams transporting neonates receiving inhaled nitric oxide require specialized personnel and delivery devices to provide the correct mixture of gases through transport ventilators. The use of inhaled nitric oxide during transport is not recommended until transport personnel are well trained with the equipment in the intensive care setting.

It is standard for infants and children to have end-tidal CO_2 monitored during assisted ventilation via an endotracheal tube during transport. Disposable end-tidal CO_2 detectors are available commercially in several sizes for use in patients ranging from infants (>2 kg) to adults. These colorimetric detectors are light-and moisture-sensitive and are most commonly used to confirm tracheal tube placement at the time of intubation rather than to monitor tracheal tube position during transport. Capnography during transport is available with a portable device or as a built-in component of a transport monitor. The advantage of end-tidal CO_2 monitoring, as opposed to detection, is the continuous graphic display of each respiratory cycle. In addition to the ongoing confirmation of endotracheal tube position, capnography can provide valuable information about ventilation and circulation when interpreted by knowledgeable providers. It should be noted that the efficacy of these monitors and detectors has not been tested as thoroughly with neonates, especially those who are preterm, compared with children and adults.

Oxygen and air cylinders must be labeled and checked regularly. A desirable supply estimate is based on at least double the anticipated needs for the transport. A portable supply must be available for the transfer of the patient to and from the transport vehicle, with appropriate tubing lengths for maneuvering equipment in and out of ambulances and aircraft. Oxygen and air connection adapters can be carried by the transport team and used to connect the transport equipment to various types of oxygen and air outlets at referral facilities to prevent depleting transport gas cylinders. It is essential to be able to provide oxygen concentrations between 21% and 100% during interfacility transport, especially for infants with congenital heart disease who are at risk of pulmonary overcirculation in the presence of high concentrations of oxygen. Certain air-oxygen blenders are less wasteful of gases than others, and the most efficient gas-conserving model should be selected. Monitoring of the delivered oxygen concentration also is required.

Suction capability in all aspects of transport is essential. Whether it is for airway clearance or for thoracostomy tube drains, a stand-alone, battery-powered unit is required. The ability to regulate vacuum pressure is essential for the neonatal population. Additionally, many state ambulance licensing agencies require mounted suction units in all transport vehicles.

Many cardiovascular and vital sign monitors are available commercially. Multifunction monitors that include oximetry and invasive and noninvasive blood pressure monitoring are desirable but can be costly. For noninvasive blood pressure monitoring, appropriate cuff sizes for a variety of patients must be available.

Pulse oximeters used in aircraft must pass electromagnetic interference testing. Pulse synchronization is essential to avoid erroneous readings during transport, when patient movements and vibration may interfere with optimal operations. A secondary pulse oximeter should be considered if the continuous monitoring of both pre- and postductal oxygen saturations is needed for the monitoring of suspected cardiac defects.

Monitoring of patients' temperature is mandatory. Hypothermia and hyperthermia are common findings in pediatric patients (eg, prematurity, sepsis, cold-water drowning, and febrile seizures). Hypothermia may result from the exposure involved in stabilization and transport, especially in preterm neonates. Personnel should be familiar with the myriad of skin and tympanic membrane probes available for transport.

Intravenous infusion pumps must have stand-alone capability and be capable of accurate, controlled, and even delivery of infusion fluids and medications through various intravenous and umbilical line apparatus. Battery-operated pumps that can deliver rates as low as 0.1 mL/hour, and high-flow rates may be required and are readily available commercially. Transport teams should use pumps that can be secured safely on intravenous poles attached to transport stretchers or incubators so that they do not have to be carried separately.

Blood glucose monitoring strips or portable glucometers are essential during transport. Many teams now use point-of-care portable testing equipment, which allows for accurate electrolyte and/or blood gas measurements. Portable blood gas analyzers are also commercially available. When considering whether to provide point-of-care testing, a transport program should be aware that there are considerable requirements for quality control and documentation in conjunction with the sponsoring institution's laboratory services.

A separate, designated pediatric defibrillator-cardioverter/pacer is highly recommended and may be required for transport vehicle state licensure, but it might not be used during most transports because of the low incidence of arrhythmias in the neonatal and pediatric age groups. Each team must consider the weight and cost of such equipment versus the realistic needs on the basis of the patient population, thereby potentially making the routine inclusion of this equipment less practical for some exclusively neonatal transport teams. If teams take defibrillators-cardioverters/pacers on transport, they should ascertain that pediatric-sized pads or paddles are included. Although it is uncommon, transport teams may be asked to provide transthoracic pacing for pediatric patients with conditions such as toxic ingestions, myocarditis, and implanted pacemaker failure. For space and weight savings, current generation defibrillator-cardioverter/pacer models are commercially available that can also perform full invasive and noninvasive patient monitoring.

The use of intracranial pressure monitoring during neonatal-pediatric transport may also be encountered. Specific training and equipment are needed to optimally manage the care of patients who need such monitoring.

Medications

Table 6.3 lists the basic groups of medications and intravenous fluids used by neonatal-pediatric transport teams. Important indications, contraindications, and special considerations for administering neonatal-pediatric transport drugs are accessible via local, published, and online formularies. A sample transport team drug dosage card is included in Appendix B.

Medications need to be checked and restocked routinely before and after every transport and their use needs to be logged appropriately. A routine and scheduled inspection for expired medications and a rotation plan for near-expired medications are recommended. Transport medications should be stored in a secure, safe, dedicated place between transports so they are not depleted inadvertently by use in another clinical area. Transport teams should always assume that community hospitals will not have the medications or specialized fluids needed to treat most neonatal and pediatric conditions. Any incorrect dose or unexpected adverse drug reaction should be

Table 6.3: Basic Groups of Medications and Intravenous Fluids Used by Neonatal-Pediatric Transport Teams

- Intravenous fluids
  - Dextrose 10% in water ($D_{10}W$), dextrose 5% in water (D_5W), dextrose 5% in 0.22% normal saline (D_5W 0.2 NS), dextrose 5% in 0.45% normal saline (D_5W 0.45 NS), lactated Ringer's, normal saline (NS), albumin 5%
- Inotropic agents
  - Dopamine, dobutamine, epinephrine, norepinephrine, milrinone
- Code medications
  - Epinephrine, sodium bicarbonate (infant and adult preparations), naloxone, lidocaine, amiodarone, atropine, adenosine, calcium chloride, calcium gluconate, magnesium sulfate
- Rapid-sequence intubation medications
  - Fentanyl, midazolam, ketamine, etomidate, thiopental, rocuronium, vecuronium, succinylcholine, atropine
- Diuretics: furosemide
- Antibiotics
  - Ampicillin, gentamicin, cefotaxime, ceftriaxone, cefazolin, acyclovir
- Prostaglandins
- Surfactant preparations
- Asthma and croup medications
  - Methylprednisolone, dexamethasone, racemic epinephrine, albuterol, terbutaline, ipratropium
- Anticonvulsants
  - Lorazepam, phenobarbital, fosphenytoin
- Intracranial pressure medications
  - Mannitol, dexamethasone, hypertonic saline

documented and reviewed with the team's medical director and the pharmacist immediately following the transport.

Most analgesics, sedatives, and induction agents are considered controlled substances by state and federal agencies. All controlled substances must be prescribed by a physician with a valid US Drug Enforcement Agency license and state controlled substance certificate. For a nonphysician transport team, orders for controlled substances must be signed by the medical control physician or appropriate designee. For hospital-based transport teams, institutional policies govern the documentation requirements for controlled substances and the process for replenishing supplies after use. For freestanding transport teams, an arrangement with one or more medical control facilities should be made to provide replacement of controlled substances through a hospital pharmacy. State ambulance licensing agencies may require a designated, locked compartment on the transport vehicle for securing narcotic medications.

The use of endotracheally administered surfactant for neonates with respiratory distress syndrome is standard of care in the neonatal ICU. Many transport teams or referring medical teams administer surfactant to appropriate patients at referring nurseries before transport to the tertiary center. It is highly recommended that each team standardize its surfactant protocol and be well trained in its administration to minimize confusion and potential adverse effects, such as accidental extubation, pneumothorax, and pulmonary hemorrhage. Lung compliance changes should be anticipated during the first 30 minutes following surfactant administration. Some transport teams wait a specified time after administering surfactant to initiate the return transport.

Drug packs optimally should be constituted according to the needs of an individual team. Because most drugs used in pediatrics are given on a dose-per-kilogram basis and the weight of some critically ill pediatric patients may not be available at the time of transport, it is recommended that a length-based tape or length-weight or weight-for-age chart be used to approximate the child's weight. This chart can be used for emergency drug and fluid calculations until a definitive weight can be obtained. Teams that use length-based tapes on which doses are provided in *milliliters* should ascertain that the concentration of the drug preparation used matches that used on the tape.

Weight-drug-dose tables should be attached to drug packs and intake sheets to facilitate efficient mixing and administration of drugs (eg, vasopressors, antibiotics, and medications used during cardiopulmonary resuscitation). Drug cards, developed by each team, may be laminated and pocket-sized and should include important telephone numbers.

CHAPTER 7

Legal Issues

Outline

- Legal concepts and issues
- General legal principles
  - Legislative law, case law, and administrative regulation
  - State law and federal law
  - General structure of the federal and state court systems
  - Role of the jury
  - Standard of care
- Basic concepts of health care law
- Medical liability
  - Criminal
  - Licensure
  - Civil liability
- Emergency Medical Treatment and Active Labor Act (EMTALA)
  - Presents to the dedicated ED
  - Ambulances and helicopters
  - Designated hospitals
  - Disaster status exception
  - Patient transfers: stable versus unstable
  - Outpatient vs. inpatient transfers
  - Administration of the law
- Health Insurance Portability and Accountability Act (HIPAA)
  - HIPAA disclosure to law enforcement
  - Public health reporting
  - Communicable diseases
  - Abuse or neglect
  - Social media

- When medical responsibility attaches to the transport team
  - Dispatch
  - Diversion en route
  - On-scene responses
  - In the hospital
  - Delivery at the receiving facility
  - When civil legal liability attaches
- Transfer agreement issues
  - Liability issues with transfer agreements
- Role of risk management
  - Credentialing
  - Policies, procedures, and protocols
  - Quality measures
  - Incident management
  - Litigation support
- Documentation
  - What should be in the record
  - How long should records be retained
- Quality of care issues at the sending facility
  - Duty to act
- Quality of care issues during transport
- Transporting Nonpatients

Legal Concepts and Issues

Clinicians generally view the legal system with mistrust. Unfamiliar concepts and vocabulary combined with high-profile, multimillion dollar malpractice lawsuits can lead to understandable apprehension. The field of medical transport is, by its nature, filled with many complex and uncertain situations, with the sickest patients often located in less-than-ideal facilities. Additionally, it is important to recognize that the rules of law that apply to medical transport are a composite of general rules, transportation rules, and ambulance rules flavored with recent aircraft and emergency medical services (EMS) regulation. Understanding the source of the rules and how they are applied are essential to consideration of legal liability and distinctions for transport application.

General Legal Principles

If law is the set of rules we live by, then the US Constitution is the highest law. Written in 1787, the Constitution creates our government and states how it works. Each state has its own Constitution as well.

Legislative Law, Case Law, and Administrative Regulations

A significant amount of US law is based on case law, otherwise known as the "common law." The common law has been created by the courts, generally ruling on disputes between 2 parties, over the past several hundred years, originating from English law. The common law provides the basis for the courts perspective on criminal law, contracts, property, and many other disciplines. The area concerned with medical malpractice is known as torts.

In addition to case law, elected legislative bodies, such as the US Congress or a state legislature, create statutory law. It is then, under the elegant system laid out by the US Constitution, the job of the executive branch (led by the president at the federal level and the governor at the state level) to carry out the laws. To do this, the various agencies and bureaus of the executive branch create administrative regulations, some of which may be quite detailed. Florida Administrative Code (§64J-1.006, FAC), for example, specifies the exact size of endotracheal tubes that must be carried on neonatal transport. Anyone providing neonatal transport in Florida who does not carry sizes 2.0, 2.5, 3.0, 3.5, and 4.0 mm is violating the FAC and potentially liable.

State Law and Federal Law

It is important to distinguish between state laws and federal laws. Medicine, and consequently medical malpractice, is generally regulated by the states. Medical transportation, however, is often regulated at both the federal and state level. The Federal Aviation Administration (FAA) controls all civil aviation. In addition, many states require companies that provide medical transportation to be accredited by the Commission on Accreditation of Medical Transport Systems (CAMTS), of which the American Academy of Pediatrics (AAP) is a member. It is important to remember that state laws as well as state court decisions only apply in that state and are not binding on any other state. Clinicians must be familiar with the applicable law in the states in which they practice.

General Structure of the Federal and State Court Systems

The judicial system in the United States is composed of 2 different systems. The Constitution gives certain powers to the federal government and other powers to state governments. Consequently, there are federal and state court systems whose role is to interpret their laws. Most, but not all, medical malpractice cases are heard in state courts. In each system, there is a hierarchical structure.

The courts where jury trials are held and where lawsuits are generally first filed are known as courts of *original jurisdiction*. In the federal system, these are known as the US District Courts. In the state system, there are a number of different names used (in Ohio, "Courts of Common Pleas"; in New York, confusingly, "Supreme Courts"). If either side appeals a case, the appeal is often heard next by an appellate court. In the federal system, there are 13 US Circuit Courts of Appeal. The states, once again, have a variety of names for these courts (in California, "District Court of Appeal"; in Pennsylvania, "Superior Court"). It is important to note that appellate courts generally look for mistakes in the application of the law by the lower court. They usually do not hear additional witnesses or admit new or different evidence in a case.

The top court of appeal in the federal government is the US Supreme Court. Of the millions of lawsuits filed in the United States each year, the US Supreme Court only decides between 100 and 150 cases. Each state also has a top appellate court. Whether the US Supreme Court or the State Supreme Court (which may have a different name) can make the final decision will depend on the particular issue. In transport, for example, the US Supreme Court would have final decision over any FAA related-dispute, whereas the State Supreme Court would have final say over the particular interpretation of a state law.

Role of the Jury

Most state and all federal courts allow either side of a medical malpractice case to request a jury trial. The number of jurors varies by locality or jurisdiction. Procedures differ between jurisdictions for selecting jury members from the pool of potential jurors. The jury must reach its decision in a medical malpractice case based on the facts it finds to be true by a preponderance of the evidence. This means that the jury must be convinced that a given fact is more likely true than untrue, or just beyond 50% probability. The number or percentage of jurors necessary to reach a verdict varies by jurisdiction.

The jury is considered the conscience of the court system. It is charged with the duty to make its decision based on the facts, evidence, and law presented to it, without allowing sympathy or prejudice to interfere in the process. The jury members may rely on their common understanding and experience in life to judge the reasonableness of the evidence and testimony and to decide what is true and not true.

Standard of Care

Often, the most significant fact that the jury must determine is whether the health care provider's care in the case was within the *standard of care.* This, essentially, is a determination of whether the health care provider "negligently injured" the patient in some way as claimed in the lawsuit.

Simply, the standard of care is based on how competent practitioners with similar qualifications would have managed the patient's care under the same or similar circumstances. The standard is generally based on usual practices that exist in a community. In current legal terms, *community* may mean a region or the entire nation, depending on the jurisdiction. The standard may also be based on the *respectable minority* rule. This rule lets the jury decide whether the practitioner, using best judgment, followed an alternative treatment recognized by a respectable minority of those in the profession. There is no current legal definition of what constitutes a respectable minority. Generally, a medical expert of the same provider specialty will testify that the care provided did or did not meet the standard of care expected in similar circumstances.

Although the court often makes legal rulings on issues that may affect what goes to the jury for its decision on facts, the concept of liability will be considered for medical malpractice claims as made up of 4 basic factual elements that the jury generally determines:

1. Duty: Did the health care provider establish a relationship with the patient that created a duty to provide care?
2. Breach: Did the health care provider fail to provide the care or provide it in a manner that fell below the standard of care of the specialty or profession?

3. Causation: Did the action or inaction of the health care provider that failed to meet the standard of care cause a legally recognized injury (physical, psychological, property damage, or damage to another legal right), worsen the injury, cause or increase expense, or (in some states) reduce the chances for a favorable outcome? Was there a logical connection between the failure to meet the standard of care and the resulting injury?
4. Damages: What award of money will compensate the victim for the injury or losses suffered and reasonably likely to be suffered in the future? This award typically includes medical expenses, hospitalization, home care, loss of wages, and pain and suffering.

Basic Concepts of Health Care Law

First and foremost in health care law consideration is the concept of patient autonomy as a fundamental right. The competent, unimpaired adult (a person who has reached the age of majority) has the right to choose whatever health care treatment he or she will receive, even if that choice might otherwise seem illogical. The competent, adult patient who is a Jehovah's Witness may refuse a blood transfusion for himself or herself, even if it may result in death. The exercise of autonomy is the foundation for the requirement of *informed consent.* Transport services providers must be well trained on local and state informed consent requirements, especially as they relate to pediatric transport.

Informed consent shows the patient's agreement to a course of treatment and must be obtained before any treatment of a patient. Lack of informed consent may be grounds for medical malpractice claims and potential (but rare) criminal prosecutions. For example, touching a person (such as providing medical care) without consent is considered *battery* under the law—illegal touching that causes some legal or physical harm to the patient. In addition, an allegation of insufficient informed consent can be added to an allegation of malpractice to imply that the physician is careless.

Consent may be legally obtained from competent, unimpaired adults for their own care. However, there may be issues about who may consent for a minor, such as in the case of a pediatric transfer. Generally, a parent may consent for health care to his or her minor child. Other adults may consent for care of a minor based on state statutes that establish *health care surrogate* or *in loco parentis* (someone standing in for the parent) laws.

The legal order in which decision-making power is conferred on relatives or significant others varies significantly from state to state. Some states allow minors to consent for care related to reproductive and sexually transmitted disease concerns.

Another area of concern is the issue of minors who are pregnant or who are parents, whether married or unmarried. Some states clearly establish by law that minors who are parents may consent for the care of their children and for themselves. Other state laws allow minor parents to consent to the care of their child but not to their own care unless they are married. In some states, a pregnant minor female may consent to her own care and that of her unborn child, whereas in others, she may not do so, and the mother's parents retain legal power of consent over the pregnant minor and the unborn child.

In some states, minors may gain limited adult rights through the process of emancipation. Depending on the state, a child may be considered emancipated by marriage, military service, living apart and financially independent, or through court order. Emancipated minors may give their own informed consent and enter into contracts.

There is also the principle of *implied* or *emergent consent.* This form of consent exists when the surrounding circumstances lead a reasonable person to believe that consent would have been granted even though the patient or legal surrogate did not directly express agreement. For example, one would expect lifesaving measures to be taken in the sudden, unforeseen circumstance that required action to protect a life. Common and statutory laws generally have supported physicians and health care professionals providing emergency care for children without the consent of a parent or guardian.

Providers must be familiar with the laws and regulations dealing with consent in their state of operation. With advice from legal counsel who have expertise in health care law, transport services should develop written policies and guidelines that conform to federal and state laws regarding consent for the treatment of minors, including specific guidelines on parental notification and patient confidentiality for unaccompanied minors.

For consent to be valid, the patient must be properly informed. The *informed* requirement means that the responsible, consenting party was provided information on the benefits, risks, and alternatives of the proposed treatment before consent. Some states require that the disclosure of risks must be all things a reasonably prudent person would want to know when making a decision on care (reasonable patient standard). Other states limit the necessary disclosure to things a reasonable physician would consider important to disclose (reasonable physician standard).

Ideally, informed consent is documented on a specific form that details the service to be provided (such as helicopter transfer with medical care en route) and a simple, clear statement of the risks associated with the transfer. A statement that "risks and benefits were discussed with the patient" is not sufficient. Hospitals should use a standardized form that includes the reason for transfer, medical benefits and risks, mode and level of transport, care to be provided during the transport, and the name of the receiving facility and authorized accepting person or physician (Appendix C).

Whenever possible, the consent should be signed by the patient or parent. If written signature is not possible, verbal authorization or phone consent should be obtained from the legal surrogate and noted and signed by the person obtaining the consent (and witness if required) when possible. Patients who are unable to consent because of injury or medical condition, intoxication, mental illness, or legal incompetency (eg, a minor) who do not have a legal surrogate available are presumed to have given implied consent for reasonably necessary care. The law generally requires that a reasonable effort must be made to contact the parent(s) or legal guardian or responsible party (such as a state agency guardian for children or developmentally disabled patients or prison warden for incarcerated patients) for consent unless physicians have determined that the delay would endanger the patient. The AAP, the American College of Surgeons, the Society of Pediatric Nurses, the Society of Critical Care Medicine, the American College of Emergency Physicians, the Emergency Nurses Association, and the National Association of EMS Physicians have endorsed the statement that "Appropriate medical care for the pediatric patient with an urgent or emergent condition should never be withheld or delayed because of problems with obtaining consent."

It is important to note that under the Emergency Medical Treatment and Active Labor Act (EMTALA; see the "Emergency Medical Treatment and Active Labor Act" section), a minor can request an examination or treatment for an emergency medical condition. A hospital is not to delay care while waiting for parental consent. If no emergency is found to exist, further care may be deferred while awaiting consent.

Medical Liability

Legal liability concerns for neonatal-pediatric transport providers involve malpractice liability, in addition to regulatory actions, licensure concerns, and the possibility of criminal charges in the most extreme cases. Transport providers may primarily be concerned with malpractice risk issues in legal discussions of liability, but the interactions of all types must be considered. In fact, violations of regulatory or licensure standards may be the basis for a malpractice allegation.

Criminal

Unlicensed or substandard operations are the most likely to result in criminal charges. Issues of unlicensed operation may occur when transport units cross state lines to pick up or deliver patients.

It is essential that transport teams have a clear understanding of neighboring state laws and licensure clearance before responding across a state line. Reciprocal agreements or multistate licensure may be required to ensure that medical care may be legally performed in a neighboring jurisdiction. In the case of rotor- and fixed-wing aircraft services, the issue may extend to an even greater radius of potential service. Responses into some states, whether by rotor- or fixed-wing aircraft, may be prohibited by state or local law except in cases of disaster. It is the responsibility of the transport service's legal counsel to determine the types of clearance needed in each potential destination state and to obtain the appropriate permissions, licenses, and/or waivers needed and educate the teams on the requirements. In addition, the service should ensure that its malpractice and liability policies are in effect when traveling to other states.

Licensure

Failure to meet or maintain the standards and requirements for licensure can result in actions against the service and individual personnel. These actions can result in fines, probationary status, suspension, or revocation of licenses. It is imperative that any licensed transport clinician who potentially will be dispatched to another state check with neighboring states for rules governing practice while in another state. Most states allow a licensed clinician working for their team to aide with stabilization and transport of a patient back to his or her own facility. If a specific team routinely performs third-party transports or telemedicine consults to facilities in another state, it is recommended that their staff be licensed in those specific states being served. Similar rules apply for administering drugs and controlled substances while on transport.

Civil Liability

In most states, a basic case of liability can be made by showing that the regulations were violated and that the regulations were in place to protect the safety of the public. In some cases, the law explicitly creates a new statutory cause of action for liability. These new causes of action, however, are legislative changes and typically are not created by regulation.

The rules that apply to regulatory violations and their effect on liability vary from state to state. In some states, when that standard is violated and harm results, "normal" medical malpractice may be established without resort to experts to establish the standard of care. One such approach is called *negligence per se.* A violation of the law or regulations is proof of failing to meet the appropriate standard of care. In a negligence per se claim, the plaintiff has to show that a law intended to prevent the type of injury that occurred was violated. A negligence per se claim may be made even if the defendant has not been convicted or administratively sanctioned under the law in question. In such cases, the plaintiff must prove that the defendant violated the law. Other states use a *prima facie rule.* In prima facie cases, it is presumed that the evidence is sufficient to establish the fact in question unless rebutted. The burden shifts to the defendant to prove that the violation of the regulation was not negligence. In either case, however, there must be resulting harm to the patient for liability to exist.

Not every violation of the regulations, however, would result in liability. If vehicle maintenance regulations were violated, for example, it would not be grounds for a medical malpractice claim, but it might be grounds for liability for patient injuries incurred in a crash that resulted from improper maintenance. On the other hand, a violation that involved failure to restock mandated equipment and the lack of equipment made it impossible to properly care for the patient would likely support a malpractice claim by a patient who was harmed by the lack of equipment. In the absence of explicit intent of the legislature or agency to create a safety standard or prior court rulings on the issue, it is up to the injured party to prove to a judge that the regulation is a safety standard that should be applied to create liability.

Emergency Medical Treatment and Active Labor Act

For years, many indigent patients were turned away from hospital emergency departments (EDs). Patients in unstable condition were transferred or denied care simply because they did not have the financial means to make or guarantee hospital payment. Congress passed an amendment to the Social Security Act, EMTALA, as part of the Consolidated Omnibus Budget Reconciliation Act of 1986. Intended as an "anti–patient dumping" law, it requires Medicare-participating hospitals to provide necessary emergency care for patients regardless of the patient's ability to pay. Subsequent revisions of EMTALA have expanded its scope and better defined its role, especially with respect to EMS. State or federal laws that contradict or conflict with EMTALA are considered preempted by it. The Centers for Medicare and Medicaid Services (CMS) issues and enforces regulations under the act.

EMTALA requirements are summarized in the box. Basically, the law provides that any patient who "presents" to the hospital's "dedicated" ED requesting evaluation or treatment must receive a medical screening examination (MSE) to determine the presence of an emergency medical condition (EMC). If an EMC is present, the patient's condition must be stabilized within the capacity of the treating hospital. Patients requiring care beyond the hospital's capacity may be transferred to an appropriate facility. The obligations related to the transfer depend on whether the patient's condition is stable. Protection under EMTALA also covers psychiatric patients and the unborn children of women in labor.

Hospital Requirements Under EMTALA

- Provide an appropriate medical screening examination to any individual who comes to the emergency department
- Provide necessary stabilizing treatment to an individual with an emergency medical condition (EMC) or an individual in labor
- Provide for an appropriate transfer of the individual if either the individual requests the transfer or the hospital does not have the capability or capacity to provide the treatment necessary to stabilize the EMC (or the capability or capacity to admit the individual)
- Not delay examination and/or treatment in order to inquire about the individual's insurance or payment status
- Obtain or attempt to obtain written and informed refusal of examination, treatment or an appropriate transfer in the case of an individual who refuses examination, treatment or transfer
- Not take adverse action against a physician or qualified medical personnel who refuses to transfer an individual with an emergency medical condition, or against an employee who reports a violation of these requirements.

Presents to the Dedicated ED

Any person who comes to the hospital's dedicated ED requesting an evaluation or a treatment must be given an MSE. The request can be made on the patient's behalf (eg, a minor). A *dedicated* ED is any department of the hospital (1) licensed by the state as an ED; (2) held out to the public as a place for emergency or unscheduled care; or (3) in which at least one third of the outpatient visits were for emergency care during the previous calendar year. The ED does not have to be located on the main hospital campus. The CMS considers labor and delivery and psychiatric units to fall under the dedicated ED definition. However, EMTALA does not apply to a person who comes to a hospital outpatient department and an EMC unexpectedly develops during a scheduled visit.

The "250-yard" rule has also been modified. The request for care, using the aforementioned criteria, may still occur anywhere on the hospital property (including driveways and sidewalks). However, the CMS uses other Medicare rules (42 CFR §413.65) to define the hospital campus. Areas such as physician offices, skilled nursing facilities (and similar separate Medicare-participating units), and nonmedical facilities are not included in the hospital's zone of responsibility. Non-EDs off the main hospital campus no longer fall under EMTALA. They still must have written policies for dealing with emergencies.

Ambulances and Helicopters

CMS has clarified a number of issues for hospital and non–hospital-owned and -operated ambulances and helicopters. Hospital property includes ambulances owned and operated by the hospital even if the ambulance is not on the hospital campus. Hospital-owned and -operated ambulances and helicopters may be diverted only if the diversion occurs pursuant to community-wide EMS protocols.

Telephone or telemetry contact with ED personnel by non–hospital-owned and -operated ambulances and helicopters does not trigger that hospital's EMTALA obligation. The hospital may divert the ambulance to another facility if the hospital is on "diversionary status" (insufficient staff or facilities to accept additional emergency patients). However, once the ambulance drives on to the hospital property, even if they were told to divert, the patient is considered to have come to the hospital's ED and the hospital has an EMTALA obligation. Additionally, if a hospital that is not on diversionary status fails to accept a telephone or radio request for transfer or admission, the refusal could represent a violation of other federal or state requirements.

In *Arrington v Wong,* the US 9th Circuit Court of Appeals ruled that diverting an ambulance requesting access may result in EMTALA liability. In this case, it was alleged that a patient with severe breathing difficulties was diverted en route from an ED to a military hospital. The patient died on arrival at the military facility, and the family sued the hospital that did not accept the patient. The hospital was not on diversion status. The court ruled that the allegations were enough to force the matter to trial on potential EMTALA liability.

"Parking" Patients

A hospital's EMTALA obligation begins as soon as a patient presents to the emergency department or other qualified area. There are certain occasions, such as when ED staff are occupied dealing with multiple major trauma cases and a patient has arrived via EMS and has been assessed and appropriately prioritized by the hospital, in which it may be reasonable for the hospital to ask an EMS provider to stay with that patient until ED staff are available. It was reported, however, to the CMS that some patients were being routinely left on stretchers with EMS staff in attendance for an extended period of time with hospital staff believing that they had no obligations to provide care or accommodate the patient until they took "responsibility" for the patient. In July 2006, the CMS issued a letter strongly discouraging this practice as concerning for both patient care and the provision of emergency services to the community. The letter clarifies that the EMTALA obligation starts at the time of presentation, not when EMS personnel transfer responsibility. Additionally, hospitals are legally required to meet the emergency needs of patients in accordance with acceptable standards of practice (42 CFR 482.55, Conditions of Participation for Hospitals for Emergency Services). The CMS concludes that the practice of "parking" patients in hospitals is not an acceptable practice.

Helipads

Under the *helipad exemption,* ambulances may bring patients onto hospital grounds without triggering the hospital's EMTALA obligation, under certain circumstances:

- The use of a hospital's helipad by local ambulance services or other hospitals for the transport of patients to tertiary hospitals located throughout the state does not trigger an EMTALA obligation as long as the sending hospital conducted the MSE before transporting the patient to the helipad. The sending hospital is responsible for conducting the MSE before transfer to determine whether an EMC exists and implementing stabilizing treatment or conducting an appropriate transfer. Therefore, if the helipad serves simply as a point of transit for patients who have received an MSE before transfer to the helipad, the hospital with the helipad is not obligated to perform another MSE before the patient's continued travel to the recipient hospital. If, however, while at the helipad, the patient's condition deteriorates, the hospital at which the helipad is located must provide another MSE and stabilizing treatment within its capacity if requested by medical personnel accompanying the patient.
- If as part of the EMS protocol, EMS activates helicopter evacuation of a patient with a potential EMC, the hospital that has the helipad does not have an EMTALA obligation if it is not the recipient hospital unless a request is made for the examination or treatment of an EMC by EMS personnel, the patient, or a legally responsible person acting on the behalf of the patient.

Therefore, the patient who had an MSE at Hospital A could be taken by ambulance to the helipad located on the grounds of Hospital B for transfer to Hospital C without triggering Hospital B's EMTALA obligation, unless the patient's condition deteriorated before loading on the helicopter. In addition, a patient picked up in the field who is brought to the helipad at Hospital X for transfer to Hospital Z under local EMS protocol would not launch Hospital X's EMTALA obligation unless the EMS personnel (or patient) requested care before loading on the helicopter.

Designated Hospitals

Although community-based EMS protocols may determine the appropriate facility for a patient from the field, once a patient has arrived in the ED, he or she must be provided with an MSE and appropriate stabilizing care. Hospitals are not relieved of their EMTALA obligation to screen or provide stabilizing treatment or an appropriate transfer because of prearranged community or state plans that have designated specific facilities to care for selected patients (eg, Medicaid patients, psychiatric patients, pregnant women, and trauma patients). Hospitals located in states with laws that require certain patients (eg, psychiatric) to be evaluated and treated at designated facilities may violate EMTALA if the hospital disregards the EMTALA requirements and does not conduct an MSE and provide stabilizing treatment or conduct an appropriate examination before referring or transferring the patient to the designated facility. If, after conducting the MSE and ruling out an EMC (or after stabilizing the EMC), the sending hospital needs to transfer a patient to another hospital for treatment, it may elect to transfer the individual to the hospital so designated by the state or local laws (these patients are not considered in unstable condition under EMTALA). The existence of a state law requiring transfer of certain patients to certain facilities does not preempt the requirement to meet federal EMTALA requirements.

Disaster Status Exception

For a national emergency or crisis (eg, bioterrorism), state or local governments may develop community response plans that designate specific entities (eg, hospitals and public health facilities) with the responsibility of handling certain categories of patients during these catastrophic events. Although CMS added a section to the rules eliminating sanctions for inappropriate transfers in these circumstances, hospitals could still be held responsible for providing a MSE to any patients who presented to the ED. For example, a patient potentially exposed to a toxin arrives at a hospital not designated, pursuant to a state or local EMS plan, as a hospital where patients exposed to toxins should go. After interviewing the patient and determining that the patient falls into the category for which the community has a specified screening site, the patient may be referred to the designated community facility without risking sanctions under EMTALA. Also, public employees may not be sanctioned for violations of the Health Insurance Portability and Accountability Act (HIPAA) or EMTALA that occur during a public health emergency (42 USC §1320b-5[b]). It is important to note that this exemption applies only to declared national—not state or local—emergencies.

Patient Transfers: Stable Versus Unstable

Not all transfers between hospitals are subject to EMTALA. In fact, only patients who have an unstable EMC fall under the rules. Although the CMS interpretive guidelines and court decisions have confirmed that EMTALA does not apply to a patient in stable condition, surveyors of an EMTALA complaint may not understand the differences. In addition, a professional review organization may be asked by the survey agency to determine whether the patient was in stable condition at the time of the transfer. Some states may have rules applicable to the transfer of patients in stable condition. For good patient care and medicolegal purposes, it is reasonable to follow the same guidelines for all transfer patients.

For EMTALA purposes, a patient is considered in stable condition when the EMC that resulted in ED admission has resolved; however, the underlying medical condition may persist. The determination of the stability of a patient's condition is based on the reasonable clinical confidence of the treating physician or practitioner that the EMC no longer exists and there is no material risk of deterioration in the condition. The example for this given by CMS is a patient with an asthma exacerbation. Although the patient's acute attack is controlled (stabilized EMC), the underlying asthma still exists.

In psychiatric emergencies, CMS interpretive guidelines state that any patient expressing suicidal or homicidal thoughts or gestures or determined dangerous to self or others would be considered to have an EMC. Psychiatric patients would be considered in stable condition when they are protected and prevented from injuring or harming themselves or others. The use of chemical or physical restraints to affect a transfer may stabilize the psychiatric patient for a time and remove the immediate EMC, even though the underlying medical condition may persist.

Patients in unstable condition may be transferred because of medical need or the patient's (or surrogate's) request. A transfer for medical need is indicated when the hospital no longer has the capacity to perform the MSE (additional specialized equipment is needed) or stabilize an EMC (provide a higher level of care). *Capacity* includes staff, resources, and physician expertise. *Higher level of care* includes facilities with specialized units, staff and equipment (eg, pediatric intensive care unit, cardiac bypass, and neurosurgeon). A patient may request a transfer for any reason. Patients in unstable condition who request a transfer for economic reasons (eg, managed care plan) do so at their own risk.

The referring hospital is responsible for coordinating the transfer. EMTALA requires the transferring physician to certify in writing that at the time of the transfer:

1. the benefits of the transfer outweigh the risks;
2. the patient (or surrogate) has given informed consent for the transfer; and
3. an appropriate transfer has been arranged.

If a physician is not physically present in the ED at the time of the transfer, the certification may be signed by hospital-designated qualified medical personnel after consultation with the physician. The physician then will need to countersign the certification.

In documenting the benefits and risks, the physician should be as thorough as possible. Terms such as "Needs level I trauma care," "No orthopedic services available," or "High-risk L&D [labor and delivery] services required" clearly show specific medical needs. Description of risk should also be straightforward (eg, "Risk of deterioration or death) but more detailed than simply "Risk of ambulance ride."

Informed consent should be obtained from the patient. If the patient is not capable of providing consent and no surrogate is available, the transfer may proceed under implied consent. Refusal to an appropriate transfer by the patient (or surrogate) should clearly be documented in the medical record. Documentation should include details about the risks and benefits of the transfer that were explained to the patient (or surrogate) and an assessment of the patient's competency to make the decision. In this situation, the hospital's EMTALA obligation is complete.

EMTALA does not require the transporting service to obtain a separate consent. Services should discuss with their legal counsel the advisability of having a separate transfer consent form. A separate form may be particularly useful for air transport services to affirmatively document that the patient or family is aware of the specific risks associated with air transport.

A separate certification form should be used. The form should include the following:

1. Description of the patient's diagnosis and condition
   - No EMC
   - Stable EMC (no material risk of deterioration during transfer)
   - Unstable EMC (material risk of deterioration during transfer)
2. Reason for transfer (medical need, patient request, refusal or failure of on-call consultant to respond within a reasonable time)
3. Mode and method of and care during transport
4. Name, time, and date that accepting physician and/or authorized receiving hospital personnel agreed to the transfer

5. List of documentation being sent with patient
6. Vital signs before transfer
7. Signed informed consent for transfer

An appropriate transfer occurs when the:

1. transferring hospital has provided medical care within its capacity to minimize risk to the patient's health (or to the unborn child of a woman in labor),
2. receiving hospital has agreed to accept the patient and has the space and resources available for treatment,
3. transferring hospital sends available medical records with the patient, and
4. transfer is effected by qualified personnel and transportation equipment.

Care within capacity (see the definition earlier in this section) is different for each patient. Performing an MSE that determines that other services are needed may be the only service within a hospital's capacity for certain conditions. Other care to minimize the risk to the patient's health can range from stabilizing airway, breathing, and circulation to the administration of medications and fluids.

The transferring hospital must determine whether the potential receiving hospital has the resources available to care for the patient. For example, it would not be appropriate to transfer a patient with a severe head injury from a rural hospital ED without a computed tomography (CT) scanner or neurosurgeon to another hospital similarly situated. Hospitals with specialized services are required to accept transfers for patient's requiring those services if they have the capacity. Having the capacity has come to mean that if the hospital could care for a similar patient in its ED, it would have to accept the transfer.

A patient in unstable condition cannot be transferred to a particular hospital simply for economic reasons, whether insured or not. A health care plan cannot require a patient be transferred to a contracted or in-network facility during the MSE or if the treating facility is capable of stabilizing the EMC. Nor can the plan require the patient be transferred to a facility with less capability than medically needed by the patient. If there are 2 hospitals of equal capabilities and transport time and one is a plan in-network facility, the patient may choose based on the insurance. Lack of or delay in obtaining health care plan authorization cannot defer a transfer to an appropriate receiving hospital.

EMTALA does not require a physician to be the accepting party for the receiving hospital. In fact, it is up to the hospital to determine who can accept patients on its behalf (eg, physician, nurse, or admission clerk). For good patient care and other medicolegal reasons, it is prudent for the transferring physician to discuss the patient's condition with the receiving physician or health care team member.

At a minimum, a copy of the medical record including triage note, physician record, patient care staff notes; records of treatments, test results, and radiographs; and transfer certification and consent must be sent with the patient. In situations in which the physician was not present at the time of the transfer, the record must include the name and address of the on-call physician who authorized the transfer. Some states may have additional requirements. A patient's transfer should never be delayed because of paperwork. Paper or electronic records may be faxed or sent by e-mail, and hard copy items (eg, radiographs) may be sent by courier. However, a record of the patient's most recent vital signs and status at the time of the transfer should be available to go with the patient.

Transport teams should check that they have the appropriate documentation before loading the patient or be able to inform the receiving hospital about how the records will be delivered. Delivery of the records should be documented by written receipt from the receiving staff or at least by notation in the transport record. Specific transport documentation is not required by EMTALA, but a copy of the transport record should be given to the receiving hospital.

The term *qualified personnel and transportation equipment* is not defined by EMTALA. The level of training and mode of transport should be consistent with the needs of the patient. The referring physician and hospital may be held liable for using inappropriate transport services. In *Burditt v U.S. Department of Health and Human* Services (934 F2d 1362 [5th Cir 1991]), the court ruled that an obstetrician as well as a fetal monitor was required to transport a hypertensive pregnant patient to a receiving hospital 170 miles away. Although transferring a patient by private vehicle per se is not an EMTALA violation, it would be difficult to defend as an appropriate mode of transport for a patient in unstable condition.

It is important to remember that it is ultimately the referring physician's responsibility to determine the scope of the MSE, the existence and/or stabilization of an EMC, and the appropriate receiving facility and level and mode of transport for the patient.

Outpatient Versus Inpatient Transfers

EMTALA defines an *inpatient* as a patient who has been admitted to the hospital with the reasonable expectation that he or she will occupy a bed at least overnight. It does not matter if the patient is directly admitted to the ward, stops in the ED to get a room assignment, or is boarded in the ED pending bed placement. Patients placed in temporary observation status or admitted for stabilizing care with the expectation of transfer without staying at the first hospital overnight are not "inpatients" under EMTALA. Patients admitted with the intent of avoiding EMTALA are not legally considered inpatients. The fact that a patient was admitted with the expectation he or she would occupy a bed overnight but whose condition deteriorated, requiring transfer, does not invalidate inpatient status.

In the past, there was disagreement among several courts over whether EMTALA applies to inpatients. In *Thornton v Southwest Detroit Hospital* (895 F.2d 1131 [6th Cir. 1990]), a Federal Appellate Court found that "once a patient is found to suffer from an [EMC] in the emergency room, she cannot be discharged until the condition is stabilized." Other courts have found that EMTALA obligations end when an individual is admitted as an inpatient. The CMS seemed to resolve the issue through a rule issued on August 19, 2008, stating that once an individual with an EMC is admitted as an inpatient, the EMTALA obligation ends. The CMS applies the Medicare Conditions of Participation (42 CFR §482) to monitor the hospital's continued responsibility to meet the inpatient emergency needs. At the time of writing of this chapter, however, the CMS is considering revisions to the current rules.

Administration of the Law

Complaints of potential EMTALA violations are investigated by the CMS through its regional offices or state oversight agencies. Complaints related to physician issues are reviewed by peer physician reviewers from the state's professional review organization. Review guidelines and policies are published and available on the CMS Web site (http://www.cms.gov/EMTALA/).

If a hospital is found to be in violation of EMTALA and the CMS determines that the violation poses immediate jeopardy to the health or safety of people who come to the ED, it is given a 23-day notice of termination from participation in federal insurance programs (Medicare, Medicaid, CHAMPUS [The Civilian Health and Medical Program of the Uniformed Services]). During that time, the hospital is to develop, present, and have approved a program to ensure compliance.

The Health and Human Services Office of Inspector General reviews all cases and may levy civil monetary penalties for violations and prosecute cases that are disputed. Hospitals with fewer than 100 licensed beds can be fined up to $25 000 per violation incident. Larger hospitals face fines of up to $50 000 per violation. Physicians found in violation can be fined up to $50 000 per patient violation incident in addition to termination from participation in federal insurance programs. The law also grants patients and aggrieved medical facilities the right to sue for damages for injuries sustained as a result of an EMTALA violation.

Summary

EMTALA is a complex law that has particular application to air and ground transport of neonatal and pediatric patients. Furthermore, the CMS is often updating their interpretation of the law. To date, more than 2000 facilities have received EMTALA enforcement actions from the CMS. It is important that all providers are appropriately educated and trained about EMTALA and that transport organizations have appropriate policies in place. Additionally, a proactive relationship with risk management and legal counsel will help ensure continued compliance.

Health Insurance Portability and Accountability Act

Confidentiality has been a core principle of medical care for centuries. Indeed, the Hippocratic Oath commands that all "that may come to my knowledge in the exercise of my profession…which ought not to be spread abroad, I will keep secret and will never reveal." The Health Information Portability and Accountability Act (HIPAA), passed in 1996, codifies this principle by including a privacy rule that creates a national minimal standard to protect personal health information. Although HIPAA greatly affects the flow of medical information, it does not prevent or require specific authorization for sharing of information among health care providers involved in the care of the patient. Each provider, however, is obligated to comply with HIPAA, and most attorneys favor separate disclosure of privacy practices and consents whenever possible. When an interstate transfer is involved, conflicting state laws may become an issue, and the "higher" or more restrictive standard applies.

Privacy notice forms are complex documents that must reflect many detailed elements of federal and state laws. These documents should be prepared by counsel and standardized for use by the transport service. All personnel should be trained regarding the content and use of the forms and in the privacy practices applicable in their jurisdiction. Emergency services such as transport teams are required to provide notice of privacy practices to patients "as soon as reasonably practicable after the emergency treatment situation." This determination of practicability will probably be somewhat lenient in scene response situations, and provision of the information at the destination hospital will likely be acceptable. In transfer situations, however, it is more likely that the privacy notice will be expected before transfer.

It is generally advisable to obtain a signature evidencing receipt of the notice of privacy practices, but when the patient or family refuses signature or it is not practical to obtain a signature, it should be documented that the notice form was given to the patient or family. If the situation is too involved for providers, patients, or family to rationally cope with legal notices, the situation should be documented, and notice may be provided later when circumstances permit.

Violation of HIPAA regulations may result in fines to a provider and federal criminal charges against individuals for certain intentional violations. Additionally, providers are required to disclose breaches of protected health information (PHI) to patients within 60 days, and when more than 500 patients are involved (easier to do in the era of laptops, jump drives, and smartphones) the Department of Health and Human Services must be notified as well as "prominent media outlets." Congress recently increased the size of monetary penalties, authorized state attorneys general to bring civil actions against violators in federal district court, and now allows plaintiffs to receive a percentage of any penalty or settlement.

State requirements may impose additional penalties, including criminal charges against individuals, for privacy violations. Although HIPAA creates a new civil liability, privacy violations can be used as grounds for medical malpractice suits in all jurisdictions. HIPAA also has the effect of standardizing privacy practices, which in turn may create a new standard of care over time.

HIPAA Disclosure to Law Enforcement

Law enforcement personnel are frequently involved in ED or acute medical cases and may come into contact with transport teams. Transport teams must be appropriately knowledgeable about the information they may disclose without violating patient privacy laws and/or HIPAA. Investigators are not always familiar with HIPAA and its restrictions.

In some cases, there may be a conflict between HIPAA regulations and existing state laws. HIPAA supersedes the state law unless the state law is more restrictive, in which case the state law controls. It is neither feasible nor desirable to attempt to resolve these fine legal points in the acute care setting when these conflicts will impair the ability of the transport team and law enforcement to perform their respective functions. ED, transport, and police administration (and perhaps legal counsel) need to address these issues proactively to reduce the stress on officers and transport personnel.

HIPAA addresses several types of situations in which information might be requested or required from health care providers by law enforcement or public officials.

Public Health Reporting

Teams may report public health conditions *required by law* to a properly designated public health agency without permission or notice to the patient or representatives (45 CFR 164.512[b][i]).

Communicable Diseases

Under HIPAA, health care personnel may report a person who may have been exposed to a communicable disease or may be a carrier of a communicable disease if the health agency has the power under the law to receive that information and track or notify the disease or condition (45 CFR 164.512[b][iv]).

Abuse or Neglect

Transport team personnel may report suspected issues of child abuse without permission or notice to the patient, parents, or legal representative

(45 CFR 164.512[b][ii]). As mandated reporters, transport team personnel may report cases of abuse or neglect to an authorized agency to the extent that it is *required by law*. They may report only the portion of information that is required by the law, *with the patient's consent to the extent required by state law*.

If the patient is not competent to consent, the disclosure can be made if the health care provider believes that:

1. it is necessary to prevent serious harm to the patient or other potential victims,
2. it is not intended to be used against the patient, and
3. an immediate investigation would be compromised by waiting until the patient was competent to consent.

In these circumstances, transport team personnel must inform the patient promptly that a report was or is going to be made, unless the health care professional reasonably believes that informing the patient or legal representative would place the patient or representative at risk of serious harm or that the representative is responsible for the abuse, neglect, or injury of the patient (45 CFR164.512 [c]).

Social Media

There are more than 500 million active Facebook accounts, and many of those belong to health care workers. It is natural for a person to come home from work and want to vent about their day or share a funny story, but clinicians must remember that they have stringent moral and legal obligations to protect patient confidentiality and privacy that may directly conflict with the candid and unguarded internet environment. It is not acceptable to share <u>any</u> information that would make a patient identifiable, even if the name is left out. This has particular relevance for transport personnel who often deal with high-profile events. Many workers have been disciplined or dismissed for careless online blogs or posts, and this is a relatively new issue. Clinicians must be very careful about revealing any work-related information online. The consequences can be severe.

HIPAA Compliance Requirements

- Provide written Notice of Privacy Practices to all patients
- Provide an authorization form for the release of Protected Health Information (PHI)
- Secure all written documents containing PHI at all times (in the ED, ambulance, office)
- PHI should only be given to providers directly involved in patient care unless there is a recognized exception (Communicable Diseases, Suspected Abuse or Neglect)
- Designate a Privacy Official
- Conduct and document privacy training
- Develop and put into place Business Associate Contracts

When Medical Responsibility Attaches to the Transport Team

Acceptance of a call for response places the transport service under a duty to the patient, but when do the team members become individually responsible to the patient in a medical sense?

One of the first important concepts is that many people can have medical responsibility for a single patient at one time. The fact that one person has acquired medical responsibility does not automatically release someone else.

Dispatch

Once a team is dispatched to a particular response, the first medical responsibility attaches, that is to not unreasonably abandon the patient. To the extent that completion of the response remains within the control of the transport team members, they have a duty to continue with a response. If control is lost because of weather, safety, mechanical issues, dispatch orders, or pilot decisions, the transport team members are not responsible for more than they can actually do. It may be reasonable to notify dispatch, but there is no requirement that team members place themselves at unreasonable risk, disobey orders, or violate flight rules to complete a response.

Diversion en Route

The implications of transport mission diversion are significant. The limited resources of transport teams in many areas make triage, mission prioritization, and potential diversion a frequent matter. The legal issues, however, may be more complex, and the exposure to a lawsuit is definitely increased if mission diversion occurs. Mission diversions must be firmly supported by written policies and procedures that clearly establish the service's position on whether mission diversion may ever occur, what priorities will be applied, who will make priority decisions, notification procedures for transport teams and hospitals, use of mutual aid, and documentation processes.

By and large, general liability law does not create a duty for a transport operation to provide service to any given patient or hospital. That duty, however, may arise in other ways. When a transfer contract exists with a hospital or EMS system, the contract may create a duty to respond and possibly also provide exceptions. Transfer contracts will be discussed in more detail later in this chapter. If a service or a team breaches the terms of a transfer contract, it may be possible for a patient to file a malpractice lawsuit for any harm caused by a delay or failure to respond.

Except for hospital-owned and operated EMS units that are not operating under a community-wide protocol, ambulances are not subject to EMTALA. Mission diversion may have EMTALA ramifications for hospitals attempting an appropriate transfer. If a transport team intended for such a transfer is diverted, the transferring physician may have to seek alternative transportation to prevent a delay in the transfer.

Transport services should standardize all procedures to provide appropriate response and service to all patients regardless of which area of the hospital the patient occupies or the formal designation of patient status. Although some payment status issues may depend on these details, appropriate care standards do not. From a medical malpractice liability perspective, levels of patient care that depend on reimbursement status, rather than patient safety, are extremely difficult to defend in court.

The second source for a legal duty to respond to the patient is acceptance of the obligation to respond. Mission diversion after accepting a patient may be viewed as "abandonment" similar to other forms of medical abandonment. In this circumstance, once accepted, a rescuer has a duty to respond if the patient relies on the acceptance and, therefore, gives up the chance to find an alternative rescuer. Typically, this would translate into whether the on-scene/referral team had sufficient time to make alternative arrangements for the safety of the patient (paramedic response, basic or nonmedical transport). The issue will then boil down to whether the mission diversion was reasonable, whether it was consistent with system policy, and whether adequate notice was provided to the transferring physician or on-scene rescue personnel.

One form of mission diversion is "stacking." In this circumstance, multiple calls are accepted for a transport team and "stacked" in order of priority or order of calls received. In these circumstances, a clear obligation exists to tell callers that a backlog of calls exists and the anticipated time of arrival. Most effective services have a policy for periodically reporting priority and response schedules. If a priority change occurs, any resulting delay should be reported expeditiously to all hospitals that will be affected.

The initial indications and subsequent notifications should be carefully documented regarding what the hospital or physician knew—and when. This information will be invaluable if review or investigation into care or delays is undertaken. The same process of documentation and notification would be expected in cases of weather delays or grounding.

The more problematic form of mission diversion occurs when an emergency response has been acknowledged and a subsequent request is deemed more urgent. This is clearly a case in which the reasonableness of the change in mission and practicality of alternative resources for the first patient may be questioned. Clearly, weather or other safety hazards may justify delay or even cancellation of critical rescue responses, but discretionary priority diversions can place credibility of the service at risk and expose the service to potential malpractice claims for abandonment. Unlike most malpractice cases, the primary source of the claim against the provider may be the physician who was left to care for a patient and felt abandoned along with the patient.

It is impossible to state that mission diversion of this type cannot legally occur under any circumstances. It seems prudent, however, to limit the types of cases and relative acuity deemed sufficient to allow mission diversion. This should be accomplished with carefully drawn policies, protocols, standards, and notification procedures that have been thoroughly reviewed by legal counsel and the service's medical malpractice insurance company.

On-Scene Responses

Once the transport team arrives to a patient location, it shares medical responsibility with the other providers. The medical obligation as the most highly trained medical personnel on scene usually extends to direct medical care for the patient within a reasonably prompt time, allowing for assessing the scene, protecting the scene, and donning protective gear. That obligation extends to entering a hazardous environment to access the patient, but only if the team members are trained and equipped for that environment. If the transport team lacks appropriate protective gear or members are not trained for the type of environment involved, they are not required to place themselves at unreasonable risk to support the rescue. It may be appropriate to leave the extrication and patient care to the rescue crew until the patient can be brought to safety and accessed by the transport team.

This raises the question of when the duty to the patient exactly starts. If an EMS team did not initiate patient care, it may be considered to have no duty to the patient. In *Zepeda v City of Los Angeles* (223 CalApp3d 232 [1990]), the patient died after city paramedics who were summoned to the scene of a shooting allegedly refused to provide medical aid until the police arrived. The appellate court held that because the paramedics had not initiated care, they did not have a duty to the patient. Two other cases found that once the paramedic made contact with the patient, even if it was a "one-minute look over," a duty had been established (*Wright v City of Los Angeles* [219 CalApp3d 318 {1990}], *Hackman v American Medical Response* [2004 WL 823206 {Cal App 4th Dis}).

In the Hospital

One of the most complex interactions of medical responsibility is when the transport team is at a transferring hospital and is preparing the patient for transport. Hospital staff may step back and allow the transport team complete control of the patient with an understanding that the transport team has "assumed care." Often, transport policies specifically state that the patient is deemed to be under the care of the service owner and the medical director of the transport service. These policies and assumptions may serve to make the alignment of tasks more convenient among the transport team and the hospital staff, but they fail to properly reflect the overlapping responsibility issues this setting produces.

There are definite reasons that a medical transport team that specializes in the care of pediatric patients should lead the process of preparing their fragile patient for transport. However, leading the effort does not translate into "command" or sole medical responsibility for the patient. The transferring physician and other qualified medical personnel remain responsible for the patient until the patient physically leaves the hospital.

While the patient is still in the hospital, the physician cannot hand off the patient to the transport team and proceed as if the patient has left the hospital and his or her care. The issues include privileges (and, thus, hospital regulations) and EMTALA. If there are physicians or midlevel providers on the transport team, they are not usually privileged to function within the referring hospital. As such, they technically have no rights of practice within the facility, except as adjuncts to the attending physician. Even this concept stretches the bounds of most medical staff bylaws. The idea that care has been surrendered to the receiving facility or transport service on arrival of the transport team is erroneous. It is reasonable, however, for the transferring hospital to allow specialty or specifically trained providers to provide care under its authority and supervision. The transferring physician must retain involvement and ultimate responsibility and sign the transfer certificate at the *time of actual transfer.* At any time the transferring physician deems it in the best interests of the patient to intervene or cancel the transfer, it is that physician's right and duty to do so. At the same time, however, the transport team has a medical responsibility to the patient as well—it is concurrent, and it must be coordinated. A team approach to care is ideal and should be strived for by all participants in the process.

When there is unresolved disagreement between the transferring physician and the transport team in a plan of care for the patient, the team should suggest a telephone conference with medical director of their service or the medical control physician. If the transferring physician still disagrees with the plan of the transport team, the team must defer to the transferring physician while the patient is still in the hospital. Refusal by the team to complete the transport could put them at medicolegal risk. All decisions or disagreements should be documented by all care givers.

Delivery at the Receiving Facility

The issue of privileges may also have a role in the delivery of a patient to a hospital, especially when transport teams are delayed from removing the patient from their gurney. When a hospital-owned and -operated service delivers patients to its home hospital, the issue may be one of scope of practice or credentialed privileges within the hospital environment compared with the transport environment.

In a busy department, a new patient may be left in the hands of the transport team until it is optimal for the ED or inpatient staff to assume care of the patient. This obviously leaves the transport team with a patient for an extended time, when their services might be needed elsewhere. It also leaves the patient in transport "packaging" when other equipment and personnel should be available to provide the patient with optimal and definitive care.

Although the transport team might want to transfer the patient to a hospital bed and proceed with other duties, the medical responsibility to the patient requires that the transport team not abandon the patient. This, in turn, means that a detailed report and orderly turnover of responsibility be accomplished before leaving the patient at the destination. The transport team retains medical responsibility until proper hand off has occurred, even though the receiving facility shares responsibility.

Much like the idea that the sending facility can hand off responsibility when the transport team arrives, receiving facilities often assume that they do not acquire responsibility until they accept the patient from the transport team. Both concepts are erroneous in their literal application. The sending facility and staff surrender primary medical responsibility when the patient leaves their direction and control, which can mean when the patient leaves the physical premises or when the patient leaves the zone of their online medical control and enters the medical control of another off-hospital system. The receiving facility and staff begin to acquire medical responsibility for a patient when the patient arrives on their premises and staff becomes aware of the patient's presence, even if the patient is being attended to by the transport team.

When Civil Legal Liability Attaches

A question that frequently follows a description of this concurrent and overlapping medical responsibility is: "So when does *legal* liability attach—or detach?" The answer to that question is that legal liability flows from medical responsibility—medical duty. As described, liability is a function of duty and violation of that duty in a manner that violates the standard of care and produces harm.

In any case in which a patient is harmed as a result of medical negligence (malpractice), any health care provider who had medical responsibility or duty to the patient has the potential for legal liability to the patient. Actual liability, however, depends on which health care provider violated his or her duty to the patient in a negligent manner and produced harm. It is possible that more than one provider meets the criteria or that no provider was liable. As with shared medical responsibility, often there is shared legal liability.

Shared legal liability has 2 factors that influence the financial impact in most states: proportion of fault and joint or several damages. In most states, a provider can be held liable only if the proportion of fault is 50% or more on the part of the provider. If more than one provider is found to be at fault by the jury, the verdict typically assigns the relative portion of fault so that the responsibility is apportioned among the negligent parties.

If there is sufficient coverage for all negligent parties, each pays his or her own proportion of the verdict. This is *several liability,* as the sum total verdict is recovered from the several negligent parties and each pays his or her own share. Under *joint liability,* the injured patient can collect 100% of the verdict from any one or more of the negligent parties. Joint liability typically becomes an issue if one or more of the negligent parties has insufficient insurance or settles before trial and another has a greater financial coverage. In effect, a health care provider who was only minimally negligent could be required to pay the entire judgment for those who were much more at fault. Some states have completely eliminated joint liability in favor of several liability, and others have required that a party must be at least "X%" at fault to be held jointly liable.

Two other mechanisms exist to balance legal liability with the medical responsibility. The first is *contribution.* In this case, health care providers cross-sue one another in the case to ensure that each provider pays his or her fair share to the others if a disproportionate recovery is taken against one party. Problems with this approach are that it can potentially set in opposition one health care provider against the others in a suit and potentially increases the risks of a perhaps unjustified finding of negligence.

The other mechanism is *indemnity,* which is based on the concept of active and passive negligence. A hospital, for example, might be negligent by failing to have proper policies and procedures that allowed negligent performance by a physician. The hospital would have passive liability and would ask that the physician indemnify or repay it for any liability caused by the physician's actions. The problem with this approach is that it sets one health care provider against another, with the same potential risks.

One may see actions for contribution or indemnity when several insurance companies are involved in a high-value case or when active hostility exists between providers.

Transfer Agreement Issues

Transfer agreements are written plans that exist between hospitals or between hospitals and transport services that define the roles, understandings, and procedures for moving patients from one facility to another. A sample transport agreement is included in Appendix C. They do not have to be lengthy but should accurately reflect the understandings of the parties. These agreements often define how payment will be made and how unreimbursed services will be handled. Transfer agreements are recommended for hospitals and transport services for business reasons, ease of interaction, and to meet legal requirements in some states.

One of the main reasons for transfer agreements is to create a smooth-working transfer system that serves the needs of all participants and helps set the expectations and standards of all parties. For patients, transfer agreements attempt to make care more efficient with the least risk of adverse outcome. For hospitals and transfer services, agreements allow participants to understand how the system is to work, what responses to expect, and how payment is to be addressed before actual need. Legal counsel is recommended to ensure the agreements meet state requirements and do not contain clauses with unintended risks. If state-mandated agreement forms are used, legal counsel should review them for compliance.

Liability Issues With Transfer Agreements

Transfer agreements seldom produce liability, except for issues pertaining to payment. If a transfer agreement provides that payment for transfers will be guaranteed by the hospital if insurance, Medicaid, or Medicare fails to pay or pays less than a specific percentage of the transport service bill and the hospital refuses to pay when properly billed, one can expect that liability might result from the contract.

If the transport service promises a specific response time or specific response personnel under given circumstances for a given price, it is likely that financial liability issues would be involved if the transport service failed to meet the conditions of the contract. If that failure resulted in harm to a patient, the hospital might cross-claim against the transport service if a medical malpractice case arose because of the lack of an appropriate and expected response. Patients can also sue directly for the breach, maintaining that patients were the parties intended to be served or protected (third-party beneficiary) by the contract terms.

The liability exposure of the transfer agreement seldom creates new liability, however, because the contract terms are usually carefully drawn to make the service conditional on availability, capacity, and other provisions to make the agreement a more nonbinding understanding than a document on which liability would rest.

Role of Risk Management

Transport services are well aware of the value of the preventive maintenance and flight checklists that must be used to keep their aircraft in safe operation. Similar attention to the medical-legal component through risk-management activities likewise prevents quality, compliance, and legal issues from imperiling the operation.

The risk-management role has many aspects that might be assigned to different members of the team and administration rather than to a single risk manager, but the elements still need to be covered to ensure the long-term survival of the service as a viable business entity so that critical public safety needs can be met.

Credentialing

A critical factor in managing risk is attention to the credentialing of members of the transport team. Aggressive and well-documented follow-up is necessary on all applications to ensure that the team members are properly licensed, functionally competent, and free of significant loss histories that warn of possible future issues. It is not sufficient to rely solely on the fact that a hospital has granted privileges to a provider to enable privileges in an independent transport system. On the other hand, hospital-owned and -operated services might reasonably use the hospital credentialing office because they are part of the same entity.

Direct contact with previous employers, instructors, and team members is recommended to help identify personnel who might not be ideal for a transport team position. Assessment of personal proficiencies should be documented before placing a person on a team, and ongoing assessment of competencies of all team members should be documented in their personnel files. Ongoing tracking of certification renewals, continuing education, and performance reviews is necessary to document that the system has not allowed an unqualified or incompetent provider on the transport team.

Policies, Procedures, and Protocols

Transport services should have detailed job descriptions, policies, and procedures, which may be modeled after those of an ED or critical care unit. As a risk-management objective, it is important to realize it is difficult to defend a practice if people do not approach events in a similar manner. Policies and procedures are useful and necessary to help create a systematic (ideally evidence-based) and defensible process.

The policies and procedures can be "care paths," protocols, guidelines, or other treatment algorithms. These may be legally necessary to allow hospital-based flight nurses, physician assistants, paramedics, or other nonphysicians to provide critical care outside the hospital. Continuing education, training, competency, and quality review need to be documented to ensure that the team members remain qualified to perform necessary services and procedures. There is an increasing emphasis on simulation as a means of improving both communication skills and patient safety. Deviation from protocols eases a plaintiff's burden of showing that transport team personnel were negligent and shifts the burden to the team to justify the variance from protocol.

Risk managers, in conjunction with clinical and legal leadership, are typically involved in the creation and drafting of policies, procedures, and protocols. They help clarify language for regulations or standard of clinical care, focus on potential risks in the process, and review documentation to ensure that it supports the care provided.

Quality Measures

One of the most important risk-management tools is ongoing quality reviews of the records of transports. These reviews set specific standards for measurement and audit and track compliance. The information provided by this process helps identify the potential vulnerabilities or inadequacies of individual team members and of the system as a whole, thereby allowing the risk manager to focus training, compliance efforts, and counseling to close the vulnerable spots in the medical-legal operations of the team. Quality reviews may or may not have discovery protection depending on state law.

All team members should be aware of exactly which quality indicators are being monitored, and they should be informed of both team performance as well as their individual evaluation to help motivate improvement.

Incident Management

An incident can include unplanned deviations from protocol, complaints, internal concerns, adverse outcomes, a medical records request from a lawyer, or any other circumstance that triggers a review of the facts, potential legal issues, and potential ways to prevent the issue from arising again in the future. The actual management of the incident may include factual investigation, communication with the parties to contain the situation, preparation of information and notification of the insurance company, or recommendations for systems or performance improvement by the staff or team.

Ongoing issues in a system may not receive a primary focus for a variety of reasons. Competition among systems, problems with client hospitals, issues with getting paid by insurance companies, and lawsuits typically receive priority attention because they must be addressed at that time. On the other hand, many of these situations may have had warning signs for a period before the event and could have been managed with favorable outcomes at these early stages. Risk-management responsibilities include identifying warning signs and ensuring corrective action early in the process, ideally before harm has ensued.

Litigation Support

If a transport service is involved in a litigated case, a great deal of effort will be expended in responding. The insurance company and defense lawyers will require the service and team members to be sources of information, documents, and records. A risk manager can provide oversight to the defense team and help keep team management informed on the progress of the case.

Documentation

The main purposes of medical record documentation are to ensure optimal patient care and to communicate appropriate and important information about the patient with other care providers. For transport services, continuity and communication are vital to the safety and well-being of patients as they transition from one system and/or group of providers to another. The documentation provides an ongoing history of the patient's course through the presentation, hospital treatment, and transfer to the next medical providers and location.

Additional functions of documentation are to provide a long-term record of the care given and evidence of regulatory compliance. A well-charted, complete record provides factual information for quality review and can help refresh one's memory for future testimony. Lawsuits, external inquiries, and, ultimately, trials typically occur several years after the events that form the basis of a claim or review. The medical record is permanent and may be considered, fairly or unfairly, a marker of the quality of care provided at the time of the event. It generally proves to be a touchstone for the credibility of all aspects of the case or issue.

The number of people who will be looking at the record can be large and can include the following: subsequent treating physicians, nurses, coders, reviewers, compliance officers, risk managers, quality and other departmental committees, utilization review personnel, medical records personnel, peer review committees, third-party payers, professional boards, government reviewers, patients and their families, patients' lawyers, insurance company representatives, defense attorneys, outside experts, judges, and juries. Although not all records will receive this scope of exposure, each report must be written as if it will; often providers do not know in advance which records will receive intense review.

Documentation should be complete, legible, and signed. The use of care maps, template documentation styles, and documenting by exception is gaining popularity in the field and in billing enhancement circles, but the medical narrative report remains a solid and reliable method to document the facts, sequence, and details necessary to justify quality of care on review or defend a lawsuit. Documenting by exception and template-only documentation may lack sequence (time) entries, details, and observations that are the heart of the care provided. When subsequent treating physicians, reviewers and juries are unable to get a clear view of the patient and the care provided, then there is often a negative view of the care providers and potentially a negative verdict from the jury.

What Should Be in the Record?

It is perfectly acceptable to use checkboxes for routine administrative entries, such as verification of contacts, completion of chart segments, one-time entries such as gender and religion, and inclusion or completion of routine tasks. Beyond those types of entries, a clearly written and legible narrative entry should be made for all conversations, orders, observations, interventions, and rechecks. These entries should be timed, and each individual transport team member should sign the record. The documentation should also clearly indicate which team member performed which function.

The record should include a summary of the referral information and become more detailed from the point of initial contact with the receiving facility by radio or on arrival. Details should include patient evaluation, interventions and treatment before arrival, treatment at the referring facility by the transport team, preparation for transport, vital signs on an ongoing basis, care provided during transport, changes in patient condition during transport, and patient condition on arrival at the destination. Any issues encountered at any point should be detailed carefully and objectively. A wrap-up narrative should include details of any changes in patient condition after arrival at the receiving facility, to whom the patient was delivered, to whom report was given, and any issues arising at the receiving facility. Information should be documented factually and objectively. All entries should be timed as closely as possible.

Details and *narrative* imply that the record will contain specific vital signs, observations, and other specific items of information. Some generalization may be necessary, such as referring to a patient's general condition as "unchanged," but specific measurable items such as vital signs should be reported each time with numeric value. Comments such as "normal" or "within normal limits" are not generally useful for documenting or recognizing changes in patient condition unless those terms are clearly defined in the transport-documentation standards.

How Long Should Records Be Retained?

Medical records constitute very important evidence in a malpractice lawsuit. When they are lost or destroyed, then a court will generally allow a presumption that the records contained information damaging to the party that lost them. For this reason, medical records should be kept for *at least* the amount of time equal to the statute of limitations, which is the amount of time after an occurrence that a plaintiff may file a lawsuit. The statute of limitations is generally varies by state, and it is generally longer for minors. In some states, such as Arizona, the statute of limitations for minors ends at age 18, and there is an additional 2 years to file the suit. Therefore, medical records for a neonatal patient would need to be kept 20 years.

Transport services not only keep medical records but a variety of other business documents. Everything from payroll records (Department of Labor) to schedules to Medicaid contract and reimbursement records (Department of Health and Human Services) must all be kept for varying lengths of time as regulated by a variety of state and federal laws. Collaboration with legal counsel is necessary to ensure appropriate compliance.

Quality of Care Issues at the Sending Facility

Transport teams may arrive and find that care the patient is receiving is different from that the transport team or receiving center recommended or would like to have provided. This may lead to a temptation to be critical in the medical record. It is important to simply document the facts of patient care, without opinion, criticism, or editorial comment. Initial entries should always state what was first observed about the patient and the ongoing treatment on arrival. Commenting on what drugs had been given, current monitoring, what procedures were conducted, and whether intravenous lines were in place and functional are among items that would typically be documented. Following the same procedure on all documentation will adequately record information without value judgments appearing in the record.

For concerns about the adequacy of care, an internal quality process should exist for review. A risk-management specialist and/or qualified attorney can assist the service to develop a process that meets the requirements for confidentiality in the state involved. Incident or quality reports should recite the facts but not include editorial comments or opinions. In most cases, the rule for incident reports is that if the facts are reported sufficiently, the issues should be evident without the need to point them out. The only exception to this approach would be for circumstances that require reporting under state law, in which case, the team should follow mandated reporting procedures.

Duty to Act

What is the duty of EMS personnel to respond to an emergency? In 2009, there was a highly publicized case of 2 uniformed New York City EMTs who did not assist a pregnant woman who collapsed in the restaurant where they were on a coffee break. The pair did call 911 but provided no other assistance. The woman and her baby both died. Both EMTs were suspended without pay, a civil lawsuit has been filed, and one of the EMTs (the other subsequently passed away) was arrested and charged with official misconduct, a crime that carries up to 2 years in prison.

High-profile cases notwithstanding, there is no universal answer to the question surrounding the duty of EMS personnel to act when they encounter an emergency. Medical practice, as well as one's duty to respond in an emergency, is primarily regulated by the states. For example, an off-duty paramedic may or may not be not required to stop at a car wreck while driving to the store. An in-service EMS unit may have a duty to stop at the same accident if not on a higher-priority call based on local rules, laws, and community protocols.

In transfer situations, the transport team may receive total deference when it arrives and care is ceded to them, sometimes to the point of almost literally stopping mid-procedure to hand the patient over to the transport team. Occasionally, when the transport team arrives at the sending hospital, transport personnel may believe that the ongoing or planned care is not optimal or in the best interest of the patient. This can be an extremely challenging situation for the team regarding how and when to intervene to help provide optimal care to the patient without alienating the providers at the same time. Keep in mind that the transport team is usually not privileged to treat patients in the sending hospital and has no inherent right to assume care of the patient. At the same time, failure to draw attention of the hospital staff to an issue raises a concern of moral duty and a possibility that the patient may receive less-than-optimal care.

So what should be done? Remember that there is a chain of command and a physician-patient relationship while the patient is still in the transferring hospital. When there is unresolved disagreement, the transport team should contact its medical director or the medical control physician to discuss the patient's care with the referring physician. The team should document any significant issues in a matter-of-fact, nonaccusatory manner. Consultation with the medical director or the medical control physician may be helpful to discuss alternatives and potential plans of action.

Quality of Care Issues During Transport

On occasion, quality of care issues or disputes between team members occur during transport. It is generally the responsibility of the senior medical team member to direct care (with input from online medical control as needed). All team members have a duty to the team and to the patient to raise questions or issues of concern during the transport. Respect and trust are essential for all team members to function in the high-stress environment of a neonatal-pediatric transport. Team members need to be able to remind, recommend, and disagree in a manner that is supportive and not divisive. The team approach, however, does not mean that quality improvement is ignored.

In neonatal and pediatric care, it may be particularly difficult to deal with perceived errors or shortcomings that injure a child. Great care must be exercised to avoid team conflict about a care incident that places the focus on guilt or responsibility rather than quality improvement. In these cases, extreme caution must be used to avoid accusations or judgments in the medical record or other documents. Only factual medical details should appear. Verbal comments that are critical should likewise be limited entirely to the quality review process, because they otherwise may result in additional performance and legal issues. Investigation may show that a perceived error had little or nothing to do with the adverse outcome, but premature comments or emotional criticism in the record can lead to a different conclusion. Unfortunately, misperceptions may expand into controversies and litigation that persist long after they could have been avoided or resolved.

The vast majority of pediatric and neonatal transport providers come to work each day intending to do their best for patients and their families. It is essential to create a culture of safety rather than a culture of fear and blame. Careful handling of the issues in a systematic quality improvement process tends to prevent the unnecessary controversies and identify and resolve the justified concerns.

Transporting Nonpatients

One area that has potential legal exposure is the practice of transporting parents (or guardian). The potential risks include additional weight and space factors and that the parent may misinterpret events that later might be claimed to involve malpractice. In practice and the transport literature, however, the latter concern has not been shown to be a significant risk; indeed, parental presence may decrease risk of malpractice claims because they directly observe the care and concern demonstrated by the transport team members.

The noise, vibration, turbulence, enclosed space, and unfamiliarity with a helicopter or ambulance transport, coupled with the emotional aspects of a family medical emergency, can result in the parent passenger becoming an additional patient who requires medical attention that could interfere with the team's ability to care for the primary patient. This disruption endangers the team in a legal sense and could endanger the original patient and the family member with resulting medical and legal risk. There should always be a transport team member assigned to be the primary contact for the parent. If the team is unable to provide that support, it may not be ideal to include a passenger on the transport. Children who are not patients should be transported in an alternative passenger vehicle, whenever possible.

For teams that allow or encourage parent passengers or observers, insurance carriers should be consulted to ensure that there is appropriate liability coverage. Documentation and consent procedures suggested by the insurance company and/or attorney should be considered.

Examples of transport-related forms are provided in Appendices C and F. The examples are supplied to provide drafting ideas and are not for direct incorporation into a program without local legal review. Examples of these forms are also provided in the text, *Providing Emergency Care Under Federal Law: EMTALA,* by the American College of Emergency Physicians and R.A. Bitterman and its 2004 Supplement (see Selected Readings).

Additionally, for additional guidance or recommendation on states' differences in standards of care, refer to the AAP Division of State Government Affairs (800.433.9016, extension 7799 or stgov@aap.org).

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CHAPTER 8

Quality Improvement

Outline

- What are quality and quality improvement (QI)?
- Monitoring quality
- The Model for Improvement and decreasing variation
- Developing a quality improvement program
- Helpful resources

Construction of a well-functioning transport program begins by building a strong foundation with the right personnel, training, equipment, and vehicles (ambulance, helicopter, or fixed-wing aircraft). Equally important is building a culture of trust. A culture of trust is critical to a successful quality improvement program. Team members must not fear repercussions bringing mistakes and errors they identify to the attention of their leadership. Team members and leadership must begin to realize that errors and issues surrounding substandard quality are rarely the sole result of poor judgment but rather inherent system or process problems that allow these errors to occur despite involving high-caliber personnel. Continually monitoring and evaluating your transport program are critical to providing quality patient care and ensuring the success and longevity of your transport organization. In the following sections of this chapter, we discuss the basics of designing a quality-monitoring system and approaches to improving the quality of the services you provide. This chapter will not make you an expert quality control officer but should provide you with the background and methodology to begin planning and implementing quality improvement (QI) projects and finding appropriate resources from which to learn more.

What are Quality and Quality Improvement?

The 2001 Institute of Medicine (IOM) publication *Crossing the Quality Chasm: A New Health System for the 21st Century*[1] defines quality in health care as "the degree to which health services for individuals and populations increase the likelihood of desired health outcomes and are consistent with current professional knowledge." It further explains "good quality means providing patients with appropriate services in a technically competent manner, with good communication, shared decision making, and cultural sensitivity."

The IOM established 6 dimensions of quality: safety, effectiveness, patient-centeredness, timeliness, efficiency, and equitability. In essence, health care should avoid injuring patients, should provide services based on best practices, should be respectful of patients' needs, should reduce long waits and delays, should avoid wasting resources, and should not vary in available options because of patients' demographics.

Quality improvement is a process that seeks to systematically, objectively, and continuously monitor, assess, and improve quality and the appropriateness of patient care provided on the basis of predetermined standards. Although leadership will direct the people responsible for monitoring activities, reviewing events, and providing recommendations for individual and team improvement, quality improvement should involve all care providers and parties in the sphere of the transport program.

How does a transport service track "quality?" Most transport teams monitor anything from operational factors such as delays in mobilization of the transport team to measures of patient outcome. Often, these measures are based on transport teams' histories, high-profile transport cases, lessons learned from morbidity and mortality conferences, patient outcomes, etc, or are borrowed from other areas of medicine (eg, neonatology, critical care, emergency medicine). Some track transport-specific measures suggested by professional organizations or legislative bodies, though at the present time, these are rare and typically not evidence-based. The Commission on Accreditation of Medical Transport Systems (CAMTS) is an accrediting body that aims to assist the transport community in providing a specific level of quality. Accreditation is a voluntary process in which an accrediting board of experts evaluates a program or institution against measurable standards and criteria—a formal transport service quality monitoring system is one of those criteria.

Monitoring Quality

Selecting Quality Indicators for Your Services

There are several ways one may choose to select *indicators* (also referred to as measures or metrics). The best approach would be adopting a list of industry standard quality metrics for neonatal and pediatric transport. Unfortunately, such a list has yet to be established. A practical approach is asking similar transport programs to share the quality indicators they regularly track. Another useful approach is having team members brainstorm measures they believe would represent whether or not they are succeeding in the various missions, roles, and responsibilities assigned to the transport service. As a starting point, one may choose to begin with quality indicators representing each of the IOM's 6 dimensions of quality. Regardless of which measures are chosen, they should be **objective, measurable criteria meaningful to a program's operations.**

The utility of selecting quality indicators similar to other transport programs is the added opportunity to benchmark an organization's performance. Benchmarking is the process of comparing one's performance with others' and begins with standardized, comparative measurements and then examines performance differences between similar processes. Benchmarking identifies top performers and their best practices. Sharing data among organizations helps us learn from variation in practice and is critical to fostering collaborative large-scale quality improvement efforts. Table 8.1 lists examples of targeted areas for QI planning applicable to the transport setting. Although the list is not all-inclusive, the categories of education, safety, communications, and overall aspects of transport operations represent the typical areas that should be considered when developing a QI program.

Tracking Quality Indicators

One of the most helpful ways of tracking quality indicators is using a graph of performance over time. Identifying trends and interpreting large amounts of data is much easier when presented in a graph form rather than in tables filled with numbers. In fact, several graphs on a single page displaying performance on key quality indicators may easily convey a tremendous amount of information to its audience, whereas the same data in lengthy tables would take much more time and effort to interpret. This is the basis

Table 8.1: Sample Categories for Process Improvement Opportunities in Transport

Education and training
Hiring process: clinical performance, experience Orientation Ongoing continuing education Skills competency training and procedural evaluation Certifications: NRP, PALS, ACLS, ATLS or trauma equivalent Annual performance appraisal
Safety
Personnel: annual physical and testing (eg, PPD) Institutional and program mandatory yearly review • Environmental safety: fire, electrical, hazardous materials • Patient safety: infection control, sedation, pain management • Transport safety: helipad/helicopter, ambulance, fixed-wing aircraft, survival training
Administration
Budget: resource allocation and expenditures Compliance with regulatory agencies Health Insurance Portability and Accountability Act (HIPAA) compliance Marketing and public relations
Communications
Internal: dispatch, triaging, meetings, logs, memos, committee minutes External: referral institutions, vendors, patient follow-up
Equipment standards
Reliability Maintenance Alarm parameters Safety features Meets technological standards of the transport environment
Vehicles (ambulance, helicopter, fixed-wing aircraft)
Design Configuration Maintenance Federal and state specifications and regulations CAMTS standards Evaluation of enhanced safety features currently available for implementation (TAWS, NVG, GPS)
Patient care guidelines, protocols, procedures, policies, and documentation
Reviewed and updated regularly Chart review Documentation: meeting critical elements Morbidity and mortality

Table 8.1: Sample Categories for Process Improvement Opportunities in Transport, continued

Sample transport review triggers
Sentinel, serious, adverse, and near-miss events
Death during transport
Death within 24 h of admission
Cardiopulmonary resuscitation
Intubation or extubation
Transported without vascular access
Deviation from protocols
Use of vasopressors
Discharged patients directly from emergency department or within 24 h
Time at the referring institution exceeded acceptable limits
Change from floor to ICU within specified number of hours
Technical interventions completed (eg, CT, central catheters, needle thoracotomy)
Mode of transport decisions questionable for particular patient or specific mode
Operational data (including quantity indicators)
Number of completed transports
Number of transports canceled because of weather
Number of transports canceled because of maintenance
Number of canceled or aborted transports
Response time
Team composition

NRP indicates Neonatal Resuscitation Program; PALS, Pediatric Advanced Life Support; ACLS, Advanced Cardiac Life Support; ATLS, Advanced Trauma Life Support; PPD, purified protein derivative (tuberculin); CAMTS, Commission on Accreditation of Medical Transport Systems; ICU, intensive care unit; CT, computed tomography; TAWS, Terrain Awareness Warning System; NVG, night vision goggles; GPS, global positioning system.

of dashboard development. Dashboards are common in the business realm and have recently begun to be used in health care. Named for its conceptual similarities to those found in vehicles, a dashboard is a powerful medium of communication—a "single-screen display of the most important information people need to do a job, presented in a way that allows them to monitor what's going on in an instant."[2]

Two of the more common charts used to track data for quality improvement are the run chart and the control chart. Both display measurements on the y-axis over time on the x-axis. Run charts and control charts are depicted and discussed in the following sections.

Understanding Variation

Identifying important trends in your tracked data requires a basic understanding of the concept of variation. Although we often report measurements over time as averages (means or medians), in terms of reporting quality improvement data, how much the data varies from the average is equally important as is the average number itself. Variation itself can be measured; standard deviation is a commonly used measure of variation. An example demonstrating variation's importance follows: over a 1-month period, 2 emergency departments were able to administer antibiotics to their patients in an average of 2 hours after physicians ordered them. In 1 emergency department, each patient's antibiotics were administered at the goal of 2 hours. In the other emergency department, half of the patients received their antibiotics in 1 hour, which is excellent. The other half received their antibiotics in 3 hours, which is less acceptable. Both emergency departments' averages are 2 hours, but there is clearly more to the story. If only averages were reported, important information differentiating the 2 emergency departments would never be recognized, and the successful processes that allow antibiotics to be administered sometimes within 1 hour may never be adequately realized.

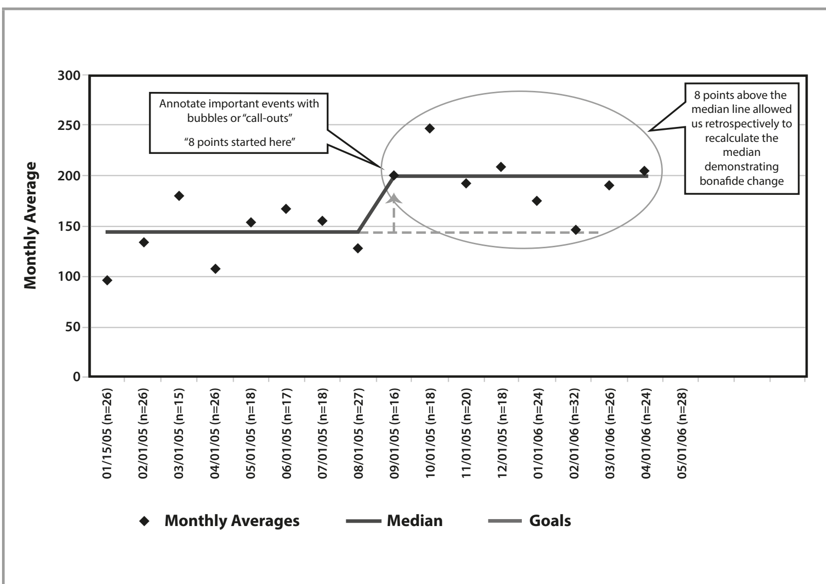
There are 2 types of variation: intended and unintended. Intended variation can be good—when active improvements result in positive change. When there are negative or positive changes in a quality indicator over time without any interventions, that variation is unintended. Both negative and positive changes deserve investigation. Negative changes are often attributable to inefficiencies, waste, or errors. Positive changes may reveal new ways to improve the outcome measure.

Variation comes from 2 different sources, described as "common cause" variation and "special cause" variation by Dr. W. Edwards Deming, one of the grandfathers of modern quality improvement methodology. Common causes are those that are inherent in a system over time, reflected in the often clinically unimportant and seemingly random small ups and downs in data. This variation is often out of one's direct control: slight variations in weather and normal wear and tear on equipment, for example. Special causes, on the other hand, are those that are not part of the system but arise because of specific circumstances. They are represented by drastic ups or downs in data. These specific circumstances may be, but are now always, anticipated; a non-sterile batch of catheters may result in a drastic rise in infection, for example, or a new electronic charting system may drastically prolong transport team scene time. Special cause variation does not have to be bad. A flurry of positive customer service evaluations clustering around days a particular transport squad is working is an example of positive special cause variation. Universally, however, good or bad, special cause variations should be reviewed. These are opportunities from which to learn and make process improvements. In contrast, the insignificant common cause variation is rarely worth the resources trying to change. Understanding the differences between common cause and special cause variation is critical to developing effective strategies for improvement.

Identifying Important Trends

Again, identifying important trends in one's data is best done graphing the data over time on what is referred to as a run chart. Fig 8.1 gives an example of a run chart. The horizontal scale is time or sequence, and the vertical scale is the measurement of interest. Trends up or down are more accurately determined after a baseline has been established. Although the number of

Figure 8.1: Run Chart



data points needed to establish a baseline varies somewhat in the literature, most sources suggest that 16 to 24 points of baseline data is required to feel confident that the median or mean line is truly that.[3] Calculate the mean or median for the baseline data and draw that line on the run chart. Although using the mean or the median is acceptable, we recommend using the median, which will protect your average from being "thrown off" by a single extremely high or low measurement. Important interventions, milestones, and process changes should also be noted on the run chart with arrows indicating when they occurred (Fig 8.2 and 8.3).

How often should you measure your quality indicator: daily, weekly, or even monthly? Much of this will depend on the type of quality indicator, how often events tend to occur, and often enough that you can catch important trends early.

Differentiating the small ups and downs of common cause variation from the statistically significant special cause variation indicating real quality improvement or worsening requires referencing run chart rules for special causes. There are many criteria with which to evaluate run charts for evidence of true quality improvement or worsening, but 3 popular ones identify special cause when any of the following are true: (1) there is a "shift"

Figure 8.2

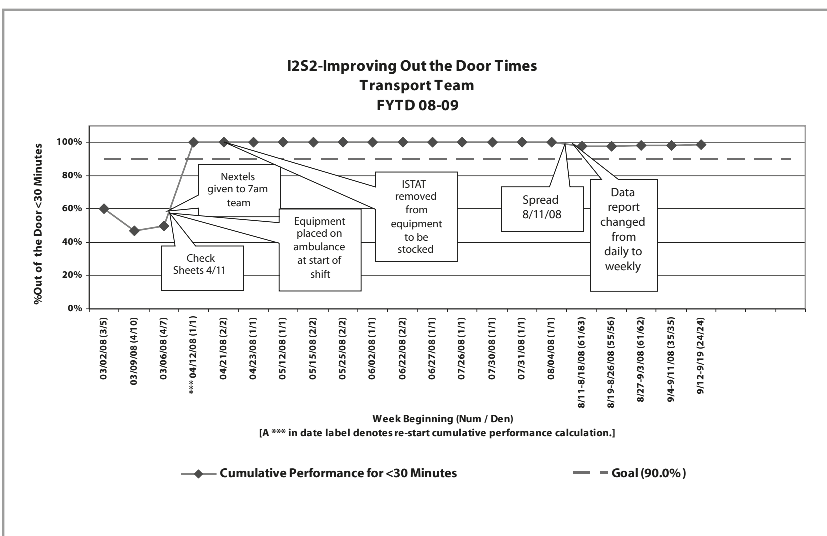
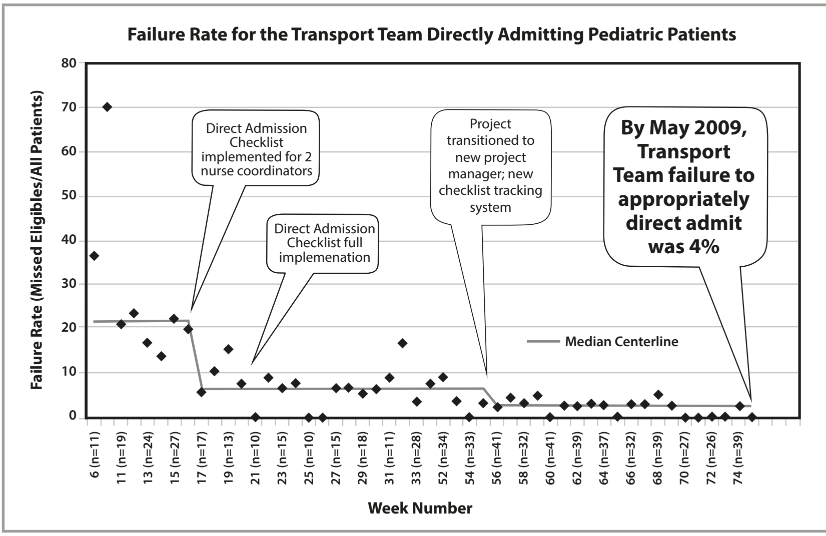


Figure 8.3



(ie, 8 consecutive points are either above or below the mean/median centerline); (2) there is a "trend" (ie, 6 consecutively increasing or decreasing data points); or (3) there are "alternating points" (ie, at least 14 consecutive points alternating above and below the mean/median centerline). Points on the line do not make or break a run. Changes following these rules may be positive—from a successful quality improvement project you have implemented or negative—from an unanticipated new problem in the process. Once a rule is met and change is "official," a new mean/median line is drawn on the basis of those data points. The new mean/median line is now used to evaluate subsequent changes using the rules, and so on.

Control charts have similar rules for special causes. They also have additional lines representing thresholds (upper and lower control limits), which, when crossed by points on the graph, demonstrate special cause, good or bad, depending on the data. Control charts are important in helping to distinguish common cause from special cause variation. A process is considered stable if the distribution of data points falls within the control limits (common cause variation). If the distribution of data points falls within and outside of the control limits, the process has special cause variation and is considered unstable. Learning from special cause variation should be the first step toward improving an unstable system. There are readily available computer programs capable of generating run charts and control charts from your data and able to assist you with analyzing them. These are easily found searching on the Internet.

The Model for Improvement and Decreasing Variation

The Model for Improvement developed by Langley et al[4] is based on 3 fundamental questions. What are you trying to accomplish? How will you know that a change is actually improvement? What changes can be made that will result in improvement?

The question "What are you trying to accomplish?" is best answered in an "aim statement." This is a concrete statement agreed on by all members of the QI team. It delineates exactly what will be achieved, how success will be measured, and over what time period. Many aim statements fit the following formula: My team will (increase or decrease) [measurement of interest] from [current value] to [desired value] by [specific date]. Aim statements are most useful when they are specific, measurable, realistic, meaningful, and time bound. Collecting the data necessary to track your measurement of interest is how you answer the question "How will you know that a change is actually improvement?"

The question "What changes can be made to result in improvement?" requires an understanding of the factors influencing your measurement of interest. To facilitate this, many use what is referred to as a key driver diagram. The key drivers are the anticipated conditions necessary to achieve your aim. Understanding the key drivers requires a solid knowledge of system processes. This may require spending time on the "frontline" or interviewing frontline personnel—better yet, invite a couple to be part of the QI team. Often, as you get to know your project better, new key drivers are identified. Flowcharting a process in chronologic sequence may help identify key process drivers. The key drivers are important, because they inform target areas with which to test changes. The key drivers are the pistons of your process engine. All pistons must function well and efficiently for your process to be successful. The malfunctioning pistons need to be taken apart and examined, and ways to improve performance need to be brainstormed and trialed. Trialing or testing new ideas is best done on a limited basis so as not to invest tremendous resources in a test that does not actually improve anything. Keep testing ideas until one works on a small scale, and then invest in expanding it. The PDSA (plan, do, study, act) cycle is a useful tool for testing these changes.

The PDSA Cycle

The PDSA cycle is one commonly used method for testing system changes as one works toward process improvement. **Plan** is when a problem is identified and a testing strategy for an improvement change is developed. It is important to predict and record what you think the results of the test will be prior to making changes. **Do** is when the testing plan is implemented with clearly defined personnel roles and expectations. The process is monitored and performance carefully tracked. If there are a lot of test cases, the change may be monitored on a run chart; however, notes may be more useful if there will only be a few cases. **Study** is the phase when data are analyzed and results summarized and discussed amongst the QI team. How do the results compare with your team's initial prediction? **Act** is the phase in which next steps are determined based on what was learned during testing. Perhaps the test is a tremendous success, and plans should be made to expand implementation. Perhaps a few more tweaks need to be tested and reexamined with another PDSA cycle prior to larger implementation. Maybe the test was a failure, and you go back to the brainstorming phase. No test, however, is truly a "complete failure," because each test, whether the result is positive or negative, allows us to learn what works and does not work in this systematic trial-and-error process.

Other QI Methodologies

There are many different approaches to quality improvement—reviewing all of them is clearly outside the scope of this chapter. However, 2 other popular methodologies worth introducing are **Six Sigma** and **Lean.** Six Sigma is a business QI strategy originally developed by Motorola, Inc. The term Six Sigma is associated with manufacturing, specifically the percentage of defect-free products a process creates. A Six Sigma process (6 standard deviations) is one in which 99.99966% of the products manufactured are expected to be free of defects (3.4 defects/million). Six Sigma's approach to QI is based on identifying and removing the causes of defects and errors and minimizing variability in manufacturing and business processes.

Lean manufacturing or, simply, "Lean" is a QI strategy that considers expenditure of resources for any goal other than the creation of value for the customer to be wasteful. The goal of Lean is to preserve value with less work and less waste. Lean manufacturing is a strategy originating from the Toyota Production System and focuses on 7 common areas of waste that hinder overall customer value: overproduction, waiting, transport, extra processing, inventory, motion, and defects.

Both Six Sigma and Lean methodologies can be applied to neonatal and pediatric critical care transport. Decreasing variation in practice by instituting evidence-based treatment protocols for the common diagnoses a team transports would be an appropriate application of Six Sigma principles. Centralizing a transport service's stock of supplies and equipment to decrease restocking delays between stacked runs would be an important application of Lean concepts.

Developing a QI Program

The Joint Commission, under its 1994 initiative Agenda for Change, first outlined its integration of performance measurement data into the health care organization accreditation process. Although several years old at this point, the The Joint Commission's generic model for monitoring and evaluation is helpful by listing important elements of a QI program. It notes the ongoing cyclical nature and the requirement for continual reassessment to ensure that the practice criteria establish and maintain a quality service based on performance. A QI program should:

- assign individual responsibility and accountability;
- define the scope of care;
- determine the important aspects of care, including clinical outcomes;
- characterize the important aspects of care and identify indicators;
- establish thresholds for evaluation that are appropriate to the individual service;
- obtain data for indicators using QI tools;
- evaluate the data in a multidisciplinary manner, and identify concerns about quality of service;
- recommend corrective action, and monitor its implementation;
- reassess, stressing the continuum, to develop new strategies for improving; and
- report the findings, and evaluate the improvement process.

Effective QI programs use the techniques and strategies described to ensure that standards of care are being met and that transport services' customers (ie, patients and families, referral institutions, etc) feel the service they receive is valuable. This is typically a collaborative multidisciplinary effort involving transport team personnel, medical directors, administrative personnel, risk management personnel, and other disciplines needed to identify opportunities to improve care. These activities are best coordinated by a QI coordinator.

The objectives of a QI program should be defined and include the following:

- Develop and support a multidisciplinary QI committee and regularly scheduled meetings in which to present service needs and areas for improvement.
- Identify important performance/quality metrics for the transport service.
- Establish regular review of performance/quality metrics, customer kudos and concerns, and serious or adverse service events. Expectations under The Joint Commission standards for an organization's response to sentinel events include root cause analyses and action plans. Definitions and further explanations are available at http://www.jointcommission.org.
- Plan strategies to address areas for improvement opportunities

Accountability for oversight of various tasks should be assigned by the transport administrative team. Accountability rests with the QI coordinator, the QI committee, and the members of the transport team. The QI coordinator should be a person with expertise in neonatal-pediatric medicine, transport, and quality monitoring. The QI coordinator is responsible for organization and direction of the QI program (Table 8.2). Crucial to the support of such a role is the vision that each team member has a role in the QI process.

Table 8.2: Typical Responsibilities of a Transport Team QI Coordinator

1. Lead the transport team's QI committee
2. Plan and organize QI committee meetings
3. Identify service or performance areas to monitor and evaluate
4. Direct data collection/monitoring process and ensure accuracy of data
5. Coordinate and implement tests of changes for improvement projects
6. Facilitate analyzing and interpreting data by the QI committee
7. Formulate recommendations with the QI committee that should include the following:
   - Changes to staff education, training, and development
   - Development and revisions of patient care standards, policies, procedures, and protocols
8. Oversee implementing change recommendations

Establishing a multidisciplinary QI committee provides the framework needed to set goals for meetings, attendance, and reporting mechanisms; oversee monitoring; establish ownership and commitment to the QI process; and recommend changes and determine the viability of the changes. The participants of this committee should include transport team members and personnel external to transport, such as additional medical advisors, those with QI expertise, and administrative staff. The committee should report to the transport service management and, if appropriate, to hospital administration.

Medical director involvement is critical to a transport QI program's success. The medical director may serve in various capacities as a resource, supervisor, moderator, evaluator, researcher, and educator. Activities medical directors use to monitor quality are prospective and retrospective, not unlike research projects.

Prospective activities may include interviewing, hiring, educating personnel, developing treatment protocols, and directing overall transport operations. Overseeing patient care during transport (online medical control) via direct communication such as radio, telephone, video, computer links, or teleconferencing directly affects the quality of the service provided. Retrospective activities review care after it has been provided, including chart review of documentation, review of transports when triggers were activated, recorded audio and/or video tapes, individual case review, and morbidity and mortality data.

Although all transport-related disciplines are important in the monitoring, review, and problem solving necessary to improve patient care, the medical director must participate in the QI process if it is to be a viable component of the transport program. The medical director's formal and informal influence on clinical decisions, efficiency, and safety is critical to the QI process.

Helpful Resources

Table 8.3 illustrates an application of the QI process from a single transport program's QI program. It is not meant to be applicable in its entirety to each transport service. From the transport program's annual goals, key performance measures are identified as the first step in the QI monitoring process. Next, specific indicators and the data collection methods are noted in the action plan. The threshold for evaluation is agreed on. Results are noted and

Table 8.3: Samples of Area-Specific Indicators*

Category	Performance Measure	Rationale	Dimensions of Performance	Specific Indicators	Method for Data Collection	Multi-disciplinary Component	Assessment	Threshold
Patient care	Pain	• High risk • High volume • Problem prone	• Efficacy • Appropriateness • Availability • Timeliness • Effectiveness • Continuity- • Efficiency • Respect and caring • Safety	• Assessment noted on transport record—presence or absence of pain • If present, pain relief measure implemented and assessment of effectiveness documented • Use of pain scale	Review of transport record	No	Monthly	95%
Patient care	Safety	• High risk • High volume • Problem prone	• Efficacy • Appropriateness • Availability • Timeliness • Effectiveness • Continuity • Efficiency • Respect and caring • Safety	• ID bands • Ambulance incident reports • Daily emergency equipment checks: storeroom check, defibrillator check, narcotic log check • Bimonthly: equipment bag check • Seatbelt and specific restraint use • Equipment secured to stretcher or incubator in vehicle	• Review of occurrence reports • Review of occurrence reports • Week-long survey • Review of occurrence reports • Review of checklists • Review of checklists • Week-long survey • Week-long survey	• Risk Management • Medical director • Ambulance personnel • RN • RT	Monthly	100%

Table 8.3: Samples of Area-Specific Indicators*, continued

Category	Performance Measure	Rationale	Dimensions of Performance	Specific Indicators	Method for Data Collection	Multi-disciplinary Component	Assessment	Threshold
Patient care	Sedation	• High risk • High volume • Problem prone	• Efficacy • Appropriateness • Availability • Timeliness • Effectiveness • Continuity • Efficacy • Respect and caring • Safety	Documentation to include: • Presedation assessment of ABCs • Response to medication • VS monitoring in progress • Complications	Transport record review	• RN • Medical director	Monthly	90%
Patient care	Vascular access	• High risk • High volume • Problem prone	• Efficacy • Appropriateness • Availability • Timeliness • Effectiveness • Continuity • Efficiency • Respect and caring • Safety	Monitor: • Umbilical artery catheters • Placement documented per CXR • Assessment of pulses and perfusion distal to the line • Well secured to abdomen • Easily aspirates and flushes • Good arterial waveform per monitor • Umbilical venous catheters • Placement documented per CXR • Well secured to abdomen • IVF only (no meds) if tip below the diaphragm IV or arterial line • Document assessment of site • Easily flushes (waveform blood return)	Review of transport record	• RN • Medical director	Monthly	90%
Documentation	• Phone call record • Transport record	• High risk • High volume • Problem prone	• Efficacy • Appropriateness • Availability • Timeliness • Effectiveness • Continuity • Efficiency • Respect and caring • Safety	• Forms completed: • Signature of RN present • If care suggestions given, individual receiving orders indicated • Time of interventions documented • VS on all patients documented a minimum of every 15 min • Patient response to interventions documented • ETT present Y/N • ETT placement noted on x-ray and documented • End-tidal co_2 monitoring used for intubated patients (optional for neonates)	Review of transport record	No	Monthly	90%

Table 8.3: Samples of Area-Specific Indicators*, continued

Category	Performance Measure	Rationale	Dimensions of Performance	Specific Indicators	Method for Data Collection	Multi-disciplinary Component	Assessment	Threshold
Education	• Mandatory yearly review	• High risk • High volume	• Efficacy • Problem prone • Appropriateness • Availability • Timeliness • Effectiveness • Continuity • Efficiency • Respect and caring • Safety	• Staff completion of yearly fire, safety, infection control, and critical clinical skills • All transport team staff will attend yearly ambulance safety, helicopter safety, helipad fire safety, and altitude physiology classes. • Staff will maintain current provider status in CPR, PALS, NRP, and ACLS. TNCC will be required by end 2002. Audit of ATLS encouraged. • Staff will attend animal lab and demonstrate umbilical catheterization, needle aspiration of the chest and chest tube insertion (RNs), and intubation (RNs and RTs) a minimum of 3 times per year. • RNs will obtain airway management experience in surgery at Westchester or on the main campus a minimum of 4 times a year (intubations on humans). • Completion of mandatory clinical education competencies, including child abuse, restraint policy, blood products administration, and age-specific competencies	Tracked in unit	No	Quarterly	100%
Satisfaction	• Staff • Patient and family • Referring hospital personnel	• High risk • High volume • Problem prone	• Staff completion of yearly survey • Review of parent satisfaction survey • Referring hospitals to complete transport team service questionnaire	• Tally responses to referring hospital questionnaires. • Press Ganey patient satisfaction survey; report given by CNE			• Yearly • Monthly • Quarterly	NA

Table 8.3: Samples of Area-Specific Indicators*, continued

Category	Performance Measure	Rationale	Dimensions of Performance	Specific Indicators	Method for Data Collection	Multi-disciplinary Component	Assessment	Threshold
Patient care	Transport Review indicators	• High risk • High volume • Problem prone	• Efficacy • Appropriateness • Availability • Timeliness • Effectiveness • Continuity • Efficiency • Respect and caring • Safety	• Multidisciplinary case review of transported patients. Patients whose cases will be reviewed include those with whom the following situations occurred during transport: death on transport; death within 24 hours of admission; unexpected need for the PICU; unexpected need for the PICU within 24 hours of admission or backup bed not previously arranged; arrest; time at referring hospital: neonate, >90 min, or pediatric, >60 min; extubation; hypoxemia: saturation <95% for pediatric or <85% for neonate (excluding neonate for ECMO, suspected cyanotic CHD, use jet or oscillator vents); intubation (excluding neonate receiving PGE); needle thoracostomy; hypothermia; chest tube insertion; arrhythmias requiring drug therapy; hypotension; hypothermia; RN-transport only; initiation of vasopressor therapy; neonate receiving NO; helicopter transport	Use of transport review trigger form (preestablished criteria)	• Medical director • RN • RT	Bimonthly	90%
Operations	Utilization appropriateness	• High risk • High volume • Problem prone	• Efficacy • Appropriateness • Availability • Timeliness • Effectiveness • Continuity • Efficiency • Respect and caring • Safety	• Coordination of transport from reception of request to liftoff/en route time: goal = 30″ • Number of transports completed • Number of transports aborted owing to weather, maintenance, and patient condition	Review of statistical reports	No	Monthly	90%

Table 8.3: Samples of Area-Specific Indicators*, continued

Category	Performance Measure	Rationale	Dimensions of Performance	Specific Indicators	Method for Data Collection	Multi-disciplinary Component	Assessment	Threshold
Operations	Utilization appropriate-ness	• High risk • High volume • Problem prone	• Efficacy • Appropriateness • Availability • Timeliness • Effectiveness • Continuity • Efficiency • Respect and caring • Safety	• Patients transferred to CMH ED by the transport service appropriately triaged before transfer to transport team vs ALS • Medical need appropriate-ness of patients transferred to CMH by the transport service without IVs or oxygen, not transferred from a critical care service, scheduled transports, or interfacility to a lower level of care	Chart review of patients discharged from ED after transport; use of pre established criteria will help determine appropriate use of transport service	No	Monthly	90%

* Example of Children's Memorial specific indicators. Reproduced with permission: Craig LaRusso, RN, Transport Team, Children's Memorial Hospital, Chicago, IL.

ID indicates identification; RN, registered nurse; RT, respiratory therapist; ABCs, airway, breathing, circulation; VS, vital signs; CXR, chest x-ray; IVF, intravenous fluids; IV, intravenous; ETT, endotracheal tube; CO_2, carbon dioxide; CPR, cardiopulmonary resuscitation; PALS, Pediatric Advanced Life Support; NRP, Neonatal Resuscitation Program; ACLS, Advanced Cardiac Life Support; TNCC, Trauma Nursing Core Course; ATLS, Advanced Trauma Life Support; CNE, chief nurse executive; NA, not applicable; PICU, pediatric intensive care unit; ECMO, extracorporeal membrane oxygenation; CHD, congenital heart disease; PGE, prostaglandin E; NO, nitric oxide; CMH, Children's Memorial Hospital; ED, emergency department; ALS, Advanced Life Support.

reported when a problem is identified and corrective action is taken with ongoing reevaluation. Overall, the QI process must show evidence of actions taken in identified problem areas and the evaluation of the effectiveness of that action. In addition, reporting the results through the established organizational structure to directly link the transport service with the base facility is vital. Monitoring may focus on a specific period, procedure, or population.

Summary

Constructing a QI program begins with a basic understanding of the methodology associated with quality improvement. Important aspects of continuous QI involve selecting appropriate quality indicators, tracking them, and being able to identify important trends in the data. There are many tools available for systematically improving quality; the PDSA cycle is useful and easy to apply.

The QI program provides a mechanism with which to review all activities related to patient care, communication, and transport operations; identify problems; resolve identified problems; monitor the implementation of change; and provide ongoing reevaluation of strategies for process improvement. A mature QI program requires multidisciplinary commitment at multiple levels: clinical, financial, and administrative. A solid foundation (the transport program), a strong framework (the QI committee), and an insightful leader (the QI coordinator) are crucial to a neonatal-pediatric transport program's maintaining QI as one of its cornerstones. The transport program that continually strives to improve and promote safe, timely, appropriate, and quality patient care will be in a better position to market its services and will rise to the challenges of the future.

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CHAPTER 9

Safety

Outline

- Ground Ambulance Operations
- Air Ambulance Operations
- Environmental factors
- Clothing
- Vehicle orientation
- Training for survival and emergency conditions
- Physical requirements
- Shift work and circadian disruption
- Teamwork training as a safety tool
- Safety responsibilities of the medical director and program director

Introduction

Patient transport involves some risk to the patient, transport personnel, and the public. Although pediatric transport services have been identified as safer systems than other types of medical transport, there are real hazards pertaining to the transportation of pediatric patients. Operating a transportation fleet, whether ground or air, poses unique hazards in this medical environment. In fact, medical transport is one of the most hazardous forms of transport on our roads, and thus, transport providers have a responsibility to be fully aware of the risks and hazards to patients, providers, and the public. Transport providers need solutions to optimize the safety of these fleets of medical transport vehicles.

Fatal crashes of both ground and air vehicles do occur, and for every fatal crash, there are many dozens of nonfatal events, particularly for ground transport. When a medical transport vehicle is involved in a crash, there are direct costs of morbidity and mortality involving the patient, members of the transport team, other occupants, or members of the public as well as the indirect costs of a negative impact on the service that can be provided by the system as a whole. Injuries can result in permanent or temporary disability, and injured personnel may be unable to return to work for extended periods, forcing their organization to find and train temporary or permanent replacements. In addition to the direct mental and physical discomfort experienced by all the injured parties, there are stresses that flow onto the whole transport team. The hospital or vehicle provider may be liable for workman's compensation claims and may become involved in civil litigation regarding morbidity and mortality of the patient, provider, or a member of the public. In many cases, these tragic sequelae and their costs can be avoided or mitigated by adequate attention to safety.

With the increasing frequency of transports and the current limited focus on transportation systems safety, and minimal requirements to meet any proscribed safety standards, particularly for ground transport, there is increasing exposure to these risks. All safety policies, performance measurement, and training, both initial and ongoing, should be in keeping with the best practice approaches for other fleets or commercial vehicles and documented and filed for review by regulatory agencies.

Ground Ambulance Operations

Most patient transport activity occurs in ground ambulances traveling short distances. Ground ambulance operations pose serious transportation hazards. In fact, the vast majority of vehicular crashes involving transport teams occur with ground ambulances. It is a surprise to many involved in medical transport that the ground ambulance vehicle is not built by the automotive safety industry, nor is it required to be subjected to automotive occupant protection safety testing for the occupants of the rear compartment beyond the captain's chair.

Unlike passenger vehicles, ground ambulances are not built by the automotive industry, but rather, are constructed by after-market retrofitters. Thus, ground ambulances of the "box chassis" design, such as the standard ambulance vehicles and the larger freightliner trucks, do not have crumple zones or injury biomechanics or occupant-protection technical expertise integrated into the design and construction of the rear compartment. Furthermore, there are limited, if any, safety performance standards for the occupants of an ambulance rear compartment. Ambulance vehicles are exempt from the Federal Motor Carrier Safety Administration (FMCSA) oversight as well as much of the Federal Motor Vehicle Safety Standards

(FMVSS). Thus, in such a setting, it is paramount that the people responsible for medical direction and oversight of a patient transport fleet are aware of the key issues that pertain to transport safety, have a comprehensive understanding of effective safety strategies and solutions, and know how to implement them.

In addition to the issues mentioned previously pertaining to vehicle design and lack of safety performance standards, there is one other very key issue that separates ground transport from air transport from a safety perspective. When an air medical vehicle has a crash, the majority of the fatalities and injuries are in the air medical vehicle; however, when a ground ambulance crashes, two thirds of the fatalities are not in the ambulance but are members of the public, usually completely unrelated to the transport.

It is for this reason that is paramount that a comprehensive approach is taken to system safety, dispatch policies, and ground transport safety performance and safety data management that address the system as a whole for the patients, providers, and the public.

Key initiatives to optimize safety for ground transport (Table 9.1), not unlike air transport, are focused on a systems approach to safety and risk management. This includes ground vehicle selection for safer, more compact vehicles with nonhostile interiors; practical policies on vehicle operation; integration of intelligent transportation systems (ITS) technology for fleet and driver performance monitoring and feedback (in vehicle telematics); use of personal protective equipment (PPE) that addresses identified injury hazards; and implementation of a structured safety program with formal safety management oversight. A number of innovative pediatric transport services across the United States and internationally have adopted this systems-based approach rather than just focusing on the pediatric patient in isolation.

The recently developed American National Standards Institute/American Society of Safety Engineers Z15.1 Fleet Safety Standard (Table 9.2) is possibly the only nationally approved safety standard in the United States that is now applicable to the safety management of ground emergency medical services (EMS) vehicle fleets and that proscribes accepted formulae for recording transport system safety data. It is likely that the implementation of this standard will provide more emphasis on EMS vehicle safety, enhance data collected regarding EMS vehicle safety, and assist in bringing EMS vehicle safety more in line with state-of-the-art automotive safety practices.

Table 9.1: Key Points for Optimizing Ground Patient Transport Safety Management

Safety Management:	
Fleet Management	Safety program ANSI/ASSE Z.15 Fleet safety monitoring and feedback
Practice and Policy	Tiered dispatch Safe driving policy and practice Seat belt use policy—for providers, patients, and passengers Stop at red lights, stop signs Telematics based driver/vehicle performance monitoring and feedback devices Impaired and distracted driver management plan Emergency vehicle operator training (EVOC, etc) Secure all equipment Use portable communications Notify driver if rear occupants are in vulnerable positions
Vehicle Safety and PPE:	

Occupant Protection	Compact OEM vehicles, ie vans
	Nonhostile interiors
	Crumple zones
	Ideally—forward and rearward facing seating
	Lock down positions for routine equipment
	Use of age-appropriate child restraints secured to stretcher
	  Seat belts for all seated occupants
	  Over-shoulder belts for all patients on the stretcher

Operational design PPE	Attention to ergonomics—patient and equipment in easy reach Minimize lifting and moving hazards Head protection Visibility—providers and vehicles Biohazard protection

PPE indicates personal protective equipment.

Forward- and rear-facing seating are identified by the automotive safety experts as optimal in the rear patient compartment for attendants. Any occupant restraint device that is complex to secure, or worse, encourages the occupant to stand or move about in a vehicle in motion, should be avoided. Pediatric patients, if medically appropriate, should be in age-appropriate car safety seats secured to the stretcher, with ideally at least 2 belt paths in the line of force (ie, horizontally) and one vertically between the bottom of the car seat and the stretcher (Fig 9.1). If the child's age indicates a need for

Table 9.2: Transport Safety Performance Data Capture as Outlined in the ANSI Z.15 Standard

Sample Incident Rates and Methods of Calculation	
Incident rates should be based on all motor vehicle incidents occurring during the reporting period. Rates should be updated periodically as revisions are made to the database. Incidents may be tracked on a rolling interval (eg, rolling 12-month) in order to accumulate additional exposure units.	
Incident rate based on number of vehicles operated:	Incident rate = $\frac{\text{Number of incidents x 100}}{\text{Number of vehicles}}$
Incident rate based on vehicle mileage:	Incident rate = $\frac{\text{Number of incidents x 1,000,000}}{\text{Vehicle mileage}}$
Injury incident rate based on vehicle mileage:	Injury incident rate = $\frac{\text{Number of incidents with injury x 1,000,000}}{\text{Vehicle mileage}}$
Incident rates based on service activity:	Incidents per 10,000 deliveries = $\frac{\text{Number of incidents x 10,000}}{\text{Number of transports}}$
Motor vehicle passenger injury rates: Or a rate based on vehicle mileage:	Passenger injury incident rate = $\frac{\text{No. of incidents resulting in passenger injury x 1,000,000}}{\text{Number of passengers carried}}$
Motor vehicle injury rates based on work hours:	Vehicle incidents per 200,000 hours = $\frac{\text{Number of incidents x 200,000}}{\text{Number of hours worked}}$

Adapted from Levick.

Fig 9.1.

Two horizontally oriented belt paths and one vertical belt path for securing the car safety seat to a stretcher. (Photo, EMS Safety Foundation, Nadine Levick, MD, MPH)

a car safety seat but the child is intubated and ventilated and/or cannot be managed medically in a car seat, then having the child in a full-body immobilization device secured to the stretcher may be preferable.

In any situation in which the restraint of the child or any other occupant is suboptimal, this must be factored into the risks taken, and driving style should be modified to attempt to mitigate this risk. For example, an unsecured adult occupant in the rear compartment is a serious projectile risk to a child passenger. Children should <u>not</u> be transported on the rear-facing captain's chair for a number of reasons. First, this is the optimal seat for a provider to access the airway of the patient on the stretcher. Second, if the child is placed in the captain's chair, then an adult provider must be forced into another less optimal seating position, which may further compromise system safety. Third, if a child is placed in the rear-facing captain's chair and that child needs any form of medical attention, then the provider of that care is unrestrained and at risk to himself/herself and others. Fourth, if the child is restrained in the captain's chair, then he or she is at substantial risk from any loose projectiles (because that is the direction any projectiles will fly), from which he or she would have no protection. Also, if there were a second patient on the stretcher and that patient were to slide forward, even in a sudden deceleration, he or she would strike the unprotected child in the head and chest.

Numerous devices are available that are stated by their manufacturers to be effective for pediatric patient occupant protection in the ambulance environment; however, independent data regarding these devices are lacking. It appears from the limited independent technical data available that a routine car safety seat secured to the stretcher provides effective age-appropriate occupant protection for pediatric patients, and for the older child, being secured to the stretcher with shoulder belts and 2 horizontal belts (ideally and if medically appropriate) with the head of the stretcher at 45 degrees upright provides effective protection.

Neonatal transport incubators are not only very heavy, they are also complex to secure safety, and there have been a number of tragic events and enough testing to highlight the inevitable outcome of a crash involving a neonatal ground transport units. While driving, emergency response teams should minimize sudden decelerations, especially when transporting neonates. In many parts of the world outside the United States, ground neonatal transport utilizes compact vans, which are not only crashworthy (ie, relatively well able to handle a crash), but also have a much smoother ride and better ergonomics for providing patient care more safely (Fig 9.2).

Access to the patient while seated is a constant challenge in larger EMS trucks, hence the preference for the more crashworthy and ergonomic compact vans. For the larger ground transport trucks, the design of a seat that slides toward the patient can offer enhanced access to the patient while still allowing medical personnel to remain securely belted in the seat.

Fig 9.2.

Forward- and rear-facing seating in an Australian dedicated pediatric/neonatal transport vehicle (Photo EMS Safety Foundation, Nadine Levick, MD, MPH)

The peer-reviewed literature on automotive safety engineering testing conducted for the EMS environment has clearly identified the benefit of using existing restraints (lap belts) for all seated occupants, preferentially to have forward- and rear-facing seating; the importance of over-the-shoulder belts for the recumbent patient (with the stretcher back in an upright or 45-degree angle when medically acceptable); and the need to firmly secure all equipment at all times. Studies have also specifically identified hostile interior surfaces and hazardous head strike zones, poor design and interior layout of the rear compartment, and a noncrashworthy rear compartment, as well as a need for head protection. Additionally, high-visibility clothing will optimize the safety of providers at an emergency scene and should be a routine practice for all providers.

Various accepted air medical practices (eg, ensuring and confirming before 'take off' that all equipment and passengers are safely secured) can be effectively translated for the ground ambulance setting to optimize ground transport safety. In addition, should any occupants become vulnerable or unsecured during transport (ie, to attend to specific patient care needs), it is important to notify the driver of the vehicle of this situation immediately so that he or she can drive with extra caution until the occupant is again secured. Currently, it appears that the reverse practice occurs in ground ambulance transport, with largely predictable consequences.

It is crucial for the leadership of a pediatric patient transport service to reach out to the diverse transport partners with whom their service collaborates to have an integrated working relationship with the decision makers. A close and trusting relationship among the leadership, air and ground personnel, and management is essential. Many services do not have a dedicated ground fleet, so working closely with the ground fleet partners on a regular basis to ensure that safety expectations are well outlined and understood is a valuable practice. The smooth and consistent translation of safety practice and oversight from air to ground should equally address patient and provider safety as well as public safety.

Conclusions

In summary, in contrast to the safety culture and the comprehensive safety oversight of air medical transport, the ground ambulance component is lacking in both national safety standards and safety oversight. Therefore, it is important that the pediatric transport medical director be familiar with the risks and hazards involved in ground transport and have the knowledge and resources to minimize these hazards and optimize safety, with design and practice as well as policy aspects. Transport safety is part of a system of safety for the patient, provider, and public.

Risks and hazards that have been identified include failure to use seatbelts for providers and other seated occupants, failure to use over-the-shoulder belts for the patient, and failure to secure equipment. Additionally, there are current challenges in the design, layout, and crashworthiness of ambulance vehicles. Other risks identified relate to excessive speed, the use of lights and sirens, failure to stop the vehicle at a stop sign or red light, and driver performance history.

There are now numerous effective solutions available to address safety technology, practice, and policy as well as optimized design. Use of technologies, such as in-vehicle telemetry monitoring and feedback devices to optimize safe driving and vehicle handling, have been demonstrated to be highly effective.

Implementation of a comprehensive safety program and basic policies—such as those that ensure optimal use of seatbelts, safe driving practices, strict intersection safety policies, and policies that ensure that all equipment is secured—are key and cost-effective enhancements to safety performance. In addition to these safety initiatives, use of personal protective equipment, such as head protective devices and high-visibility clothing, should be implemented.

The new Z15 standard is a valuable tool in designing and maintaining a safety program, culture, and safety oversight for the ground vehicle component for a patient transport system. These are useful tools to optimize system safety relevant to ground transport of pediatric and neonatal patients with an approach focused on strict safety oversight as is routine for the air component.

Air Ambulance Operations

Air medical transport, particularly using helicopter ambulances (HEMS), remains potentially dangerous despite years of attempted safety improvements. There are approximately 1.18 fatal crashes per 100 000 HEMS flight hours, and this crash rate has remained relatively stable over time. The most important causes of fatal crashes are: (1) inadvertent flight into terrain, (2) pilot disorientation and lack of spatial awareness during night operations, and (3) adverse weather conditions. Many potential crashes can be avoided by ensuring that aircraft involved in patient transports are equipped with terrain-avoidance devices, that the pilots have appropriate night vision equipment, and that the operator has strict and inflexible rules regarding operating in inclement weather. Additionally, all pilots should be qualified in instrument flight rules (IFRs) in case the aircraft is forced to operate in IFR conditions. The managers responsible for the team should ensure that these provisions are met before allowing the team to fly. Additionally, a hallmark of truly excellent air-medical programs is continual training of pilots. In choosing a provider of air-medical services, teams would be wise to consider the amount of continued training afforded to the pilots.

Additionally, all team members must undergo thorough training to function safely and effectively in the air-medical environment and to comply with Federal Aviation Administration (FAA) and Commission on Accreditation of Medical Transport Systems (CAMTS) regulations. This training is, by necessity, divided into 2 types; nonmedical and medical. All crew members, regardless of role, must understand the specific dangers associated with working around aircraft, especially helicopters (see section on vehicle orientation). Team members have to know how and when to approach the aircraft, the hazards associated with certain kinds of clothing and equipment, the impact of environmental factors like noise and altitude, and especially, the dangers of rotor-wash. They need to understand how to safely move around the aircraft when the terrain is uneven or when movement is difficult because of ice, mud, water, or other obstacles. They must also understand how to safely load and unload the helicopter. A thorough orientation to each specific aircraft is also necessary. Transport team members need to be able to assist the regular crew in the event of an onboard emergency and should be well schooled in the emergency procedures necessary to manage problems like on-board fires and emergency landings. Teams that fly over remote areas should have wilderness survival training (see section on training for survival and emergency conditions). Finally, all teams should participate in Crew Resource Management and Air Medical Resource Management, which emphasizes a team culture of shared decision making and mutual assurance of safety and quality.

Medical providers must also learn how to manage medical emergencies in flight and must understand the physiologic effects of flight on patients. Procedures that might be considered straightforward in the controlled setting of a well-lighted critical care unit can become difficult or impossible in a dark, noisy, moving helicopter. Alternative means of dealing with such emergencies as inadvertent extubation and acute pneumothorax while in the aircraft must be learned and practiced. CAMTS standards thoroughly delineate the training requirements and capabilities needed.

Environmental Factors

Transport medicine is greatly influenced by environmental conditions. In many cases, the acceptance or rejection of a transport is dependent on the weather. Weather conditions have their greatest effects on aircraft but also are important for ground transport vehicles. Just as foggy weather and high winds make aircraft operations dangerous, icy roads and heavy rain or fog may make it imprudent to operate a ground ambulance. All teams should have clear guidelines delineating the minimal weather requirements for the vehicle(s) used, and these guidelines should be strictly followed. The rules may vary depending on the type of vehicle used and the local terrain. Aircraft may use visual flight rules (also called VFRs) or, if more sophisticated, IFRs that allow safe flight in less-than-ideal (but not all) weather conditions. For ground operations, travel advisories issued by state and local authorities should be considered before a decision is made to proceed with the transport. In addition, the CAMTS and the FAA offer guidelines for minimal safe weather conditions. In all situations, the final decision rests with the driver or pilot and should be made solely on the basis of prevailing weather conditions along the entire round trip route of travel. Neither patient severity or need, nor pressures such as productivity or competition, should influence the driver's or pilot's decision. Furthermore, administrative personnel and the medical director should support these decisions.

Safety Policies

In addition to weather rules, the team should have policies dictating the safe conduct of transports based on the medical needs of the patient coupled with the safety of the patient and the team members. These policies should, for example, address if and when a ground ambulance can use lights and sirens to circumvent certain traffic regulations. In most cases, this practice is unnecessary, because a potential few minutes saved does not justify the substantial risk of an emergency response. However, when the team lacks a clear policy regarding issues such as the use of lights and sirens and adherence to traffic regulations, the driver is free to use his or her judgment with potentially disastrous results. Other examples of necessary guidelines include the following: optimal use of restraints for both the patient and crew members and circumstances under which it is acceptable for a crew member to become unrestrained to care for the patient, standard precautions, use of hands-free communication technology by the driver or pilot, and transport of family members. There should be specific rules concerning team members who are impaired by drugs, alcohol, exhaustion, illness, or injury. All team members should be oriented to and understand the rules. Furthermore, personnel employed by contracted vehicle vendors must adhere to the transport team's safety policies unless those of the vendor company are more stringent.

Clothing

Clothing is an essential safety consideration. Some aeromedical teams wear helmets and fire-retardant clothing, whereas others, particularly those in very warm climates, do not. Aeromedical teams may require specialty transport personnel to conform to their clothing rules. All teams, however, need to give attention to clothing. Attire that is appropriate and functional in the hospital may be hazardous during patient transport. Long or loose white coats, scarves, stethoscopes, or other clothing and accessories can become tangled in equipment or in restraints. Clogs, popular among health care workers, are absolutely not appropriate for transport. They do not provide adequate traction on uneven surfaces or satisfactorily protect and support the foot and are less than ideal for walking long distances in remote environments. Certain types of jewelry, such as dangling bracelets or necklaces, may become quite dangerous if caught in equipment or machinery.

Clothing should be appropriate to the expected or potential environmental conditions, providing adequate warmth in the winter and preventing overheating in the summer. Depending on the team's mission(s) and geographic location, options include flight suits, jumpsuits, and a standard uniform. Some teams providing on-scene care in hot environments wear short pants and short-sleeved shirts, although consideration must be given to universal safety protection as well as prevention of potential transport related issues (skin protection from heat, burns, sharp objects). Many teams choose uniforms that include pockets for extra equipment.

Attention should also be given to appropriate eyewear. In addition to protection from prolonged sun exposure, protective eyewear is an essential component of standard precautions and can protect the eyes from debris when the team member is loading, unloading, or boarding a running helicopter.

In addition, team members need to be cognizant of the possibility, however remote, of prolonged environmental exposure and ensure that they have appropriate protective clothing with them. A 1-hour flight may become a several-day ordeal if the aircraft is required to make an emergency landing in a wilderness location during the winter. Hospital scrubs and a light jacket would be inadequate under such circumstances. Environmental exposure also can occur under less extreme circumstances, for example, failure of the heating or air conditioning system in an ambulance. A team member with hypothermia will be unable to care for the patient or assist team members. Clothing choices should recognize these possibilities. During cold weather operations, layered clothing may be the best solution, because it allows team members to remain comfortable across a range of temperatures. All protective clothing should also address the need to maintain standard precautions for protection of the crew from blood and body fluid exposure. Additional, more sophisticated protective equipment may be required for the transport of patients with toxic exposures or certain infectious diseases.

Vehicle Orientation

Every team member, especially those who infrequently participate in transports, should be oriented or reoriented to the transport vehicle(s) used by the team. For aircraft, the content of the orientation is mandated by the FAA. US Department of Transportation rules govern the operations of ambulances. In addition, CAMTS offers transport programs the opportunity to be evaluated voluntarily against standards of quality and safety. The CAMTS standards include criteria for training in the safe use of transport equipment and vehicles. These issues are particularly important for neonatal-pediatric transport teams that occasionally fly with one or more unrelated aeromedical services. In such cases, the neonatal-pediatric team is expected to function as an integral part of the aeromedical team and is subject to the same rules and guidelines.

The transport team should be fully oriented to all aircraft used and should understand how to safely approach the aircraft to board and to load and unload patients. Likewise, team members should be well versed in all emergency procedures. Although specific guidelines vary with the type of aircraft used, team members should be aware of the potential dangers associated with each type of aircraft, how to minimize these dangers, and how to respond if necessary. Helicopters pose the greatest hazards. Contact with the tail rotor blade or main rotor blades, which can dip several feet if turning slowly in high winds, is likely to be lethal. In addition, a landing helicopter can generate gale force winds that, like naturally occurring winds, will cause flying debris and can damage nearby objects and injure bystanders.

All team members should be familiar with and use restraint systems and ensure that the patient and all passengers are properly restrained. Equipment, such as stretchers and incubators, must be properly restrained within the vehicle. Emergency evacuation procedures and appropriate responses to a vehicular crash, fire on board the vehicle, and other emergency situations should be well rehearsed.

The more realistic the training, the more likely the crew is to survive an actual incident. With an estimated accident rate of approximately 1 in 1000 ground transports, it is likely that most transport teams will have experience with an adverse vehicular event.

Training for Survival and Emergency Conditions

Teams that travel over or through remote areas must have the training necessary to survive in these environments until rescued. Emergency and survival training should occur at regular intervals so that these skills are well understood by all team members. All such vehicles should carry survival equipment, including food and water. Personal flotation devices are mandatory for flights over water unless a safe glide to land can be ensured. In many cases, the transport vehicle will serve as the crew's shelter; however, alternative arrangements should also be made in case the vehicle becomes unusable. In cold or cool environments, body heat can be lost quickly, and hypothermia is a risk for the crew and the patient. Crew members should have adequate clothing to withstand the weather, and a survival kit should include means of providing adequate warmth. Likewise, teams must have multiple methods of communication so that help can be contacted, if needed.

Physical Requirements

Although survival training is important, it is even more important that team members and hospital administration understand that the transport environment requires physical capabilities beyond those expected of personnel who function only in a hospital or clinic. Team members may be required to lift patients or to carry heavy equipment, often with little or no help. Personnel need to be agile enough to maneuver within the confines of a transport vehicle and dexterous enough to perform procedures in a moving environment. In addition, they should not be unduly prone to motion sickness or should have mastered techniques to mitigate the effects of motion sickness. Most aircraft are subject to weight restrictions that vary with type of aircraft and the location and distance of the flight. These restrictions are likely to prevent very large team members from participating in at least some transports. Team members with certain chronic illnesses or disabilities may also be unable to perform all expected duties. Likewise, pregnancy may temporarily preclude participation and, at a minimum, medical clearance by the team member's obstetrician should be provided. In addition, certain medical conditions may permanently or temporarily preclude participation in transports. Unlike the situation in a hospital, the transport team has few options should a member become incapacitated while on duty. If the team member is suddenly unable to function, patient care and crew safety might be compromised. Therefore, rules precluding team participation under certain circumstances are reasonable. For example, team members with sinusitis, otitis media, or upper respiratory infections may be temporarily unable to fly, whereas those with uncontrolled seizures or uncontrolled diabetes mellitus might be completely removed from transport duty because of risks to themselves and others. These issues are best addressed by a policy clearly and specifically stating the physical requirements for team membership (Fig 9.3). These policies should be drafted with the assistance of the human resources department and legal counsel. Team members should be encouraged to maintain physical fitness, and it is reasonable to make continued participation dependent on the results of regular (eg, annual) physical fitness testing.

Shift Work and Circadian Disruption

In recent years, considerable attention has been given to the role of shift work and sleep deprivation in medical error, road collisions, and other types of incidents. Disruption of circadian rhythm is a key issue for many types of

Fig 9.3: Sample Team Participation Policy

METHODIST HEALTHCARE SYSTEM
METHODIST CHILDREN'S HOSPITAL OF SOUTH TEXAS

TITLE:	Criteria for Transport Duty
EFFECTIVE DATE:	May 1997
REVISED DATE(S):	March 19, 2006 May, 2011
REVIEWED DATE(S):	
AUDIENCE:	Children's Transport Services
APPROVED BY:	Coordinator

All standard policies and procedures represent our current knowledge and judgment regarding the issue covered by this policy. If you can think of a better way to handle the issue covered in this policy/procedure, or if this policy/procedure needs to be revised to reflect changes that have occurred, please "draft" a revision and give it to the transport coordinator or the team medical director so that we can consider improving this policy/procedure accordingly.

Policy:

1. On-duty team members will be physically and mentally able to manage a critical care transport. Criteria include, but are not limited to the following:
   - The team member is able to lift up to 50 lb.
   - The team member is able to withstand the potential stressors of the transport environment and transport activities. The team member is well rested—has had a minimum of 6 hours of sleep within the 24-hour period prior to on-duty status.
   - The team member is able to tolerate variances in diet.
   - The team member is not under the influence of medications that can cause excessive drowsiness or sedation.
   - The team member has not ingested alcohol within 8 hours of on-duty status.
   - The team member has not donated blood within the last 72 hours.
2. In the event of illness, injury, or personal difficulties that occur during a transport shift that would limit the team member's ability to adequately perform in the transport environment, the team member will notify:
   - Transport coordinator, clinical administrator, or other supervisor

   If the team member cannot be replaced with in-house or on-call coverage such that a full team could still be mobilized, the "Closure of Transport Services" policy/procedure will be initiated.
3. Team members who have symptoms that would limit their ability to perform their duties on transport must notify the transport coordinator or respiratory therapy director/supervisor. The team member will be alert to the following conditions that are relative contraindications to aeromedical transport and may render them ineligible for duty:
   - Impacted sinusitis
   - Invasive dental work within 24 hours of on-duty status
   - Otitis media
   - Scuba diving within 24 hours of on-duty status
   - Any condition for which the employee health nurse has enacted work restrictions
   - Any condition for which the team member's physician has placed him/her on work restrictions
4. Any team member who has been placed on work restrictions is required to furnish a physician's statement clearing him/her for transport activities before returning to active duty status.
5. Team members who are aware they are pregnant are requested to notify the Transport Coordinator (as well as their manager/director) of their condition. Pregnant team members will be allowed to remain on active status until their first prenatal appointment with their MD. At the time of the first prenatal exam, they must obtain a letter/note from their MD clearing them for continuing active transport status. The pregnant transport provider assumes responsibility for informing her MD of the physical stressors of the transport environment and transport duties. She may provide her MD with a copy of this policy.

MD indicates physician. Used with permission: Methodist Healthcare System, San Antonio, TX.

workers. Certainly, health care has always been a 24-hour business. However, transport teams have special problems related to sleep deprivation and shift work. First, unlike their colleagues in the hospital, transport team members may not be exposed to the stimulation of lights and personal interactions that contribute to remaining alert. In fact, they may be required to travel for many hours in a darkened vehicle, performing relatively routine and monotonous tasks. Under such circumstances, vigilance and judgment may falter. Second, shifts can become lengthened with a prolonged transport, forcing the team member to work well beyond the scheduled end of the shift. For team members working several consecutive shifts, the result might be inadequate rest. In extreme cases, such as international or cross-country transports, team members may be subject to jet lag, further disrupting sleep. There are few easy solutions to this problem. All drivers and pilots should adhere strictly to regulations governing adequate rest before and after duty, even if this means that some transports must be delayed, divided into legs, or referred. Scheduling for team members should occur in a "circadian-friendly" manner, moving forward from day shifts to middle shifts to night shifts with adequate rest between the transition from nights to days. Dedicated transport teams (ie, the teams whose members have no other assigned or primary clinical duties when not transporting patients) may want to consider allowing team members to sleep during the night shift when not transporting patients. All teams should have rules dictating rest time before duty hours. Such rules should also address the minimum number of hours before duty that a team member can consume alcohol and certain medications.

Teamwork Training as a Safety Tool

It is becoming well understood that errors are minimized and safety is supported when the members of highly skilled teams function as a cohesive unit. The concepts were developed in the military and later were embraced by the aviation industry as "cockpit resource management" and the evolution to "crew resource management." More recently, they have been adapted for use in health care settings. At their core, these concepts place responsibility for safety on the entire team, and any member of the team, regardless of level of training or seniority, is empowered to voice safety concerns without fear of reprisal. In fact, team members are encouraged to address these issues candidly.

A complete discussion of these concepts is beyond the scope of this chapter (the reader is referred to the Selected Readings); however, the basic tenets will be summarized briefly. First, team structure is created and strengthened, and team members are assigned specific roles. Although one team member serves as the leader during each patient encounter, this role need not remain fixed across encounters; one member may serve as the leader for one transport with another member serving as the leader for a subsequent transport. Second, all team members are accountable to one another for performing their assigned duties and for asking for assistance when needed. Third (and a very important concept for teams that include a physician), team members must not be bound by traditional roles and are free to object to or question an order or a plan at least twice. This so-called 2-challenge rule is intended to force the leader to reconsider the action or order in question. Fourth, team members are encouraged to communicate in a specific manner. Orders are acknowledged and repeated by the recipient to ensure understanding. Unclear orders and plans are immediately questioned and clarified. Fifth, when errors or untoward events occur, as they surely will, they are discussed openly and in a spirit of system correction rather than individual blame.

Safety Responsibility of the Medical Director and Program Director

The ultimate responsibility for the adherence to safety policies lies with the medical director and the program director. These individuals should establish and enforce the physical requirements for the role. They are also responsible for delineating the safety policies of the team and should have the authority to require certain safety standards on the part of contracted vehicle vendors. Team members who knowingly violate safety policies are endangering themselves, their colleagues, and the patients. The medical director and program director should not tolerate such behavior. The medical director, the program director, or others in the organization are likely to receive occasional complaints from referring hospitals when transports are delayed or referred based on weather restrictions, crew fatigue, or other safety-related factors, and they should address these issues directly.

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CHAPTER 10

Transport Mode: Issues, Timing, Safety, Selection Criteria, Considerations, and Options

Outline

- Critical transport decisions
- Criteria for consideration of air versus ground transport
- General considerations
- Ground ambulances
- Helicopter air ambulances
- Fixed-wing air ambulances (airplanes)
- Vehicle operations
- Summary

The optimal transport of each neonatal and pediatric patient is facilitated when the personnel involved ensure the appropriate use of available resources, including staff, equipment, and vehicles. An increased awareness of transfer requirements has been highlighted by the federal Emergency Medical Treatment and Active Labor Act (EMTALA [42 USC §1395dd]), which requires that all transfers be effected using qualified personnel and transportation equipment. Various medical and legal opinions have concluded that appropriate vehicle selection is no longer merely a patient care issue, but also an EMTALA compliance issue.

The selection of the most appropriate mode (vehicle) for neonatal-pediatric transport is influenced by numerous factors. The acuity and stability of the patient's condition and the need for unavailable local services (ie, a higher level of care) have major roles. Vehicle availability, weather, distance, geography, transport time, and transport "logistics" are also essential considerations. Transport logistics include the potential advantages and disadvantages of the various modes of transport.

Vehicles used in patient transport include surface (ground) and air ambulances. Air ambulances are rotor-wing (helicopter) or fixed-wing (airplane) aircraft. The transfer of a neonatal or pediatric patient between facilities may require one or a combination of these vehicles. Transport teams and program administrators commonly determine which of these vehicles best fits their particular mission profile. A fully integrated transport system would include all 3 mode types as options. At the time of a transport request, a triage decision should be made to determine the most appropriate vehicle (or combination of vehicles) for the particular mission. Unfortunately, but realistically, many transport teams have limited resources. Although it may be common for transport programs that serve large rural areas to provide helicopter and airplane transport, they may do few (if any) nonair transports. In these circumstances, the transports may be outsourced or coordinated with a program that provides ground transports. Programs that predominantly serve an urban area may provide only helicopter or ground ambulance transport.

Patient transfers may be 1-way, when a vehicle is dispatched directly from the referring facility to the receiving facility; however, for neonatal-pediatric transport, the transfer more commonly is 2-way, in which the vehicle and specialized transport team members are sent from the receiving facility to the referring facility to pick up the patient. In addition, transports also can be 3-way, in which a transport vehicle and team from neither the referring nor the receiving facility are requested to undertake the transport. Private ambulance companies (air and ground) and most community- or hospital-sponsored air-medical flight programs perform such 3-way transfers as needed or under the terms of an established transport agreement.

Vehicle purchasing and leasing decisions should be made with direct input from people who are knowledgeable about the transport environment and the capability of the various vehicles. The planning group should include members of the transport team who are directly and routinely involved in transport decisions. The items presented in this chapter usually are considered when administrative and transport personnel decide which vehicle(s) will best fit the goals of their program.

Critical Transport Decisions

Before any transport, attention to the safety of the transport team and patient should always be the foremost consideration when determining the mode of transport. There are 4 subsequent critical decision steps necessary for each transport; consideration of these steps facilitates the selection of the optimal mode of transport.

The first step involves evaluation of the clinical status of the patient. It is important to know the patient's current medical condition and to anticipate the most serious complication reasonably possible during transport. This does not need to be based on a final diagnosis but on an accurate assessment of the patient's illnesses or injuries, present or potential. If a patient's medical condition is unstable, even a minimal shortening of the response time to the referring facility achieved by selecting one mode of transportation over another may be lifesaving. The emphasis on reducing the out-of-hospital transport time may be especially beneficial to patient outcome in situations such as surgical emergencies.

The second step is an evaluation of the medical care the patient requires before and during transport, including an evaluation of the available medical care at the referring facility or scene of an accident. Usually, the primary consideration is the level of care required during transport. However, there also may be a need for urgent provision of a higher level of care or additional personnel at the referring facility, such as for certain types of airway or surgical emergencies.

The third step is to determine the urgency of the transport. For time-sensitive transports (eg, a need for urgent or locally unavailable interventions), the time required for a selected vehicle to reach the referring facility and to deliver the patient to the receiving facility should be considered. These considerations will take into account the distance between facilities, the mode of transportation, geographic characteristics of the area to be served, and the availability of vehicle options. If the transport is less urgent, the key consideration becomes the availability of an appropriate vehicle.

The fourth step involves some of the logistics of a patient transport (eg, local resources available for transport, weather considerations, and ground traffic accessibility). Depending on the type of vehicle selected, the number of staff may be affected. If a ground ambulance is used for a patient with a complex medical condition, staffing can potentially be increased as needed. Conversely, staffing additions may be limited in a small helicopter.

Most often, the decision on mode of transport is made between the transport logistics manager and the control physician. The decision to transport by ground or air involves expert judgment of the condition and potential complications that might be experienced by the patient and require high-complexity medical decision making. Once the team is dispatched, the control physician will remain in intermittent verbal contact with the transport team, assessing the patient's condition and supervising treatment options. These physician services are covered potentially by *Current Procedural Terminology* (CPT) codes 9948x1 and 9948x2.

General criteria addressing the appropriate use of air-medical services can be divided into categories, which correspond to the aforementioned third and fourth steps. These criteria are summarized in the following section.

Criteria for Consideration of Air Versus Ground Transport

Time and Distance Indicators

Distance. Distance to the closest appropriate facility is too great for safe and timely transport by ground ambulance.

Transport Time. The patient's clinical condition requires that the time spent out of the hospital environment, in transport, be as short as possible.

Timely Treatment. The patient requires a specific treatment or timely treatment that is not available at the referring facility (or scene) to minimize morbidity and mortality.

Transport Delays. The potential for transport delay that may be associated with the use of ground or air transport (eg, weather or weather-related obstacles, traffic congestion, construction, road obstacles, location of patient, and distance) is likely to worsen the patient's clinical condition.

Logistic Indicators

Critical Care. The patient requires critical care support (eg, monitoring, personnel, medication, special equipment) during transport that is not available from the local ambulance service.

Inaccessible Area. The patient is located in an area that is inaccessible to regular ground traffic, impeding ambulance egress or access to the scene because of environmental obstacles or conditions, weather-related events (eg, floods, heavy snowfall), traffic congestion, wilderness rescue, or other geographic considerations.

Local Ground Resources. The use of a local ground transport service would leave the local area without adequate emergency medical service coverage, or local ground units are not trained or available for long-distance neonatal-pediatric transport.

Transport Times

When evaluating the time needed to undertake and complete a transport, many factors are involved beyond the speed of the vehicle and the distance between the referring and receiving facilities. The time-related considerations for transport include the following:

Mode of Transport

To keep the out-of-hospital time to a minimum, consideration must be given to the distance between the referring and receiving hospitals. Comparing only the actual travel speeds, the airplane typically provides the fastest mode of transport, and the ground ambulance provides the slowest. In a time-critical transport in remote geographic areas, the reduced travel time offered by a helicopter or airplane may be essential. However, in an urban setting, where much shorter distances may be traveled, the ground ambulance or helicopter may provide the best option. For transport over a moderate distance to or from locations without on-site helicopter access or landing facilities, direct ambulance transport may be as efficient as rotor-wing aircraft.

Response Time

The length of time from receipt of a transport call until the transport team arrives at the referring facility or scene of an accident often is referred to as the *response time.* Transport services that respond directly to the scene clearly require a rapid response time. Similarly, in a true medical emergency, if a transferring facility cannot stabilize a patient's condition, the response time to the referring facility with a critical care transport team may be more crucial than the time in transit to the receiving facility after the patient's condition has been stabilized. Many variables enter into the response time equation. Following the initial contact, there is the time needed to accept the patient and to mobilize and dispatch the transport team. Dedicated ground and helicopter teams can often be on their way within 15 minutes, although specific guidelines and requirements may vary between programs and municipalities, as well as with specific patient populations (eg, scene response teams that depart in ≤5 minutes). The departure of a medical airplane usually takes longer, ranging from 30 minutes to an hour or more. The fixed-wing delay often is because the transport team and pilot may be on call rather than on-site at the airport. In addition, the pilot is required to preflight the aircraft, complete a weight and balance, and file a flight plan before departure. The response time may be more prolonged if the airplane is not dedicated to patient transport and requires changes in the interior configuration.

The various response times and related logistics of the vehicle options may make the choice more difficult. A ground ambulance may be available immediately at a referring facility that could be en route to the receiving facility long before a distant helicopter could arrive at the referring facility. The ground ambulance, however, may have to contend with local terrain, traffic, construction, and other ground-related delays, and the local emergency medical services (EMS) team may not have the training, experience, or equipment required to manage the patient in transit.

If a helicopter is to be considered, the response time should include the availability of a safe and close helipad or landing zone. An on-site helipad or landing area near both facilities is advantageous. A distant landing zone that would require a 3-point transfer (an intermediary transfer between location and transport vehicle) may eliminate the advantage of the helicopter's speed by requiring additional ground time, increased patient risk, and transfers between vehicles to travel between the landing area and the referring facility. In most cases, the patient should not be delivered to a distant landing zone to meet the aircraft and transport team. During this period of transfer, the clinical care and monitoring of the patient may not be optimal, and a lack of interventional capability creates an unstable environment. In addition to the potential for disruption of the care of the patient, any patient transfer between different types of vehicles may be challenging, especially if there are size limitations. Patient movements necessitated from multiple patient transfers may be detrimental to the patient's medical condition. If the helicopter must land in a location away from the site of patient care, ideally, the critical care transport team will be transported to the patient rather than the patient to the air ambulance. Following assessment, stabilization of the patient's condition, and preparation of the patient for transport, the ambulance will take the patient and team back to the helicopter. If a helicopter needs to land at a site distant to the receiving hospital, the air transport team members should accompany and continue to manage the patient until formal transfer of care occurs at the receiving facility. They should not, if at all possible, transfer care to an intermediary team or plan to do a sophisticated care transfer in the field. This practice of maintaining care and responsibility for the patient until the definitive care transfer helps maximize care consistency and minimizes potential information deficiencies.

If airplane versus helicopter transport is considered, in addition to distance issues, the ability of the helicopter to arrive directly at the hospital or nearby landing zone must be evaluated and compared with the airplane landing at a more distant airport and the requirement for an ambulance to travel the distance between the referring facility and the airport.

The response times of any vehicle selected may be affected by the vehicle's availability and weather conditions. A local air-medical helicopter already may be committed to a transport or may be unable to fly because of adverse weather conditions or maintenance requirements. These considerations may require that an alternative vehicle be selected to avoid a significant delay in response time. Fixed-wing aircraft have the advantage of pressurized cabins; therefore, they are able to operate at higher altitudes to avoid weather and turbulence found at lower altitudes.

When promoting a neonatal-pediatric transport program, it is important to help the referring physicians understand the factors that can affect the response time and what the "routine" response time will be. Confusion may exist for referring physicians, who might anticipate response times from neonatal-pediatric transport programs to be identical to those of EMS agencies, local ground ambulance services, or other available transport teams.

Stabilization and Preparation Time

The amount of time spent by the transport team to stabilize the patient's condition and prepare the patient for transport is another important consideration related to vehicle selection. Compared with local ground ambulance services, critical care transport teams that arrive by air or ground often take more time to assess a patient and stabilize the patient's condition before transport. Critical care teams should have a minimum of 2 personnel accompany a critically ill patient. This may consist of a combination of physician, nurse, respiratory therapist, and critical care technician (see Chapters 3 and 4). A critical care transport team is an extension of an intensive care team. Sophisticated neonatal-pediatric assessment, evaluation, stabilization, and treatment of the patient are necessary. A helicopter transport service will need to consider these issues regarding potential prolonged downtime at the referring hospital, which may remove them from EMS or other responses and can add to the per-capita cost for transport.

Out-of-Hospital Time

For a patient in unstable condition or for a time-critical transport, the out-of-hospital time may be the most important factor in the transport vehicle equation. In addition to the distance between the referring and receiving facilities, the total time spent between facilities in the transport environment will depend on the mode of transport and the related times and logistics necessary to get to and from the vehicle. Like the response time, the out-of-hospital time will be affected by off-site helicopter landing zones and travel to and from airports. The transfer of a patient from one vehicle to another is time-consuming and recognized as a particularly risky time in the transport of any critically ill or injured patient. Temperature instability may occur during the transfer. Equipment is most likely to become disconnected or fail during transfer between vehicles, and, as mentioned, monitoring of the patient's condition is more difficult. To enhance patient care and reduce transport times for critically ill patients, transfers between vehicles should be kept to a minimum. For patients in stable condition or patients whose conditions have been stabilized, the out-of-hospital time may not be a critical consideration.

The philosophy and practice of many neonatal-pediatric transport teams may lead to a different approach to the linking of the response time, stabilization time, and out-of-hospital time than is usual with other transport services. For example, to reduce the response time for transport of a critically ill patient, a team may be dispatched to a referring facility by helicopter but may return by ground ambulance after stabilizing the patient's condition, making the helicopter available for other transports during a sometimes prolonged stabilization period.

Vehicle Selection

Many makes and models of ground vehicles, helicopters, and airplanes used to transport patients are available. When evaluating a transport vehicle for neonatal-pediatric transport, specific aircraft or ground ambulance capabilities should be studied to ensure that the program uses the vehicles that best serve its mission. Vehicles should be assessed to determine the usable cabin space and available options for the medical configuration. The speed of transport and vehicle range also may be important considerations, and noise and vibration are inherent factors for all transport vehicles and the transport environment. If aircraft are under consideration, additional specifications to evaluate include single engine versus multiple engine, useful load (amount of weight that can be lifted in specific weather conditions), and cabin pressurization (airplanes). From an administrative and financial standpoint, the costs related to purchase or lease and operate transport vehicles should be evaluated carefully. Some organizations that provide transport contract with private service(s) for vehicle provision. Contract negotiations may include response time of the vehicle crew, vehicle configuration, supplies and equipment needed during transport, determine of team composition and determination of billing services.

The ideal transport vehicle should be safe, fast, quiet, comfortable, and medically equipped to care for pediatric and neonatal patients. It should be large enough to appropriately secure 1 or 2 patients for transport with 2 to 4 transport team members. The vehicle should be easy to load and should allow the caregiver easy full access to the patient with seatbelts in place.

Safety

Safety must be the most important consideration in patient transport. A careful consideration of the risks and benefits of the different modes of transport should be completed before any patient transfer. This is also a requirement of the referring physician under EMTALA. Everyone involved with patient transport is responsible for overall safety in and around any transport vehicle. The selection of reliable and safe vehicles (ie, ground ambulances, helicopters, and airplanes) is as important as the training and experience of the pilots, drivers, and mechanics responsible for their operation. Only transport services (air or ground) with a demonstrated commitment to safety should be considered.

Accidents have occurred with all modes of patient transport. Collisions and crashes involving neonatal-pediatric transport teams are uncommon but have been reported. Data obtained by King and Woodward[1] from neonatal and/or pediatric transport teams suggest that 1 collision or crash occurs for every 1000 patient transports. Collisions or crashes involving injury were less common and reportedly occur at a rate of 0.546 per 1000 transports. In their 5-year incident review, all 8 reported neonatal-pediatric transport personnel deaths occurred as the result of aircraft crashes. Ground ambulance collisions accounted for some moderate to severe injuries. The aircraft crashes usually resulted from pilot error or adverse weather conditions, whereas ambulance collisions were most often attributed to issues related to the driver, weather, mechanical breakdown, or a third party.

In January 2006, the National Transportation Safety Board (NTSB) issued the "Special Investigation Report on Emergency Medical Services (EMS) Operations" and included, in detail, the briefs of 7 EMS accidents.[2] It noted that 55 EMS aviation accidents occurred in the United States between January 2002 and January 2005, resulting in 54 fatalities and 18 serious injuries. Summary statistics for the 1990–2005 period revealed 125 accidents, with 41 of those involving fatalities. During that period, there were 109 fatalities, 43 serious injuries, and 47 minor injuries reported. Although the number of flight hours increased from approximately 162 000 in 1991 to 300 000 in 2005, the accident rate also increased. The NTSB identified the following recurring safety issues: less stringent requirements for EMS operations conducted with patients on board; a lack of aviation flight risk evaluation programs for EMS operations; a lack of consistent, comprehensive flight dispatch procedures for EMS operations; and no requirements to use technologies, such as terrain awareness and warning systems to enhance EMS flight safety. Their specific conclusions included the following:

1. The safety of EMS operations would be improved if the entire EMS flight plan operated under Airworthiness Standards (14 CFR Part 135) operations specifications; 35 of the 55 accidents in this special investigation occurred with crew members but no patients on board.
2. The minimal contribution of medical personnel to the safe operation of EMS flights is not sufficient to justify operating EMS positioning flights under the less stringent requirements of General Operating and Flight Rules (14 CFR Part 91).

3. The implementation of flight risk evaluation before each mission would enhance the safety of EMS operations.
4. Formalized dispatch and flight-following procedures, including a dedicated dispatcher with aviation-specific knowledge and experience, would enhance the safety of EMS flight operations by providing the pilot with consistent and critical weather information, assisting in go/no-go decisions, and monitoring the flight's position.
5. The use of terrain awareness and warning systems would enhance safety of EMS flight operations by helping to prevent controlled flight into terrain accidents that occur at night or during adverse weather conditions.
6. If used properly, night vision imaging systems could help EMS pilots identify and avoid hazards during nighttime operations.

Because of the dramatic rise in fatal helicopter EMS accidents that occurred in 2008 (13 accidents, 29 fatalities), the NTSB issued a Safety Recommendation to the Federal Aviation Administration in September 2009.[3] The NSTB made the following recommendations as a result of public hearings held on February 3–6, 2009:

1. Develop criteria for scenario-based helicopter emergency medical services (HEMS) pilot training that includes inadvertent flight into instrument meteorological conditions and hazards unique to HEMS operations, and determine how frequently this training is required to ensure proficiency. (A-09-87)
2. Once the actions recommended in Safety Recommendation A-09-87 are completed, require helicopter emergency medical services pilots to undergo periodic FAA-approved scenario-based simulator training, including training that makes use of simulators or flight training devices. (A-09-88)
3. Require helicopter emergency medical services operators to implement a safety management system program that includes sound risk management practices. (A-09-89)
4. Require helicopter emergency medical services operators to install flight data recording devices and establish a structured flight data monitoring program that reviews all available data sources to identify deviations from established norms and procedures and other potential safety issues. (A-09-90)

5. Require helicopter emergency medical services operators to report activity on at least an annual basis to include total hours flown, revenue flight hours flown, revenue miles flown, patient transports completed, and number of departures. (A-09-91)
6. Permit the helicopter emergency medical services (HEMS) Aviation Digital Data Service Weather Tool to be used by HEMS operators as an official weather product. (A-09-92)
7. Conduct a systematic evaluation and issue a report on the requirements necessary for a viable low-altitude airspace infrastructure that can accommodate safe helicopter emergency medical services (HEMS) operations. The evaluation should consider improved collection and dissemination of weather data, the role of automatic dependent surveillance-broadcast, approaches to helipad and designated landing zones, and integration into the National Airspace System. Include in the evaluation process HEMS operators, related industry associations, and hospitals, among others. (A-09-93)
8. Once the evaluation and report as recommended in Safety Recommendation A-09-93 are completed, initiate action to develop this infrastructure. (A-09-94)
9. Require helicopter emergency medical services operators to install night vision imaging systems and require pilots to be trained in their use during night operations. (A-09-95)
10. Require helicopters that are used in emergency medical services transportation to be equipped with autopilots and that the pilots be trained to use the autopilot if a second pilot is not available. (A-09-96)

The FAA released a Notice of Proposed Rule Making in October 2010, under which helicopter air ambulances would be required to have stricter flight rules and procedures, improved communications and training, and additional on-board safety equipment.[4] As a result, operators would use the latest on-board technology and equipment to avoid terrain and obstacles and for flying in challenging weather, at night, and when landing in remote locations. These proposed rules would require helicopter air ambulance operators to:

1. Equip with Helicopter Terrain Awareness and Warning Systems (HTAWS).
2. The proposal seeks comments on requirements for less sophisticated digital flight data recorders (DFDR) dubbed lightweight aircraft recording systems (LARS).

3. Conduct operations under Part 135, including flight crew time limitation and rest requirements, when medical personnel are on board.
4. Establish operations control centers if they are certificate holders with 10 or more helicopter air ambulances.
5. Institute preflight risk analysis programs.
6. Conduct safety briefings for medical personnel.
7. Amend their operational requirements to include Visual Flight Rules (VFR) weather minimums, Instrument Flight Rules (IFR) operations at airports/heliports without weather reporting, procedures for VFR approaches, and VFR flight planning.
8. Ensure their pilots in command hold an instrument rating.

The FAA proposal did not take in consideration of all of the recommendations that the NTSB has advocated for years (ie, night vision goggles, autopilots). Furthermore, the proposal did not mandate the installation of flight data recorders on helicopter air ambulances. Cost and weight were factors in excluding these items. Future crash data will dictate whether these items will be in forthcoming FAA recommendations.

Transport Safety: Challenges, Innovation, and Future Direction

Safety is an extremely important yet complex issue in the patient transport environment, given the added dimension of providing emergency acute care, usually to a recumbent patient, while transport is underway in a nonuniform automotive vehicle. This occurs in a setting of fairly limited transport safety research data and rudimentary safety guidelines. It also has been the case that the world of state-of-the-art automotive safety research and development has been slow to embrace patient transport environments, and vice versa, although those bridges are now being built and defined.

The ground transport environment, although hazardous because of its very nature, includes predictable and preventable occupant risks, particularly to the occupants of the rear compartment, which has been clearly demonstrated in safety crash test and epidemiology studies. Much of the sparse epidemiology and engineering literature has been published recently—however, it is now clear that application of even basic automotive safety principles is well overdue in ground patient transport vehicles. Crashworthiness in ground vehicle design, both interior structure and exterior structure; use of appropriate restraints (with monitoring) and safe placement for all occupants and equipment; and ergonomically and biomechanically appropriate interior designs with protective padding and the use of safety "intelligent transportation system" technologies are key to the safety of the occupants in patient transport vehicles. Intelligent transportation system technologies include hazard warning devices, vehicle stabilizing technologies, and crash prevention devices, to mention a few. An excellent overview of ergonomics and safety is described by Ferreira and Hignett,[5] highlighting the importance of this science to the field of patient transport and the limited available research data. Safety benefits have been demonstrated in the patient transport environment with the use of monitoring and feedback devices to augment driver safety performance (black boxes with audible real-time feedback) and in studies addressing personal protective equipment, including helmets and noise cancelling headsets with communication devices for ground vehicle personnel.

Oversight of safety, particularly in ground transport, has some substantive challenges. Although the FAA is required to investigate aviation EMS crashes, there is not a similar mandate for ground transport, with ground transport vehicles essentially exempt from Federal Motor Vehicle Safety Standards. Even capturing data on ground transport safety and adverse events can be difficult. The 2006 American Society of Safety Engineers and American National Standards Institute Fleet Vehicle Safety Standard ASSE/ANSI Z15.1 provides a valuable model for the development and design of ground vehicle safety oversight.[6] The purpose of this standard is to provide organizations with a document for the development of policies, procedures, and management processes to control risks associated with the operation of vehicles. This standard sets forth practices for the safe operation of vehicles owned or operated by organizations, and the scope of the standard specifically includes emergency vehicles. Each of the sections covered in the Z15 standard—management, leadership and administration, operational environment, driver and vehicle considerations, and incident reporting and analysis—provide clear structure relevant to the development of a comprehensive vehicle safety program. It should prove to be a useful tool to optimize the safety of the system.

Dissemination, acceptance, and implementation of best practices can be challenging in the rapidly changing, developing, and competitive area of transport medicine. The importance of including a focus on safety, when initial training is conducted and with continuing education, cannot be overstated. It is important to ensure that the material provided is accurate and reliable, ideally from appropriate peer-reviewed medical and/or engineering publications or from experts in the field who have relevant experience and evidence-based information. Automotive safety is a science, and the laws of physics prevail. Web-based portals for patient transport safety information are available (eg, www.objectivesafety.net) and are useful resources for the rapid dissemination of peer-reviewed and state-of-the-art safety information. User caution is advised with public access portals to ensure that the information is reliable, accurate, and objective.

It is important to continue to advance the field of patient transport safety and to reevaluate the design of transport vehicles and practice policies with multidisciplinary teams, including EMS providers, automotive engineers, ergonomists, and public health researchers. Restraint techniques that have been demonstrated in engineering safety testing to enhance patient transport safety should be used. Injury-mitigating interventions that have been demonstrated to be safe need to be included in the specifications for ambulance vehicles. Personal protective equipment options during transport should be presented to EMS providers in training courses. Standards specific for ambulance vehicle occupant safety need to be developed and supported by ambulance safety testing designed to simulate the real-life setting and practice. Technologies that have been demonstrated to be effective, such as high-visibility clothing, head protection, and black box monitoring and feedback devices, should be encouraged for all patient transport services.

General Considerations

Cabin Space

Space is limited in transport vehicles. Although vehicles come in different sizes, shapes, and configurations, the available patient care area in the transport environment is more limited than in the hospital setting. In choosing a vehicle to support a transport program or to perform a particular transport, several space considerations should be assessed. It is important to determine the number of patients and transport team members that can be transported at one time, the medical configuration, and the amount and type of medical equipment that can be carried. Many vehicles, especially helicopters, are capable of transporting only 1 patient, whereas other vehicles may accommodate 2. The cabin space may be so cramped that the optimal number and type of personnel may be unable to accompany the patient, and assessment and procedures are limited because of restricted access to the patient.

An important issue related to cabin space is the consideration for family members accompanying a neonate or child during transport. Parental presence often is beneficial when transporting an anxious child (see Chapter 12: Family-Centered Care). In the tight confines of some vehicles, this may not be possible or recommended. Increased size, however, will increase the cost of purchase and operation as well as compromise comfort and efficiencies. For example, the larger box ambulance with a longer wheel base provides ample space; however, it often suffers the consequences of having a rougher ride for the patient and crew.

Medical Configuration

Most states have regulations that establish the minimum medical equipment required for ground transport vehicles. Some state regulations also address medical configuration, whereas the FAA regulates how built-in equipment must be installed and secured in aircraft. Adherence to local and federal regulations is required for ground and air ambulances. The design of the medical interior is usually left to the owners and/or operators of the vehicles and the transport personnel who use them.

Medical configuration goes beyond the location of equipment and the number and location of patient litters and seats for transport team members. Easy access to the vehicle's patient care area is critical and must be addressed. Doors must be wide enough to accommodate a transport incubator or patient litter (gurney) with all attached medical equipment. Two personnel should be able to maneuver the equipment easily into and out of the vehicle without excessive rotation or tilt from the horizontal plane. A hydraulic lift device on a ground ambulance is helpful for reducing lifting injuries. Adequate access to the patient while seat belted in place in the transport vehicle is essential, and easy access to the patient's airway and visualization of the patient's upper torso must be possible at all times.

The medical configuration must be designed with the safety of the patient and transport team in mind. Equipment should never be installed in proximity to a person's head. During a crash or severe turbulence, the head strike area must remain clear to avoid a head injury. This is true for air and ground ambulances. In addition, the transport team members, patient, and all equipment must be secured during any vehicle movement. Unsecured or improperly secured equipment may become projectiles during a crash or a sudden extreme movement of the vehicle, possibly resulting in significant injury to the transport team members, the patient, or the pilot or driver, with potentially devastating consequences. All equipment and supplies must be secured, and all responsible personnel must be properly instructed in procedures to secure all on board.

Because medical equipment undergoes the same stressors of transport as vehicles, patients and transport personnel (ie, vibration, gravitational forces, thermal stress), they do not have the expected lifetime usage as compared with similar equipment used in a hospital unit setting. If not secured properly in an ambulance, medical devices can become projectile objects and become damaged. Care must be taken when transferring a patient to and from a gurney or loading or unloading from an ambulance, because medical devices can become damaged by falling off the gurney or being struck by a door. Therefore, transport medical devices should be maintained on a daily basis. Daily checks, such as battery check and calibration of defibrillators, monitors, point of care devices, intravenous pumps, and ventilators, ensure that the equipment does not fail during transport. If a device is found to be faulty, it should be taken to the institution's biomedical engineering department or sent to the device manufacturer for repair or replacement.

Oxygen and Air

All patient transport vehicles should have built-in and portable gas sources with the ability to provide oxygen in concentrations from 21% to 100%. Sufficient medical gas must be carried to meet the estimated duration of the longest anticipated trip, with a recommended reserve of approximately 2 times the trip length. Vehicles that may transport 2 patients should have separate medical gas supply systems for each patient. Portable medical gas tanks should be available to back up the built-in system and to safely accomplish the transfer between the vehicle and facility or between vehicles.

Suction

Suction capability is essential in the transport environment. Built-in suction is generally recommended, with a portable system for backup. The suction should be regulated with a maximum of –300 mm Hg achievable as needed. As with the medical gas, vehicles that will transport 2 patients should have duplicate suction capabilities.

Medical Equipment

Most medical equipment used during transport should be portable to allow the equipment to go with the patient, bedside to bedside. This also eliminates the need for the primary monitors, ventilators, infusion pumps, and other devices to be built into the vehicle. However, it may be prudent to have equipment built into the vehicle or as portable devices as backups in case of battery power loss or equipment failure. If possible, rotation of the devices between the patient bedside and the ambulance allows efficient charging and use. Regardless of the number of devices used, it is necessary to configure the vehicle to properly secure all equipment.

Supply Cabinets

Whenever possible, adequate cabinet space should be built into a vehicle for the storage of routine and necessary supplies during transport. Cabinets for these on-board supplies should be easily accessible to the transport team members from a seat-belted position. The cabinets should be closed and secured during transport. Interior vehicle configurations and certain equipment may vary; however, they are subject to safety policies mandated by local or state regulations.

Electrical Outlets, Power Inverters, and Demand Inverters

Although portable medical equipment usually is supported by battery reserve, it is often preferable to conserve battery life during transport. The transport vehicle should provide an alternating current inverter and electrical outlets in sufficient numbers for the equipment used. Many vehicles also are equipped with a "shore line," allowing portable equipment to be plugged into outlets in the vehicle so that the batteries can charge while the air or ground ambulance is stationary between transports.

Cabin Lighting

Adequate cabin lighting, allowing continuous assessment of the patient and necessary treatment en route, is essential. The lighting should be adjustable to meet the needs of each transport situation. Patient care compartments should have illumination to 400 lux, with high-intensity directional lighting of 1000 to 1500 lux available for procedures. In addition, barriers should be available to protect the driver or pilot from the bright patient cabin light that could interfere with night vision.

Climate Control

Patient transport has the potential to expose the vehicle, patient, and transport team members to significant temperature variation, which may result in clinical and operational complications. This is true for ground and air transport with regard to seasonal and geographic considerations. Flying at higher altitudes also results in significant temperature changes.

Neonatal and pediatric patients have large surface/mass ratios and, therefore, can become hypothermic or hyperthermic rapidly. For the transport team members, marked deviation from the normal comfort zone may result in impaired performance. Therefore, the environment of the patient cabin should be easily controlled and monitored.

The 9th *Edition Accreditation Standards* of the Commission on Accreditation of Medical Transport Systems (CAMTS) stipulate that the interior of an ambulance or aircraft must be climate controlled to prevent adverse effects on patients and transport personnel on board. A thermometer must be mounted inside the cabin to measure and document cabin temperatures every 15 minutes during the patient leg of the transport. Transport programs are now required to have written policies that address measures to be taken to avoid adverse effects of temperature extremes. Furthermore, cabin temperatures <50°F or >95°F will require transport programs to record these events and undergo a quality-management process to evaluate the measures taken to avoid the adverse effects and what outcomes resulted.

Communications Equipment

Every transport vehicle should be equipped with adequate communication equipment. At a minimum, the transport team members in the vehicle should be able to contact the communications center or base of operations and medical control. In addition, aircraft crew members must be able to talk to the FAA control tower personnel and personnel in other aircraft. Cellular phones are, however, prohibited by the FAA and the Federal Communications Commission in airborne aircraft because of potential interference of aircraft navigational aids, especially those on the ground that send radio signals to planes to help pilots stay on course. Satellite phones, however, are FAA approved, do not interfere with avionic equipment, and have an extensive coverage area that is larger than most commercial cellular systems.

It is advantageous to have multiple communication modalities in ambulances. In ground ambulances, cellular phone technology is permitted. Ground ambulances are often equipped with 2-way radios having very high frequency (VHF) and/or ultrahigh frequency (UHF) capabilities. Therefore, the transport team can contact its base hospital, medical control, or the receiving hospital via the dispatcher of the ambulance vendor. Similar methods can be used with aircraft pilots communicating with their dispatcher or air traffic control. Helmets outfitted with avionics can be used by helicopter transport personnel who can communicate with the pilot, who, in turn, can transfer information to an appropriate recipient. Ideally, specific medical information is relayed directly to the intended recipients and not through a nonmedical intermediary. Communication can also be achieved by other modes such as alphanumeric paging, fax machines, and computer-based programs (ie, wireless Internet).

Speed

In a time-critical situation or when out-of-hospital time must be kept to a minimum, the speed of the transport vehicle may be important. Ground ambulances may be limited to the legal speed limit, and there is little difference between the different types of ambulances with regard to capabilities for speed. The speeds for helicopters and airplanes, however, vary by make and model. Helicopters can fly between 100 and 180 mph, and airplane speeds range between 120 and 450 mph, depending on the manufacturer and model of the aircraft.

Range

The *range* of a vehicle is defined commonly as the total distance it can travel without refueling. Ground ambulances and helicopters often have a functional range between 0 and 150 miles (although it can be farther), whereas airplanes and jets commonly used for medical transport may have a range up to 2000 miles.

Service Area

There is a direct correlation between the anticipated service area of a transport program and the range and speed for the chosen vehicle. Beyond distances of 100 miles, a ground ambulance may become inefficient, costly to operate, and time-consuming. Programs with helicopters generally operate within a radius up to 150 miles from the base of operations, although this may be expanded in some programs with refueling or long-range capabilities, whereas programs with airplanes may be regional, cross-country, or international.

Costs

Financial considerations are addressed in Chapter 15; however, a few points deserve emphasis in this chapter. The cost varies greatly based on the type of vehicle chosen and whether the vehicle is dedicated to patient transport and/or to only 1 transport team. The helicopter is the most expensive (cost per mile) vehicle for transportation from the operational standpoint and with regard to patient charges. Airplane transport also may be costly but becomes more economical for greater distances.

It also is likely that a dedicated vehicle will be more expensive than a vehicle that can be used on an as-needed basis. A dedicated vehicle may or may not be feasible for a particular transport service. If it is impractical for a neonatal-pediatric transport team to have its own dedicated vehicle, involvement of other transport teams to share the vehicle and the high costs involved in its operation and upkeep may be necessary. If a dedicated vehicle cannot be justified, it is recommended that the team select one or more vehicle operators who can provide the appropriate vehicle(s) for use within an established timeframe.

Ground Ambulances

Ground ambulances are the primary means of prehospital patient transport and the most common vehicle used for interfacility transport. As with selection of any vehicle for neonatal-pediatric transport, consideration of the potential advantages and disadvantages of the mode of transport is important.

Ground vehicles offer many advantages over air ambulances. More ground ambulances are routinely available to serve a given geographic area.

Although the scope of services (critical care, advanced life support, and basic life support) and availability of ground ambulances may be limited in many rural areas, urban and suburban areas usually have large numbers of ground vehicles in their service areas. If an ambulance breaks down, other ambulances are likely to be available for backup. Parts and maintenance also are more readily available, so that a disabled ambulance can be back in service without extensive delays. Diesel fuel or gasoline also is more readily available than aviation fuel.

The ground ambulance can operate in weather conditions that often restrict safe air operations. Thus, transport team members determining the mode of transport will have a reliable vehicle that should be readily available in a wide range of weather situations.

The transport environment of the ground ambulance may be more user-friendly and functional for the transport team than other vehicles. The cabin usually is larger than cabins in aircraft, and many vehicles are able to accommodate 2 to 4 transport team members and 1 or 2 patients, depending on the configuration of the vehicle. There also are fewer restrictions to the size, weight, and amount of equipment that can be taken on a ground transport. Unlike aircraft, especially helicopters, there usually are not significant weight issues in ground transport for the amount of equipment that can be carried or the location of the equipment during transport. Another advantage is that the transport team can easily "pull over" and interrupt a transport in an emergency situation to facilitate patient assessment and intervention. If necessary, the ground ambulance also can be easily diverted to the closest hospital if the patient's condition deteriorates or supplies have been exhausted.

Ground ambulances provide door-to-door service, with no need for a helipad, landing zone, or runway. The patient or incubator is secured on the stretcher, which is then secured in the ambulance for transport directly to the receiving facility. The patient does not need to be moved from vehicle to vehicle. Keeping transfers between vehicles to a minimum is always desirable.

Many health care professionals believe that it is easier to educate personnel for ground transport than to educate them for air-medical transport. Medical personnel can be oriented more quickly to ground safety procedures and to the location and proper use of supplies and equipment. However, medical personnel unfamiliar with the world of "mobile medicine" may still find this environment most challenging.

In times when cost, use, and reimbursement are important issues, the ground ambulance remains the most affordable vehicle to operate. The approximate cost of a medically configured ground ambulance is $150 000 to $350 000, depending on the manufacturer and model selected. The annual maintenance and fuel costs might range from $10 000 to $25 000 per vehicle. Costs vary depending on annual use of the vehicle. Compared with the costs for helicopters and airplanes, the ground ambulance costs considerably less to operate, purchase or lease, maintain, and insure.

There are 3 basic types of ground ambulances. A type I ambulance is a modular or box-type unit mounted on a conventional cab and chassis. Unless specifically modified, a passageway does not connect the crew and patient compartments. Type II is a standard van in which the body and cab are continuous. A type III ground ambulance is a larger modular-type vehicle with a walk-through between the cab and the patient compartment.

A decision about the type of ground ambulance for a transport system should be based on numerous factors. Most important are safety, expected patient population, and the maximum number of transport team members and patients to be transported at one time. In addition, it is important to consider the amount, type, and size of medical equipment that will be taken on transport.

Although there are many advantages to the ground ambulance, there also are limitations. Ground vehicles have a high potential for a rough ride because of the type of vehicle suspension, narrow wheel base, high center of gravity, and bad roads. The bouncing and vibration may be painful or potentially detrimental to certain patients, including those with vertebral fractures and other orthopedic injuries as well as the neonate with potential for intraventricular hemorrhage.

Another common problem is the possibility of motion sickness for the patient, family member, and transport team members. This usually is a result of various factors, including a confined space, poor ventilation, sideways seating, poor road conditions, a lack of visual references (the horizon), and a loss of orientation to the direction of travel. The smell of gasoline or diesel fuel may be an aggravating factor for people experiencing motion sickness. Medication to prevent or alleviate motion sickness may be beneficial. Transport team members should, however, be concerned about the potential adverse effects of any medication taken, especially drowsiness. Optimal vehicle ventilation, visual fixation on a distant object, and other nonpharmaceutical approaches have proved helpful.

In any mode of the transport, vehicle configuration should ensure the safety of not only the patient but also the transport team personnel. This is especially important in ground ambulances because of recent data showing that an increasing number of fatalities in ground ambulance crashes occur in the occupants in the rear of the ambulance. If possible, transport team leaders should meet with ground ambulance vendors to build an ambulance to the specifications of the team. Size and layout of the ambulance will depend on the transport team's personnel, discipline of practice and number of transports performed. The traditional box ambulance has its advantage of being large, allowing transport personnel to move about to tend to the needs of the patient; however, this is also a detriment, because a team member may have to unbuckle seat belts and safety restraints to move closer to a patient. The typical box ambulance configuration has a side-facing bench seat. Ambulance crash studies looking at frontal impacts have shown that even with safety restraints, a rear compartment occupant in a side-facing bench or seat can experience more significant forces more than an occupant sitting in a frontward- or rearward-facing seat. These serious forces can result in serious neck injuries and possibly death as a result of the head continuing to move laterally as the occupant's body is belted in place.

This risk of rear occupant hazards has brought about a new philosophy looking at smaller ambulances, such as the Mercedes Sprinter. Being more economically affordable and fuel efficient, these ambulances can be ergonomically configured so that medical providers can reach for equipment and tend to a patient without having to unbuckle restraints and move around. This ambulance unit, used in Australia and by 1 ground ambulance provider in the United States, has front-facing seats that are tested to 20 *g* and can only be swiveled to the side and folded up when not in use. Furthermore, by reducing cabinets and obstructions in head strike zones and minimizing the chance of ballistic projectiles in an ambulance crash, this ambulance design can eliminate potential devastating injuries.

Ground ambulances have significant time, distance, and access constraints. They may be unable to proceed into remote or restricted areas. Their speed is limited, and traffic congestion, construction zones, detours, inclement weather (eg, rain, floods, fog, ice, and snow), and inaccessible terrain can delay or halt ground transport. With lengthy trips or long distances and prolonged out-of-hospital times, there may be a greater risk of patient complications and fatigue of the transport team members. When the number of ground ambulances is limited, the dispatch of one unit on a distant transport may cause other areas to be underserved temporarily.

Ground ambulances should have a well-defined and well-documented vehicle maintenance plan to prevent a vehicle failure during the transport of a critically ill patient. Ambulance manufactures typically provide recommendations for service intervals either in miles or in time (usually months). For example, checks of the lights, signals, warning systems fluids levels, tire pressure, wipers, brake pedal travel, air condition and heating systems and monitoring of the engine condition should be done on a daily basis. Oil and filter changes, checks of the suspension, engine belts, alternator tire and break wear and battery load should occur at 3000-mile intervals. At the 6000-mile mark, the suspension, differential, fuel filter, brake rotors, and brake pads should be inspected. Replacement of the belts, fuel filters, air filters, and transmission fluid should be performed at the 9000-mile service checkup.

Because ambulances undergo more vehicle operational wear and tear than a standard truck or utility van, a more aggressive preventative maintenance plan should be used. Detailed maintenance histories and monitoring can identify vehicle component or system failures after a particular time of usage. Parts can be replaced prior to the time onset rather than waiting for a break down during an emergency transport. Furthermore, the maintenance needs will depend on the ambulance service area: an ambulance operation that services a mountainous area will have very different issues than one that operates in the desert.

Overall, although ground ambulances have their limitations, they remain the dominant vehicle in patient transport and often the preference for critical care transport.

Helicopter Air Ambulances

Helicopters have a definite role in patient transport, but they are not the single solution to all patient transfers. Like any other vehicle, their strengths and weaknesses must be considered carefully when making a selection.

Generally speaking, when one thinks of a medical helicopter, it usually is synonymous with experienced transport team members who provide advanced medical skills using specialized medical equipment. The vehicle itself, however, provides significant advantages over other modes of patient travel.

Helicopters provide rapid transport at speeds of 120 to 180 mph, depending on the type of helicopter, weather, altitude, and weight load. Traveling via medical helicopter often equates to a transport time of one third to one fourth that required for an equivalent distance by ground transport, making the helicopter very beneficial when time is critical. The service area of helicopter programs usually is up to 150 miles from the base of operations; most helicopters are able to cover this distance in 1 to 1½ hours.

The speed of travel is only one unique capability of the helicopter. The helicopter does not need a runway to land; it requires only a relatively small, flat area (100 × 100 ft) that is clear of obstructions. The helicopter has the ability to avoid common traffic delays and ground obstacles and can fly into locations that are inaccessible to other modes of travel. This may be beneficial when roads become impassable because of traffic, flooding, snowstorms, tornadoes, or other disasters. Like the ground ambulance, the helicopter has the ability to go door-to-door when there are on-site helipads or landing areas at the referring and receiving facilities.

Although helicopters have distinct advantages as patient transfer vehicles, they also have inherent disadvantages. The limitations of helicopter transport may vary with the type of helicopter considered for use. In many helicopters, the patient cabin may be considerably smaller than the cabin in ground ambulances. In small and medium-sized helicopters, cramped patient compartments and weight limitations may be disadvantages for optimal patient care. In larger helicopters, access to patients may be limited after they have been loaded into the aircraft.

Weight and balance are extremely important considerations for every helicopter flight, regardless of the size of the aircraft. Every helicopter has a maximum lift capability, from which a useful payload can be calculated. The combined weight of the pilots, transport team members, patient(s), and equipment must be considered. High ambient temperatures and high humidity reduce the useful load that a helicopter can carry. Commonly in these conditions, pilots may choose to carry less fuel (thereby, decreasing their range) to maintain an adequate payload for each medical mission. Larger helicopters may have fewer restrictions, but the same principles apply.

Landing zone requirements for helicopters are a disadvantage compared with ground ambulances, but they offer an advantage over the airport requirements of fixed-wing aircraft. If a helipad is not readily available, the time needed to prepare or access the landing zone may diminish the helicopter's advantage of speed.

Weather considerations can significantly limit the availability of helicopter transport. These conditions include low-lying clouds (decreased ceiling), limited visibility (eg, fog, sleet, heavy snowfall, and heavy rain), high winds, lightning, and high ambient temperatures that create "density altitude" conditions. Most helicopter programs operate under visual flight rules (VFRs), but travel under instrument flight rules (IFRs) is becoming more common. Additional recurrent pilot training and specialized aviation equipment are necessary for IFR missions, which may make this option costly. However, in some areas where poor visibility and low ceilings cause a significant number of missed flights, IFRs may be an important consideration. The majority of IFR flights are airport to airport, but global positioning system technology is making possible IFR medical missions direct to a medical facility helipad. IFR flights are subject to Federal Aviation Regulations (FARs). A pilot cannot initiate an instrument approach procedure to a designated landing zone unless the airport has a weather reporting facility operated by the US National Weather Service or a source approved by the US National Weather Service and the latest weather report issued by the weather reporting facility indicates that weather conditions are at or above the authorized IFR landing minimums for that airport. Interference and distraction from noise, vibration, and turbulence usually are more severe in helicopters than in other forms of transportation. Helmets or headsets should be worn by the transport team members, and a headset can be given to awake patients to facilitate communications in flight and/or protect hearing (earplugs can be used for small infants). Altitude and flight physiology can be factors affecting helicopter transport, as noted in Chapter 11.

Transport by helicopter is significantly more expensive than travel by ground. The costs related to purchasing or operating a helicopter indicates why dedicated helicopters may be cost-prohibitive to many transport programs. In addition, the recurrent controversy surrounding the use of twin- or single-engine aircraft goes beyond cost. Although twin-engine helicopters are more expensive, they have an inherently larger safety margin than their single-engine counterparts. Further discussion on this complicated issue is beyond the scope of this chapter.

Helicopters have been described as a "thousand precision parts flying in close formation," because they are extremely maintenance-intensive machines. They are more expensive per hour to operate and maintain than fixed-wing aircraft. As complex machines, helicopters have many sophisticated parts that are highly stressed and operating at high rate of speed. As per FAA and aircraft engineers, helicopter providers must schedule periods of downtime during which helicopter equipment is checked and repaired. This amount of scheduled downtime that is necessary for proper maintenance needs to be stipulated. Maintenance and overhaul of the parts are based on "cycles." FAR 1.1 describes a "helicopter cycle" as take off to landing. An "engine cycle" is counted when the engine is started. Engines as well as rotational components such as tail rotor blades, main rotor blades, drive shaft bearing, and thrust links are tracked by total time. Cycles are counted to predict part attrition and to manage maintenance. When a part reaches its life limit, it is either removed or overhauled. Many helicopter components are destroyed and not used again. These components must be meticulously tracked over their lifetime. Helicopter providers must maintain their helicopters in an airworthy condition consistent with all service bulletins provided by the helicopter manufacturer. The provider should also require that the FAA maintain the helicopter in keeping with airworthiness directives issued.

The purchase price of a medically equipped single-engine helicopter (eg, Eurocopter A-Star [European Aeronautic, Defense and Space Company Germany, Spain, France, USA] or Bell 407, Textron, USA) averages approximately $2 million. A light twin-engine helicopter (eg, Eurocopter EC 135 or Twin Star 355) may cost twice as much. The new Eurocopter EC145 and Bell 430, both medium-sized, twin-engine helicopters, cost between $4 and $7 million, and a large twin-engine helicopter, such as the Eurocopter Dauphin 365N-2, the Bell 412, or the Sikorsky SR76, costs approximately $1 to $3 million more. Of course, these prices are only for the helicopter and do not include other aviation-related expenses. Pilot salaries range from $90 000 to $125 000 annually; a staff of 4 is required to cover 1 helicopter 24 hours, 7 days a week. If the helicopter is IFR-capable, the pilot salary budget can double because of the need for 2 pilots for IFR missions. Financial concerns include fixed and variable (hourly) costs. Fixed costs include insurance, taxes, pilot and transport team member costs, overhead, interest, hangar fees, and capital equipment. These costs are irrespective of the number of hours the helicopter has flown and vary with the type of helicopter. Variable (hourly) costs or direct operating costs vary directly with the number of hours flown. These costs include fuel and oil, scheduled maintenance labor, unscheduled maintenance labor, engine overhaul, airframe overhaul, and airframe items with a limited life span.

Looking only at the aviation-related expenses for a leased medical helicopter (eg, aircraft lease, pilots, mechanics, flight time, and fuel), the annual operating expense typically starts at more than $1 million for a single-engine helicopter and increases to almost $2 million for a large twin-engine helicopter.

Fixed-Wing Air Ambulances (Airplanes)

Fixed-wing aircraft travel at greater speed, cover a greater service area, and offer several other advantages over the ground ambulance and the helicopter. The patient cabin often is larger than the cabin in helicopters. Many airplanes can transport 2 patients and allow room for 2 or more transport team members or additional family members, although the transport of 2 critically ill patients may result in space limitations. Each patient may require individual transport teams, monitors, and other medical equipment. Weight restriction, weather, noise, vibration, and turbulence are less of a factor with fixed-wing travel than with helicopter travel. Airplanes have the ability to fly above or around inclement weather conditions on long-distance transports. The cost per mile for long-distance, fixed-wing transport is often less than for helicopter transport. As a general rule, for transports more than approximately 150 miles, programs should consider the use of an airplane or jet rather than a helicopter.

Certain makes and models of airplanes have the capability to provide a pressurized cabin, which helps combat the effects of altitude on the physiologic functions and provides for a safer and more comfortable transport environment. Smaller fixed-wing aircraft typically are not pressurized and are limited to flying at lower altitudes. Pressurized aircraft, flying at actual altitudes of 30 000 to 40 000 feet usually can simulate a cabin altitude of 7000 to 8000 feet (or even lower, although this feature is not often used because of effects on efficiency and cost). When transporting patients with significant respiratory compromise and for whom altitude-related hypoxia is a concern, it may be beneficial to fly at lower altitudes, allowing cabin pressure to approach that of sea level.

The greatest limitation to the use of fixed-wing aircraft is the necessity to land at an airport, which may be distant from the referral and/or receiving facilities. The length of the runway needed depends on the type of aircraft used. Generally speaking, jets require longer runways than propeller airplanes. Also, with fixed-wing transports, patients require multiple transfers—from facility to ambulance and ambulance to airplane. Stresses of flight, discussed in Chapter 11, are of significant relevance when flying at altitudes above 8000 feet and are especially important with pressurized aircraft that may fly at an altitude of 30 000 to 40 000 feet. Although a pressurized cabin is extremely beneficial, a loss of cabin pressure at altitude can be very hazardous.

Although most ground ambulances and medical helicopters are dedicated and properly designed for patient transport, the same is not always true with airplanes. There is a potential that fixed-wing "ambulance" providers (or any type of ambulance provider) promote their patient transport capabilities in what could be considered a less than ideal medical transport environment. The patient litter, oxygen tanks, and medical equipment may not be secured properly. The medical gas and electrical systems may be inadequate for long transports. Before using any fixed-wing provider, carefully inspect the airplane and the medical configuration to be certain that the emphasis is on safety and appropriate medical capabilities and that appropriate FAA certifications have been received. Professional air-medical organizations, such as the Association of Air Medical Services and the Commission on Accreditation of Medical Transport Systems, also can provide service information.

Similar to helicopters, fixed-wing aircraft also have interval maintenance schedules set forth by the aircraft manufacturer and the FAA. A properly maintained aircraft is a safe aircraft; therefore, the preservation, inspection, overhaul and repair of the aircraft, including replacement of parts, ensure that the aircraft remains airworthy throughout its operational life. Although maintenance requirements vary for different types of airplanes, some inspection is required at least once every 12 calendar months, whereas inspection is required for others after each 100 hours of operation. This depends on the kind of operation, climatic conditions, storage facilities, age, and construction of the aircraft. An airplane can also be inspected on the basis of calendar time, time in service, number of system operations, or any combination of these. An FAA-certificated airframe and power mechanic holding an Inspection Authorization, an FAA-certificated repair station that is appropriately rated, or the aircraft manufacturer must render inspection and repair services.

The cost of operating fixed-wing aircraft can be substantially higher than that of operating a ground ambulance but often less than a helicopter program. Fixed-wing vendors may use their aircraft for nonmedical transports. This business venture defrays some operational costs (see “Vehicle Operations”) of the plane. On the other hand, aircraft availability may be limited when the plane is on a business flight and an urgent fixed-wing transport is pending. The transition of the interior of a plane to a medically configured format may also delay transport; thus, delivery of urgent medical care is compromised.

The purchase price of new fixed-wing aircraft may be prohibitive for a particular transport team or hospital system budget. Used fixed-wing aircraft prices are more reasonable. These prices can range from $3 million for a Beechcraft King Air turboprop (Raytheon, Kansas) to $12 million for a Learjet (Bombardier Aerospace USA, Canada, Ireland). General estimates of annual aviation expenses include pilot and copilot salaries (approximately $60 000 each), hangar fees ($24 000), insurance ($28 000), training ($20 000), and computerized maintenance ($10 000). Total direct operation costs can vary depending on the number of hours of flight annually. For example, a Lear 36 jet with 200 annual hours of flight time will have direct operating costs at approximately $200 000; at 400 annual hours, approximately $400 000; and at 600 annual hours, approximately $600 000. However, because of these operational constraints, the airplane is not practical for transports of less than 150 miles, unless traveling to an island or similarly isolated area.

Vehicle Operations

Various options are available for neonatal-pediatric transport teams to obtain the vehicle of choice. A hospital can decide to operate the entire medical ambulance program independently. The vehicle(s) can be purchased or leased, and the personnel (pilots, drivers, and mechanics) can work directly for the base facility (usually a hospital). The base facility is then financially and legally responsible for compliance with all state and federal regulations. This option places all the financial and legal risk on the base facility, and expenses and liabilities are less predictable than with other options. If the transport program is well managed, the base facility can save a significant amount of money, but if poorly managed, the endeavor can be very costly.

Another option is for the base facility to enter into a contractual agreement for the entire air or ground operation. The contract operator usually will assist the base facility with vehicle selection and medical configuration. The entire operation (vehicle maintenance, backup vehicle, nonmedical personnel, and regulatory compliance) becomes the responsibility of the operator, and all of the base facility's costs are determined by the contract. This option is often the most expensive, but the financial and legal risk belongs to the operator. Under this option, annual expenses are much more predictable.

The base facility may select another option—buy or lease the vehicle(s) and have an operator manage the entire operation. The base facility gains the benefit of owning or leasing and retains a purchased vehicle if operators are changed.

A fourth option is for a transport team to enter into agreements with other air and/or ground ambulance services that then transport the neonatal-pediatric transport team when a transport request is received. Depending on the volume of transports, this option may be the most cost-effective and is the practice of many helicopter and airplane programs that make their aircraft available to several transport teams.

Any contract between a base facility and an operator or an agreement between a transport team and an outside transport service should address several important issues. A commitment to safety must be evident, and the safety record should be reviewed carefully. The qualifications, experience, training, and licensure of the pilots, drivers, and mechanics must be known. Vehicle specifications and capabilities should be discussed, and there should be a plan for backup when maintenance is required on the vehicle or when personnel are on vacation. Vehicles should be dedicated and configured specifically for the needs of the transport team. Availability (ie, 24 hours per day, 7 days a week, except when the vehicle is already on a transport) and response times (ie, within 30 minutes of the contact call) should be defined. Provision of liability limits and insurance verification data for all transport vehicles and vehicle operators should be mandated.

Future Technologies

The transport vehicle is an unstable environment as patients are at risk of further injury and/or decompensation. Therefore, the transport setting should be situated in a critical care setting as close as possible to an inpatient critical care unit. An emergent technology that has been advancing rapidly to aid this is the use of telemedicine in the monitoring and treatment of transported patients. Telemedicine allows physicians to help with the care of a patient in a facility in a remote region. On arrival at such a facility, the transport team can send live data and video via video conferencing equipment through cellular communications or satellite technology to a receiving physician to help in the management of the patient. Moreover, the ambulance unit can also be considered a "remote facility." Real time data and video can be streamed to the physician specialist who can give medical advice to transport team personnel on the care of the transport patient. Future research and pilot projects should be conducted to determine the benefits of real-time patient data on transported patients.

A nice complement to telemedicine is the implementation of electronic health records (EHRs). Compared with paper records, an EHR system is a speedy and efficient means to maintain critical medical information. Paper records can be bulky and cumbersome and can take up costly space. An EHR provides immediate access to key information, especially during a serious emergency situation. Other significant advantages EHR have over paper records include improved legibility, accuracy, and completeness. In the transport environment, this is important, because legibility in a vibrating ambulance can be compromised. Radiologic images and other diagnostic tools all create an electronic image or information; therefore, an EHR system is an idea tool to store and transport of this information in one place. As with any transport equipment, EHR devices should be small, portable, and user friendly. Advancing technology will allow EHR functionality be available on smart devices, such as tablets and smart phones.

Summary

Transport of neonatal and pediatric patients requires appropriate planning, personnel, medical equipment, and vehicle selection. Many types of helicopters, airplanes, and ground vehicles are available for transporting patients, and no single vehicle will be ideal for all patient transports or all transport teams. Rather, it is essential to determine the appropriate mode of transport (air or ground vehicle) based on the mission profile of the neonatal-pediatric transport team and the unique needs of each patient.

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CHAPTER 11

Transport Physiology and Stresses of Transport

Outline

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Medical transport of neonatal and pediatric patients provides many unique challenges. Perhaps nothing is more demanding than trying to provide optimal critical care in the poorly controlled confines of a mobile environment during air and ground medical transport. This is especially true with respect to considerations related to altitude and flight physiology.

The prevalence of medical helicopters and airplanes within pediatric health care delivery systems makes it more likely for children to be transported longer distances more quickly for evaluation and treatment of critical illnesses and injuries. Therefore, an in-depth understanding of flight physiology is essential for the transport team to provide optimal patient care in the aeromedical setting. This objective is intensified, because the normal physiological responses to a changing altitude are further complicated when transporting an already compromised child or infant The patient, the flight crew, the transport team members, and some medical equipment may be affected by the changes in the partial pressures of gases at altitudes above sea level.

Altitude physiology and the stresses of flight may have their greatest impact during fixed-wing transport; however, helicopter transport is not immune from these stresses. An understanding and knowledge of many of these same stresses is also beneficial for transport personnel who use ground ambulances. With this in mind, we are no longer dealing only with *altitude* or *flight* physiology. More appropriately, the topic might be referred to as "*transport* physiology and the stresses of *transport*."

Background

Before directing our attention toward the *stresses of transport*, it is necessary to have the background knowledge pertaining to the atmosphere, physical gas laws, and cabin altitude. A general understanding of these 3 topics will help illustrate how the human body responds to the atmospheric changes and begins to explain the various stresses of flight.

The Atmosphere

The atmosphere is composed of various gases. To an altitude of approximately 70 000 ft, these gases exist in a uniform percentage. Nitrogen constitutes the largest percentage (78.08%), followed by oxygen (20.95%). Argon, carbon dioxide, hydrogen, neon, and helium, all in very small percentages, represent the remaining gases in the atmosphere.

The atmosphere can be characterized by the *physiologic zones* that predict the effects of altitude on the human body. Many of these predictable effects are based on atmospheric properties that can be observed at any given altitude. Atmospheric pressure, or barometric pressure, is the force or weight exerted by the atmosphere at any given point. Temperature and volume changes will also be observed at the varying altitudes. Table 11.1 summarizes altitude-related properties.

There are 4 physiologic zones that compose the earth's atmosphere. These zones are characterized by the pressure changes that take place within the altitude boundaries and their physiologic effects on the human body.

The *physiologic zone,* or the *efficient zone,* extends from sea level to approximately 12 000 ft. Within this zone, the barometric pressure decreases from 760 to 483 mm Hg. This is the most acceptable zone for normal physiologic functioning, unless a person acclimatizes to a higher altitude or supplemental oxygen is used. With prolonged exposure, only minor problems may occur, especially if the person continues to ascend, exerts himself or herself, or stays too long at the higher altitude. The majority of private aviation occurs within this zone.

A dramatic drop in barometric pressure and temperature is seen in the *physiologic deficient zone.* From 12 000 to 50 000 ft, the barometric pressure drops from 483 to 87 mm Hg. Normal physiologic function is seriously impaired at the upper limits of this zone if there is no appropriate intervention. Most commercial aviation occurs in this zone.

The *partial space equivalent zone* and the *total space equivalent zone* represent the final 2 physiologic zones of the atmosphere. The partial space equivalent zone extends from 50 000 ft to 120 miles, where a pressurized environment is mandatory to compensate for the barometric changes that

Table 11.1: Altitude-Related Effects in the Earth's Atmosphere

Altitude (feet)	Barometric Pressure, torr (mm Hg)	Temperature °C	Temperature °F	Gas Expansion Ratio
0	760	15.0	59.0	1.0
2000	706	11.0	51.8	1.1
5000	632	5.1	41.2	1.2
8000	565	-0.9	30.4	1.3
10 000	523	-4.8	3.4	1.5
15 000	429	-14.7	5.5	1.8
18 000	380	-20.7	-5.2	2.0
20 000	349	-24.6	-12.3	2.4
25 000	282	-34.5	-30.1	2.7
30 000	228	-44.4	-47.9	3.3
40 000	141	-56.5	-69.7	5.4
50 000	87	-56.5	-69.7	8.7

can affect the body. Beyond 120 miles above sea level is the total space equivalent zone, where weightlessness occurs in "true space."

Physical Gas Laws

Boyle's Law

Boyle's law relates to the expansion of gases in the earth's atmosphere. It states that the volume of a given gas varies inversely as its pressure. The formula for Boyle's law is as follows:

$$\mathbf{P_1V_1=P_2V_2}$$

P_1 equals the initial barometric pressure; V_1, the initial volume of gas; P_2, the final barometric pressure; and V_2, the final volume of the enclosed gas.

As an aircraft ascends, the ambient (surrounding) barometric pressure decreases and, according to Boyle's law, the volume of gas within an enclosed space expands (Table 11.1). As the aircraft descends, the reverse is true.

Gas expansion ratios can be calculated for different altitudes. The amount of gas expansion will be relatively small (10%–15%) at the altitudes that helicopters usually fly (up to a few thousand feet above ground level, except in mountainous regions). At 8000 ft above sea level, the gas expansion will be 30%. This altitude is an important consideration for unpressurized aircraft and also represents the effective cabin altitude for many pressurized aircraft flying at 35 000 to 40 000 ft.

Boyle's law can affect any medical equipment or body cavity that has an enclosed air space. Intravenous flow rates, the pressure in air splints, and endotracheal tube cuff expansion can be altered. One recent study demonstrated that endotracheal tube cuff pressures can be affected significantly at altitudes as low as 1000 to 2000 ft in helicopters. Body cavities that can be affected include the stomach, intestines, middle ear, sinuses, and a closed pneumothorax. Other potential areas of involvement include the intracranial space and brain (pneumocephalus), bowel wall (pneumatosis), the abdominal cavity (pneumoperitoneum), and skin (subcutaneous emphysema). The respiratory rate and volume of gas exchange may be affected.

Dalton's Law

Dalton's law of partial pressure describes the pressure exerted by gases at various altitudes, stating that the total pressure of a gas mixture is the sum of the individual or partial pressures of all the gases in the mixture. Mathematically, Dalton's law can be represented by the following equation:

$$P_t = P_1 + P_2 + P_3 \ldots Pn$$

P_t is equal to the total pressure, and P_1, P_2, and so forth represent the partial pressure of each gas in the mixture containing "n" gases (Table 11.2).

Table 11.2: Partial Pressure of Gases in the Earth's Atmosphere

Gas	Percentage Within the Atmosphere	Partial Pressure (torr)			
		at Sea Level	at 2000 ft	at 5000 ft	at 10 000 ft
Nitrogen	78%	593	551	493	408
Oxygen	21%	160	148	133	110
Other gases	1%	7	7	6	5
Total in the atmosphere	100%	760	706	632	523

Within a mixture of gases, each gas exerts a pressure equal to its own percentage of the total gaseous concentration. At sea level, where the total barometric pressure is 760 mm Hg, the percentage of oxygen is equal to 20.95%. The partial pressure of oxygen (PO_2) at sea level can be calculated as follows:

$$PO_2 = 20.95\% \times 760 \text{ mm Hg} = 159.22 \text{ mm Hg}$$

From sea level to 70 000 ft, the relative percentage of each gas within the atmosphere remains constant. As the altitude increases and the total barometric pressure decreases, the partial pressure of the gaseous components decreases, exerting less pressure. At an altitude of 10 000 ft, the atmospheric pressure is 523 mm Hg. The percentage of oxygen remains 20.95%, but the PO_2 will decrease as follows (Table 11.3):

$$PO_2 = 20.95\% \times 523 \text{ mm Hg} = 109.57 \text{ mm Hg}$$

Table 11.3: Effects of Altitude on Oxygenation

Altitude (ft)	Barometric Pressure (mm Hg)	PO_2 (mm Hg)	PAO_2 (mm Hg)	PaO_2 (mm Hg)	$PaCO_2$ (mm Hg)	Oxygen Saturation (%)
Sea level	760	159.2	103.0	95	40.0	98
2000	706	148.0	93.8	86	39.0	97
5000	632	132.5	81.0	73	37.4	95
8000	565	118.4	68.9	61	36.0	93
10 000	523	109.6	61.2	53	35.0	87
15 000	429	89.9	45.0	37	32.0	84
18 000	380	79.6	37.8	30	30.4	72
20 000	349	73.1	34.3	26	29.4	66
22 000	321	67.2	32.8	25	28.4	60

*PO_2 indicates partial pressure of ambient oxygen; PAO_2, partial pressure of alveolar oxygen; PaO_2, partial pressure of arterial oxygen; and $PaCO_2$, partial pressure of arterial carbon dioxide.

PaO_2 varies with underlying pathophysiology and, therefore, may require periodic or continuous monitoring. Almost all neonates have pulmonary systemic shunts of varying magnitudes. Therefore, the data in the column labeled PaO_2 should be considered an approximation only. The data are presented for illustrative purposes. The actual equation is as follows:

$$\textbf{A-a }(O_2) = (FIO_2\%/100) \times (P_{atm} - 47 \text{ mm Hg}) - (PaCO_2/0.8) - (PaO_2)$$

A-a (O_2) is the difference between the alveolar (A) and arterial (a) oxygen; FIO_2, the fraction of inspired oxygen; P_{atm} is the barometric pressure in mm Hg; and 47 mm Hg at 37°C represents the partial pressure of water at body temperature. Because carbon dioxide displaces oxygen in the alveoli, the estimated alveolar carbon dioxide must be subtracted. The alveolar carbon dioxide is estimated by dividing the arterial $PaCO_2$ by a "respiratory quotient fudge factor" of 0.8. Some authorities prefer to multiply the $PaCO_2$ by a respiratory quotient fudge factor of 1.25. The net result is the same.

Henry's Law

Henry's law is another important gas law affecting air medical transport and explains the solubility of gases within a liquid. According to this law, the amount of gas dissolved in a liquid is determined by the partial pressure and the solubility of the gas. With a significant change in barometric pressure, nitrogen gas bubbles can form in the blood. The *bends,* a type of decompression sickness, is a clinical condition exemplifying this law.

There is no specific altitude threshold to predict a clinical response to Henry's law and the probability of developing a decompression sickness. However, there is evidence of altitude decompression sickness occurring in healthy people at altitudes below 18 000 ft who have recently been scuba (self-contained underwater breathing apparatus) diving. Exposure to altitudes between 18 000 and 25 000 ft has shown a low occurrence of a decompression sickness, and most cases occur among people exposed to altitudes of 25 000 ft or higher. The higher the altitude of exposure, the greater the risk of developing decompression illness.

Cabin Altitude

The first protection against the influences of a changing altitude is the creation of an artificial atmosphere or *cabin altitude*. In a pressurized fixed-wing aircraft, compressed air is pumped into the cabin to maintain a cabin altitude significantly less than the flight altitude. The cabin altitude that can be maintained in various ambient altitudes varies with aircraft. Of note, helicopters are unpressurized and, therefore, cannot create an artificial atmosphere. Therefore, these vehicles offer nothing to prevent the effects of a changing altitude, because the cabin altitude will be the same as the actual flight altitude.

Although airplane travel is clearly affected by flight physiology and the stresses of flight, helicopter transport is also susceptible. It is often thought that flying at altitudes only above 8000 ft affects the patient, transport team, or flight crew, but this is not always the case. According to Boyle's law, team or flight crew members or patients flying with sinus problems, ear problems, or upper respiratory infections may feel the effects of barometric pressure changes with as little as a 1000- to 2000-ft change in altitude.

Smaller, unpressurized airplanes and helicopters are equally ineffective in combating the effects of the gas laws and, therefore, are generally limited to altitudes less than 10 000 ft. Pressurized fixed-wing aircraft, however, can fly higher while counteracting the negative effects of altitude. At flight altitudes of 30 000 to 40 000 ft, environmentally modified (pressurized) aircraft can often create an internal cabin altitude of 5000 to 8000 feet above sea level. This corresponds to an interior cabin pressure equal to approximately 3/4 atm (565 mm Hg), which also prevents pressurized airplanes from expanding and contracting too much as they change altitude. Although pressurization of the cabin can help to alleviate the risk of hypoxia, it is important to realize that most fixed-wing cabins are pressurized to approximately 7000 ft; in reality, this is still a high-altitude environment. By flying at lower altitudes, high-differential cabin-pressure aircraft have the ability to create a cabin pressure that simulates pressures at ground altitude. This may be beneficial when transporting a patient with a decompression illness.

Up to 25% of people who rapidly ascend to an altitude of 8000 ft (cabin altitude of 8000 ft or actual attitude of 8000 ft in an unpressurized aircraft) will become symptomatic. Nearly everyone abruptly exposed to an altitude of 12 000 ft will have symptoms commonly referred to as *altitude sickness.*

A malfunction of the pressurization equipment or aircraft structural damage (ie, cracked window or foreign object strike) may result in a loss of cabin pressure or *decompression.* When this happens, the pilot will attempt to rapidly descend to a lower altitude. The transport team must be prepared to deal with the effects of decompression, which will depend on several factors: total cabin volume, size of the structural defect in the hull, flight altitude, and the pressure differential between the flight altitude and the cabin altitude.

During a *rapid decompression,* objects move toward the structural defect and will be affected by the gravitational forces of a rapid descent. At the same time, there is a sudden decrease in the cabin temperature. This causes the aircraft to fill with fog because of moisture condensation in the expanding cabin atmosphere. This fog may be mistaken for smoke in the cabin. Hearing becomes impaired secondary to noise and to effects of the rapid decompression on the middle ear. The most important clinical consequence of rapid decompression at high altitude is a rapid drop in the cabin PO_2, which can quickly lead to hypoxia in the flight crew, transport team, and patient. Supplemental oxygen for the pilot, transport team members, and patient is essential, and the window of time for effectiveness of this intervention can be very short before unconsciousness ensues. A loss of cabin pressurization may result in a variety of decompression illnesses as gas dissolved in the blood is released. Another clinically significant event is the rapid expansion of air within an enclosed space. If decompression occurs, all catheters, chest tubes, and nasogastric tubes should be unclamped (Table 11.4).

Table 11.4: Prevention of Complications During Air Transport of Neonatal and Pediatric Patients

Gas Expansion

1. Insert orogastric or nasogastric tubes open to air in every infant and child who may experience gastrointestinal symptoms or may be at risk for vomiting.
2. If a cuffed endotracheal or tracheostomy tube is in place, carefully monitor cuff pressure or consider replacement of air with water to prevent expansion of the cuff with altitude changes.
3. Ensure that chest tubes, endotracheal tubes, and other artificial vents are patent.
4. Suction airway well before and during transport, as needed.
5. Reevaluate frequently for presence of extrapulmonary air.
   a. Carry a portable transillumination device (for neonates).
   b. Have a needle thoracentesis set available.
6. Request that, if possible, the pilot fly at a lower altitude or increase the cabin pressurization (to simulate a lower altitude) when transporting a patient with trapped gas (eg, pneumothorax, pneumoperitoneum, or bowel obstruction).

Decreased PO_2

1. Before leaving the referring hospital:
   a. Ensure that the child is optimally oxygenated
   b. Correlate arterial PO_2 and CO_2 measurements with cutaneous pulse oximetry and end-tidal CO_2 ($ETCO_2$) (in-line or nasal) and/or blood gas values by using point-of-care testing.
   c. Check placement and stabilization of the endotracheal tube.
2. En route:
   a. Use a cutaneous oxygen saturation monitor for all patients requiring oxygen or assisted ventilation (along with frequent careful assessment of the color of skin and mucous membranes).
   b. Increase FIO_2 as needed to maintain adequate oxygenation saturation.
   c. The oxygen adjustment equation can be used to calculate the FIO_2 required at any cabin altitude or destination altitude as follows:

$$\frac{(FIO_2 \cdot BP1)}{BP2} = FIO_2 \text{ Required}$$

where FIO_2 is the fraction of inspired oxygen the patient is receiving; BP1, the current barometric pressure; and BP_2, the destination or altitude barometric pressure.

Stresses of Flight and Transport

Two types of stresses are associated with the transport environment and air medical transport: the stresses of flight and self-imposed stresses. These stresses are *cumulative* and may lead to significant emotional and physiologic compromise. Many of these stresses also affect ground transport. Therefore, even neonatal-pediatric transport teams that never participate in helicopter or fixed-wing transport will benefit from a basic knowledge of the stresses.

Several authors and organizations have identified various stresses of flight: barometric pressure, hypoxia, noise, vibration, thermal changes, decreased humidity, dehydration, gravitational forces, fluid leakage out of intravascular spaces (third spacing), fatigue, spatial disorientation, flicker vertigo, and exposure to fuel vapors and exhaust. Patients, transport team members, and pilots may all be affected by the stresses of flight. Vibration, noise, and turbulence are generally more severe in helicopters than in other forms of transportation. The stresses that may have the greatest effect on ground transport are noise, vibration, temperature, gravitational forces, and fatigue.

Any significant altitude change exposes the patient, pilots, and transport team members to additional physiologic stresses. There are 3 major factors that influence the incidence, onset, and severity of complications that can be experienced during air transport: rate of ascent (or descent), the altitude achieved, and the length of stay at that altitude. Varying severity of complications occurs when any of these factors or a combination of them exceeds a person's ability to adapt to the new environment.

Infants and young children have many anatomical and physiological differences which make their responses to illness and stresses different from adults and are at greater risk for the development of many altitude-related illnesses. This is especially true for neonates and infants in the first 12 months of life. Many of these differences may result in an increased tendency to ventilation-perfusion mismatch making neonates and young children more susceptible to hypoxemia. For children, the severity of symptoms will decrease with increasing age; however, it is essential to watch for the onset of symptoms during all neonatal-pediatric transports.

Barometric Pressure

The effects of changing altitude during air medical transport may be related directly to physical gas laws. The effect of barometric pressure changes can affect the transport team, patient, and equipment in many ways.

There are 3 mechanisms by which barometric pressure affects the body. The first follows Boyle's law, dealing with gas within an enclosed space and changes in ambient pressure. If air is unable to escape, positive pressure develops that may result in a rupture or the compression of adjacent structures. The second mechanism follows Henry's law, when gas dissolved in blood is released. The third mechanism applies to barometric changes in an underwater environment (ie, scuba diving) and addresses abnormal tissue concentrations of various gases.

In the setting of eustachian tube dysfunction, disturbances of the middle ear (ie, barotitis media) may result from barometric pressure changes. As altitude increases, gas expands in the middle ear behind the tympanic membrane. As altitude decreases, the gas within the middle ear contracts, pulling the tympanic membrane inward. Gas usually will pass through the eustachian tube (actively or passively), allowing for equalization of pressures; air escapes as expansion occurs on ascent, or air enters the middle ear on descent. However, if a person has allergies, an upper respiratory infection, or sinus problems or is a small infant, the eustachian tube may be obstructed and equalization may be restricted. Children with adenoidal hypertrophy and recurrent otitis media are at a greater risk of failure to equilibrate pressures in the middle ear. Middle ears that are filled entirely with fluid are less likely to cause symptoms than those ears with an air-fluid interface.

Encouraging a small infant to suck a pacifier or older children to swallow, drink liquids, and use the Valsalva maneuver during ascent and descent helps to maintain patency of the small eustachian tubes and to prevent pain. Nasal decongestants may also be helpful to prevent symptoms when used 1 to 2 hours before takeoff and 30 minutes before descent. If the patient is paralyzed, equalization of pressure requires active assistance during descent.

Normally, air can pass easily in and out through the air-filled sinus cavities. If a person has an upper respiratory or sinus infection, swelling of the mucous membrane lining may result. This trapped air expands as altitude increases, causing barosinusitis. Symptoms include severe sinus pain and epistaxis.

Special attention should be given to patients with suspected or documented pneumothorax. It is optimal that pneumothorax be diagnosed and treated before transport, because pneumothorax is prone to further expansion at higher altitudes.

The stomach and the intestines normally contain a variable amount of gas (up to 1000 mL in an adult) at a pressure approximately equivalent to the surrounding atmospheric pressure. The stomach and large intestine contain considerably more gas than does the small intestine. On ascent, symptoms of bloating may develop. At 18 000 ft, the volume of gas in an enclosed expandable space will double, but symptoms usually do not become severe until an altitude of 25 000 ft, when the volume of gas triples. Crying children and infants who are feeding tend to swallow a substantial amount of air. In addition, eating large meals, ingesting a large amount of a carbonated beverage, chewing gum (and swallowing air), and preexisting gastrointestinal problems may also increase the volume of gas in the intestines. As gas expansion occurs, a person may experience discomfort, nausea, vomiting, shortness of breath, and hyperventilation.

Changes in atmospheric pressure may affect any medical equipment with air enclosed in a given space. Endotracheal tube balloons should be evaluated to prevent rupture or excessive pressure on the tracheal wall during ascent and for an inadequate air seal on descent. Replacing the air in the endotracheal tube cuff with water eliminates this potential complication during air medical transport. The air in intravenous containers expands on ascent, resulting in an increased flow of the intravenous fluid. On descent, the flow of the intravenous fluid slows when the air volume is decreased. Pneumatic splints and pneumatic anti-shock garments (also known as MAST) also may be affected by pressure changes, resulting in hypotension on descent or distal circulation compromise during ascent. Ventilators not tested for use in the flight environment can also malfunction because of pressure changes.

Henry's law predicts that gases will move from an area of higher concentration to that of lower concentration. Clinically, a drop in barometric pressure may result in the release of gas dissolved in blood. When a scuba diver ascends too quickly, nitrogen gas bubbles can form in the blood. Special precautions should be taken for decompression victims who must be transported by helicopter. In some cases, even a minimal altitude increase can cause significant gas bubble formation. It is advised that patients with a decompression illness be transported at an altitude of not greater than 1000 ft above the diver's ascent site in nonpressurized aircraft.

Hypoxia

During air medical transport, the most threatening aspect of hypoxia is its insidious onset. The transport team may be involved in patient care activities and may not notice the early onset of signs or symptoms in the patient or in themselves.

Serious effects of altitude hypoxia do not usually develop until atmospheric pressure drops to between 10 000 to 12 000 ft. No one is exempt from the effects of hypoxia, although the onset and severity of symptoms may vary among individuals. Some people may tolerate a few thousand feet more altitude than others. However, all patients, pilots, and transport team members will begin to experience symptoms of hypoxia if exposed to a high enough altitude.

The results of available research suggest that no significant risk is associated with air medical transport of a pregnant woman and her fetus. The arterial partial pressure of oxygen in the fetus is significantly lower than that of the mother. A healthy fetus at sea level has arterial oxygenation (PaO_2) of 32 mm Hg in the umbilical arterial circulation, whereas the PaO_2 of the mother will be approximately 100 mm Hg. At an altitude of 8000 ft, the PaO_2 of the mother will drop to 64 mm Hg, corresponding to an oxygen saturation of approximately 90%; the fetal PaO_2 will drop only from 32 to 25.6 mm Hg. In addition to the lower PaO_2 in the fetus, the oxygen dissociation curve for fetal hemoglobin differs from that for mature hemoglobin. Consequently, fetal hemoglobin is more fully saturated at a lower PaO_2 than is the hemoglobin of the mother.

Neonates, especially preterm neonates, are more likely than adults to develop hypoxia as the partial pressure of alveolar oxygen falls during ascent. Although the usual alveolar-arterial oxygen difference in adults is approximately 10 mm Hg, the difference in neonates is much larger (approximately 25 mm Hg). Therefore, a modest drop in partial pressure of alveolar oxygen will result in hypoxia in neonates.

Many factors may influence an individual's susceptibility to hypoxia. Children and other patients with low tidal volumes and increased oxygen consumption are less able to respond to the hypoxic insult and, therefore, are more prone to the development of related complications. Many pediatric medical illnesses are exacerbated at altitude, including pneumonia, acute asthma, pneumothorax, shock, and blood loss. Numerous social factors also have an important role in susceptibility. Physical activity, physical fitness, metabolic rate, diet, nutrition, emotions, and fatigue influence the response to hypoxia. A physically fit person normally will have a higher tolerance to altitude-related problems, although an acute increase in physical activity will raise the body's demand for oxygen and cause more rapid onset of symptoms. A person's metabolic rate will increase with exposure to temperature extremes, increasing oxygen requirements and, therefore, reducing the hypoxic threshold.

Although altitude-related hypoxia in patients is a concern, the routine use of pulse oximetry and supplemental oxygen minimizes this hazard. In the setting of hypoxemia, increasing FIO_2 levels and, in some circumstances, the addition of positive end-expiratory pressure (PEEP) easily compensates for the hypoxic effects of altitude. However, in rare patients already receiving maximal oxygen support, flight at lower altitudes may allow the artificial cabin pressure to approach that of sea level, resulting in an increase in the partial pressure of oxygen and maintaining an acceptable PO_2.

Hypoxia is also a concern for pilots and transport team members, who generally are not monitored. During air medical transport at high altitudes, it may be advantageous to check oxygen saturation values of the pilots and transport team members. In addition, the Federal Aviation Administration (FAA) has specific regulations addressing the use of oxygen. Federal Aviation Regulations (FARs) require pilots to use supplemental oxygen if they are flying at cabin altitudes above 10 000 ft for more than 30 minutes and at all times when above 12 000 ft. At cabin pressure altitudes above 15 000 ft, each occupant of the aircraft must use supplemental oxygen.

Noise

Noise and vibration may represent the most difficult and troublesome stresses encountered in the air and ground transport environments. Excessive noise may interfere directly with patient care.

During transport, it may be impossible to accurately auscultate the lungs or blood pressure. As a result, the transport team must rely on other means to monitor and assess patient condition. Close observation for alteration in the patient's respiratory rate, chest expansion, level of consciousness, discomfort, and abdominal distention may detect a possible change in the patient's condition. Blood pressure can be monitored by using invasive or noninvasive devices. Pulse oximetry provides valuable information about the patient's oxygenation and respiratory status, and carbon dioxide detectors or monitors are helpful when assessing tracheal tube position and patency.

As with many of the stresses of flight, there is individual variation in tolerance and effect of noise. The longer the exposure and the more intense the noise, the greater the potential damage.

Prolonged and intense exposure to noise may generate discomfort, headaches, fatigue, nausea, visual disturbances, vertigo, temporary or permanent ear damage, and deterioration in performance of tasks. During aircraft operation, hearing protection (ie, ear plugs, headsets, or helmets) should be worn by the flight crew, transport team, and patient.

Vibration

Vibration is inherent to all transport vehicles and may interfere with patient assessment and some routine physiologic functions. In general, helicopters produce more stress from vibration and noise than fixed-wing aircraft. The most common sources of vibration during air medical transport are the aircraft engines and air turbulence. During helicopter transport, vibration is most severe during transition to a hover or during turbulent weather conditions. In fixed-wing transport, vibration increases during high-speed, low-level flight and during cloud penetration in turbulent weather. In ground ambulances, poor road conditions, tight vehicle suspensions, narrow wheelbases, and high centers of gravity predispose to rough and unstable rides that may be detrimental or excessively painful to patients with spinal cord injury, intracerebral hemorrhage, and orthopedic injuries.

Exposure to moderate vibration results in a slight increase in metabolic rate and can cause fatigue, shortness of breath, motion sickness, chest pain, and abdominal pain. Vibration from the aircraft also may interfere with normal body thermoregulation and with the operation of some invasive and noninvasive electronic patient monitoring equipment.

Little can be done by pilots or flight crew members to eliminate or decrease the amount of vibration in the aircraft. This also is true of the ambulance drivers and ground transport personnel in ground vehicles. To minimize the effects of vibration, efforts should be made to avoid or reduce direct contact with the vehicle's frame. Padding should be placed on any part of the frame that may come in contact with people on board. Adequate padding in the form of cushioned seats and stretcher pads should be used. Direct contact with the bulkhead of the vehicle should be avoided by placing blankets or other cushions appropriately. Patients and transport team members should be properly restrained at all times to minimize the effects of vibration. In ground transport vehicles, careful attention also should be given to correct loads, tire pressures, appropriate shock absorbers, and overall vehicle maintenance.

Thermal Considerations

During helicopter, fixed-wing, and ground transports, the patient and transport team may be exposed to a significant temperature variation that may result in clinical and operational complications. These temperature changes may be attributable to inherent seasonal changes, geographic factors, and altitude variation.

Exposure to extremes in temperature can result in increased metabolic rate, oxygen demand and consumption. This may further compromise an already hypoxic patient. Prolonged exposure also can result in motion sickness, headache, disorientation, fatigue, discomfort, irritability, impaired performance, and reduced ability to cope with other stresses, such as hypoxia.

Many factors can exacerbate or mitigate exposure to temperature variation, such as air circulation, duration of exposure, condition and type of clothing, and physical condition. Whenever possible, the transport team should take steps to prevent potential complications related to thermal stress. The cabin should be kept at a comfortable temperature, minimizing exposure to ambient environmental extremes. To prevent hypothermia, appropriate layers of clothing or blankets should be used to limit heat loss. In addition, wet clothing or moist dressings should be removed. Prolonged exposure to high temperatures may require increased oral or intravenous fluids to prevent dehydration. The use of increased ventilation, cool water mist, or moist dressings may be of benefit.

Regardless of which medical transport vehicle is used, it is recommended that the transport team members be "dressed for the weather." In the summer, it may be appropriate for transport team members to undertake a transport wearing scrubs and a short, nonflowing hospital lab coat, as long as these articles can be safely worn in that environment. As the temperatures get colder, however, this would not be adequate, because team members should be prepared for prolonged, unexpected exposure to the elements in case of an accident, vehicle breakdown, remote location, or change in environmental controls. In the winter, appropriate attire includes a winter coat, gloves, hat, appropriate footwear, and layered clothing.

Humidity and Dehydration

As altitude increases and the air cools, the amount of moisture in the air drops significantly. Therefore, a pressurized aircraft that draws its fresh air from the outside dry atmosphere results in a pressurized cabin with an extremely low humidity level, and dehydration becomes another concern. In addition, dry medical oxygen will further predispose the patient to dehydration.

The decrease in humidity is particularly important as it relates to patient airway secretions. Dried airway secretions can lead to airway obstruction, atelectasis, and hypoxemia. Providing humidified medical oxygen helps to prevent airway obstruction attributable to dried secretions.

To prevent dehydration, fluid intake (oral or intravenous) should be monitored carefully, and all patients should receive humidified medical oxygen. These recommendations are especially important during long transports.

Gravitational Forces

During routine flight operations, gravitational forces (*g*-forces) will not significantly affect the patient, pilots, or transport team. However, an understanding of the relevance of gravitational forces to positioning of the transport team and patient within the aircraft and to their safety and survival is needed. One "*g*" represents the force that a person exerts when seated and is a result of gravitational force imposed on the body. Gravitational forces are applied to the body during ascent and descent and during a change in speed or direction.

During any sudden or excessive change in direction or speed, a person or object is subjected to the effects of gravitational forces. During deceleration of an air or ground vehicle, an unrestrained or improperly restrained person in a forward-facing seat may be injured or ejected from the seat. In contrast, a rear-facing seat may provide better restraint during crash deceleration.

In theory, patient positioning within the aircraft may enhance or minimize the effect of gravitational forces during takeoff (acceleration) and landing (deceleration). For patients with cardiac disease, myocardial perfusion is improved during acceleration by positioning the patient with the head toward the back (aft) of the aircraft. As negative gravitational forces increase, pooling of blood occurs in the upper part of the body. In head-injured patients or patients with fluid overload, augmentation of positive gravitational forces, which would pool blood in the lower extremities, may be desirable. This is accomplished by positioning the patient with the head toward the front (fore) of the aircraft. In a head-injured patient, positioning the head toward the front of the aircraft may reduce the risk of a transient increase in intracranial pressure during takeoff.

Fluid Dynamics

Long-distance or high-altitude air medical transport may precipitate third spacing of fluid. A decrease in barometric pressure may cause this leakage that also may be aggravated by temperature extremes, vibration, and gravitational forces. Signs and symptoms include edema, dehydration, increased heart rate, and decreased blood pressure.

Other stresses of flight or preexisting medical problems, such as preexisting capillary leak, cardiac conditions, and nephrotic disease, may aggravate the onset and complications of third spacing.

Fatigue

Although fatigue is considered a stress of transport, it also may be considered an end-product of the other contributing factors that make up the stresses of flight and the self-imposed stresses. Hypoxia, gravitational forces, barometric changes, and dehydration all contribute to fatigue that may compromise both the crew and patient. By understanding the elements that cause and contribute to fatigue, the team member may be able to mitigate the effect of this stressor.

Fatigue is a state or condition that follows a period of excessive mental or physical activity or inactivity. The emotional and physical stress of prolonged patient care in the transport environment may result in fatigue and it is important to minimize the factors that can contribute to fatigue, especially the self-imposed stresses, which should be within their direct control.

Self-Imposed Stress

A transport team member's self-imposed stresses can greatly influence physiologic performance during medical transport. Most of these stresses may be applicable to the flight crew and transport team members; their application to pediatric patients may be limited. However, a clear understanding of these stresses is important to be able to provide optimal patient care.

Self-imposed stresses may greatly influence physiologic response during air or ground medical transport. Therefore, having a clear understanding of these factors is important for optimal transport safety and patient care. The acronym "DEATH" may be helpful to remember the components: **d**rugs, **e**xhaustion (fatigue), **a**lcohol, **t**obacco, and **h**ypoglycemia (diet/dehydration). However, another way to approach the self-imposed stresses is by way of a personal evaluation. The FAA Advisory Circular on Aeronautical Decision Making suggests that pilots "preflight" *themselves* as carefully as they preflight their aircraft to assess their physical and emotional readiness to fly. Each member of the medical team should undertake the same process as a way to evaluate his or her self-imposed stresses and to determine whether *"I'm safe."* The letters in "I'm safe" correspond to: **i**llness, **m**edication, **s**tress, **a**lcohol, **f**atigue, and **e**ating. This simple personal checklist (Table 11.5) contains all of the elements common to impaired performance and can easily be committed to memory by each team member.

Table 11.5: "I'm Safe" Checklist

Illness	Do I have any symptoms?
Medication	Am I taking prescription or over-the-counter medications that could impair my performance?
Stress	Am I experiencing any signs and symptoms of stress? Do I feel hurried or stressed by any work, home or personal situations? Are there any specifics about this transport that may result in a stressful situation?
Alcohol	Have I had any alcohol within the past 8 hours? Within 24 hours?
Fatigue	Am I adequately rested?
Eating	Have I eaten enough to keep adequately nourished and hydrated during the entire flight?

Illness

The best rule is not to fly when ill, but this is not always possible. As part of the "I'm safe" checklist, each crewmember should ask, "Do I have any symptoms?" An acute or chronic illness can easily impair a pilot or team member. Even minor illnesses can seriously impair performance. In December 2000, a medical helicopter crashed after the pilot became incapacitated from nausea and collapsed on the cyclic during the final approach to landing.

Fever, headache, malaise, pain, or other distracting symptoms may get in the way of judgment, memory, alertness, and ability to concentrate. Any illness that is serious enough to require medication may also be serious enough to consider not flying (or doing ground transports). Respiratory infections, seasonal allergies, sinus problems, pharyngitis, ear problems, or gastrointestinal tract distress may be exacerbated during flight by the changes in atmospheric pressures and altitude.

Medication

Prescription and nonprescription medications and the medical conditions for which they are taken may interfere with performance, perception, decision making, and motor skills. Transport team members must be aware of the adverse effects, overdose reactions, allergic responses, and synergistic effects of medications they are taking.

Although there are known potential adverse effects of medications, every individual may respond differently to the same medication. If a label warns of adverse effects, team members should consider waiting twice the recommended interval to be certain that they are "safe." An obvious consideration is to avoid taking any new medication while on duty or before a transport.

FAA regulations prohibit pilots from performing crewmember duties while using any medication that may adversely affect their faculties and impact safety. Considering the important safety role the medical team plays, common sense would dictate the same approach for the entire transport team.

Stress

The effects of stress are often difficult to recognize. It is this inability to recognize stress that may be hazardous in aviation and during transport.

Failure to manage stress often leads to eroded judgment, errors in decision making, decreased work performance, inattention, degraded communication skills, preoccupation, and complacency. Other common signs and symptoms of stress include anxiety, irritability, impulsiveness, aggressiveness, emotional or physical isolation, problems concentrating, and difficulty remembering important things. An individual may also experience diarrhea, indigestion, frequent urination, headaches, grinding teeth, cold sweats, increased smoking or overeating, and alcohol or drug use or abuse.

Top stress producers include emotionally upsetting events, the death of a family member or close friend, a separation or divorce, the loss of a job, or financial problems. However, in transport medicine, daily events may result in varying stressors to the pilot and medical team. Encountering bad weather, night operations, scene transports, performing an instrument approach in poor conditions, flying in high density traffic area, flying in a back-up aircraft, and flying in unfamiliar areas are all examples of potential stressors. Equipment malfunctions, the critical nature of the patient, and interpersonal conflicts with other team members may also result in stress for the pilot and medical crew. The other elements of "I'm safe" (illness, medication, alcohol, fatigue, and eating), if present, will also play a significant role in individual stress.

The best treatment for undue stress is prevention. It is better to avoid getting into situations that are likely to overwhelm the team's ability to cope. This is not always possible, because stressors often come from outside sources that may be beyond an individual's control.

Alcohol

The effects of alcohol ingestion are increased by altitude. Ingesting one alcoholic beverage at 10 000 ft is equivalent to ingesting 2 or 3 times as much at sea level. Similarly, the effects of tobacco are magnified during flight. The carbon monoxide by-product of smoking at sea level may result in mild hypoxia similar to that seen at an altitude of 8000 ft. This may occur with smoking as few as 3 cigarettes in rapid succession.

FAR 91.17 regulates the use of alcohol and drugs by pilots. Among other provisions, this regulation states that no person may act or attempt to act as a crewmember of an aircraft within 8 hours after the consumption of any alcoholic beverage, while under the influence of alcohol, with a blood alcohol content of 0.04% or greater, or while using any drug that adversely affects the person's faculties in any way contrary to safety.

Because of variation in individual metabolism of alcohol, an excellent rule to follow is to allow at least 12 to 24 hours between "bottle and throttle" for pilots as well as medical team members.

Fatigue

Fatigue is one of the most treacherous hazards to flight safety and patient care. All transport team members, aircraft pilots, and vehicle drivers should avoid exhaustion and fatigue to prevent errors in judgment, poor attention span, and decreased work capacity and performance.

Concerns and controversy regarding fatigue in health care providers has received a great deal of attention in recent years and also was a concern for aircraft pilots and teams that use resident physicians. As a result, pilots are regulated by the FAA with regard to maximum duty hours. FAR Part 135 requires a pilot to have a minimum of 10 hours of uninterrupted rest within every 24-hour period. "On-call" time, when the pilot is required to carry and respond to a pager, is counted as "duty time" and cannot be included in the minimum 10 hours of required rest. Similarly, in July 2003, the Accreditation Council for Graduate Medical Education (ACGME) developed work limits for resident physicians and fellows. ACGME revisions effective July 2011 limit resident physicians to a maximum of 80 hours per week (averaged over a 4-week period) and 24 hours on duty at a time for postgraduate year-2 residents and above. Residents are required to have a minimum 8 hours off between scheduled duty periods, at least 14 hours free of duty after 24 hours of in-house duty, and 1 day off every week. The ACGME also encourages residents to use alertness management strategies and to utilize strategic napping, especially after 16 hours of continuous duty and between the hours of 10:00 pm and 8:00 am.

Unfortunately, the medical transport community remains divided regarding duty time and fatigue, and there are no uniformly accepted work rules. Many dedicated teams routinely work 24-hour shifts, and some team members may work several jobs or shifts back to back. Systems should be in place to audit duty time and to ensure the availability of backup personnel in case of fatigue.

Eating

A properly balanced diet and adequate hydration represent the final self-imposed stress and element to ensure that "I'm Safe." An inadequate or improper diet can result in nausea, headache, lightheadedness, dizziness, errors in judgment, and loss of consciousness. Precautions should be taken to avoid the development of hypoglycemia and dehydration.

Conclusion

Transport-related stresses create a significant challenge to personnel providing medical care to critically ill or injured children or neonates. An in-depth knowledge of flight physiology, stresses of flight, and self-imposed stresses enables the transport team to provide optimal patient care in the unique environment. The team must anticipate and prevent potentially serious complications by vigilant monitoring of the patient's condition and the initiation of appropriate treatment.

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CHAPTER 12

Patient- and Family-Centered Care

Outline

- Core concepts in Patient- and Family-Centered Care (PFCC)
- Benefits of PFCC
- Team Safety
- Cultural Sensitivity
- Transition to Inpatient PFCC

Patient- and family-centered care (PFCC) is a philosophy of care that recognizes and respects the pivotal role of both the patient and the family in the delivery of medical care. Visionary leaders in the Maternal and Child Health Bureau (MCHB) began to evolve the concepts of family-centered care in the 1980s, with family-professional partnerships as central to the discussions. The MCHB recognized the critical role that families played in caring for the health of children, particularly families of children with special needs. The MCHB partnered closely with families in developing and defining the concepts of family-centered care. A definition and set of principles for family-centered care were created in 1995 by a team of family leaders and professionals under the guidance of the MCHB (http://www.fv-ncfpp.org/quality-health-care1/family-centered-care). These principles articulated the elements of respectful family-professional partnerships, including the encouragement that as a child grows, he or she assumes a partnership role. The principles of family-centered care are now in the forefront of both child and adult health care discussions. The terms “family-centered care,” “patient-centered care” and PFCC are widely accepted as standards of practice that result in high quality care. PFCC helps providers support families in their natural caregiving roles by building on their unique strengths as individuals and as families. Patients, family members, and professionals are viewed as equal partners committed to excellence at all levels of health care. Patient and family-centered care enhances patient and family satisfaction, while optimizing outcomes. In the intense and emotional environment of transport medicine, the philosophy of PFFC is paramount.

Core Concepts in PFCC[1]

- *Respect and dignity*. Health care providers listen to and honor patient and family perspectives and choices. Patient and family knowledge, values, beliefs, and cultural backgrounds are incorporated into the planning and delivery of care.
- *Information sharing*. Health care providers communicate and share complete and unbiased information with patients and families in ways that are affirming and useful. Patients and families receive timely, complete, and accurate information so they can effectively participate in care and decision making.
- *Participation*. Patients and families are encouraged and supported in participating in care and decision making at the level they choose.
- *Collaboration*. Patients and families are also included on an institution-wide basis. Health care leaders collaborate with patients and families in policy and program development, implementation, and evaluation; in health care facility design; and in professional education, as well as in the delivery of care.

Benefits of PFCC[2]

The American Academy of Pediatrics has identified the following benefits of PFCC:

- A stronger alliance with the family in promoting each child's health and development
- Improved clinical decision making on the basis of better information and collaborative processes
- Improved follow-through when the plan of care is developed collaboratively with families
- Greater understanding of the family's strengths and caregiving capacities
- More efficient and effective use of professional time and health care resources (eg, more care managed at home, decrease in unnecessary hospitalizations and emergency department visits, more effective use of preventive care)
- Improved communication among members of the health care team
- A more competitive position in the health care marketplace

- An enhanced learning environment for future pediatricians and other professionals in training
- A practice environment that enhances professional satisfaction
- Greater child and family satisfaction with their health care

The transport team fulfills a crucial role in the initiation of PFCC for critically ill and injured children. Principles used in the inpatient environment are no different from those used in the transport environment. However, the acuity of the patient condition and the need for rapid mobilization and transport may lead to the parent's separation from the child at a highly vulnerable time. Handing the care of an ill child over to strangers who are taking the child to an unfamiliar destination is likely to create and intensify feelings of helplessness, fear, and loss. For these reasons, parents should be given the opportunity to discuss their child's management with transport team members at the earliest time possible.

Parents need to know that their unique knowledge of their child's history and reactions to illness is valued and will be incorporated into the plan of care. Moreover, the expertise of the parent can be profoundly valuable to the clinical care of the child. For example, parents of chronically ill children may know the best intravenous site for success; parents of an injured child may be able to calm the child by singing a favorite song. It may, in fact, be much easier to care for the child with the parent present. By incorporating the parent, the energy and concern of the parent can be directed to the therapeutic goals and ease the burdens of the child and transport team. Consequently, parents should be assured that they will continue to have access to their child, whenever possible. Of course, it is crucial that they feel that their child is in the care of competent and compassionate staff.

Offering families the option to be present even during the provision of emergency and critical care is a cornerstone of PFCC. Family presence during resuscitation continues to gain widespread support. Many studies have shown that this practice allows families to remain as therapeutic allies in the care of their children, even in the most dire circumstances. In Woodward and Fleegler's[3,4] investigations of family presence in a large transport system at a children's hospital, parents were cooperative and did not create difficulties for transport team members or patients. Furthermore, family presence at attempted resuscitations enabled them to see, first hand, that the team members did their best for their child and also treated the child with respect, dignity, and empathy throughout the process.

Despite literature in support of the benefits, as in the emergency department setting,[5] it should be noted that there still exists some controversy about family presence in other critical settings, including transport. Some of the potential challenges of family presence on transport include: (1) anticipated difficulty caring for the patient, should the parent need attention; (2) difficulty controlling a child with the parent present; (3) general team member anxiety about providing care and performing interventions with a parent watching; and (4) potential trouble dealing with emotional or distraught parents. Transport providers must be knowledgeable about the practice of PFCC and adept in its implementation. By addressing the needs and concerns of the parent, the transport team can work with the parent to keep the child calm; this, in turn, helps relieve any potential parental anxieties.

Team Safety

Although it is nearly always preferable to include the parent on the transport, team safety must also be considered. The above discussion reviews the potential pitfalls of the combative family, but there are other considerations as well. Although parents will certainly want to be as close as possible to their child, all vehicle occupants must wear appropriate restraints. Children should never be transported in a parent's lap or arms.

Parental size may introduce spatial concerns. Parental weight is an important consideration with rotor-wing flights. Maximum flight weights must be strictly respected. The parents must obviously be able to tolerate the mode of travel. Motion sickness or fear of flight would, of course, preclude those modes of transport. Family members should be provided with an explanation if it is unsafe or problematic for them to ride along in the transport.

Cultural Sensitivity

Prehospital providers will come in contact with families with diverse health beliefs, customs, and practices. Additionally, the use of complementary or alternative treatment methods is becoming more commonplace. Eliciting a complete history of health care treatments from the family is important, and thorough documentation is beneficial to the overall care of the child. Strategies to overcome language and cultural barriers must be developed and made available to all transport team members.

Transition to Inpatient PFCC

The principles of PFCC should be practiced throughout the transport process: from on-scene treatment, through transport, to the transition of care to in-hospital health care providers. Because of this continuum, all members of the health care team—including emergency medical services prehospital personnel—should be involved in the development of strategies to support the practice of PFCC.

An essential element in the transport process is the "point person." This person, who can be any of the team members, will be the main communication contact between the family and the clinical staff. The point person provides information to the family about the anticipated clinical management of their child during the transport, and about any anticipated or potential complications. The mode of transport and relevant equipment and procedures should be explained. In addition, the point person assists in arranging ongoing family access to the patient.

When or if the family is not able, or does not want, to travel with the child, they should receive detailed information about their child's destination. This should include the name and telephone number of the hospital and the name of the receiving physician and clinical service. Driving directions and parking information for the receiving hospital should also be provided.

On arrival at the receiving facility, the child and family should be introduced to the new health care team. The transport team should assist with this clinical transfer; involving the family in this transfer is also a desirable practice, as the family's information can enhance the quality of the handover. At this time, a new point person should be identified who will now be responsible for providing ongoing information within the hospital setting. If the ideals of PFCC have been established from the onset of the transport, this transition to inpatient PFCC will be seamless and provide the optimal patient family experience.

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CHAPTER 13

Marketing the Neonatal-Pediatric Transport Program

- Current trends
- Market research
- Formulating a marketing plan
- Implementation
- Maintaining presence
- Limitations

Current Trends

The last several decades have seen numerous changes in the provision of regional pediatric health care and, thus, the role of transport medicine. As specialty pediatric services become more prevalent in the community and as hospital alliances/networks expand, the marketplace for neonatal-pediatric transport has become more competitive. Additionally, cost-containment strategies and reimbursement systems are changing the services hospitals offer and the need to transport patients to reach these services.

This changing marketplace requires hospitals to evolve their marketing strategies. Although not all transport systems function in a competitive landscape, the role of marketing has become increasingly important to the success of any transport program. The transport staff stands on the marketing front line—both indirectly as an ambassador for the hospitals' brand image and directly as a tool to recruit and maintain clients at referral facilities. Attention to the principles and practices of marketing are required to demonstrate the core hospital philosophy while improving positioning in the marketplace.

This chapter details how to research, develop, and implement a marketing plan for a neonatal-pediatric transport program.

Market Research: Defining Your Customer

The first step in selling any product/service is properly defining the market and customer. Although interfacility transport is a service to patients (the end-user), marketing efforts should focus on the direct customers, who may differ depending on the local market dynamics. In some arenas where there is little competition, the customers are the hospital executives and administrators who then recommend the service to their providers. In other arenas, the referring physicians (neonatologist, hospitalist pediatrician, intensivist, emergency physician) may be the decision makers in choosing a transport service for a particular patient. Clearly, the incentives for these individuals differ, and therefore, the marketing strategy must be customized accordingly. Hospital administrators may prioritize price and quality of service, whereas referring physicians may prioritize timeliness and reliability.

Indirect customers additionally play a role in marketing. As opposed to direct sales, which target key personnel, aspects of advertising and marketing can inform *external* markets about your service. External markets are indirect customers, distributors, or suppliers who you use to exchange goods/services and may recommend your services to their clients. This can be helpful for outsourcing arrangements or just building reputation within the industry. In transport medicine, external markets include ambulance/helicopter vendors, equipment suppliers, and state officials.

Market Research: What Your Customer Wants

Once you define your customers, it is critical to assess their needs. Market research is the process of gathering data about a customer's satisfaction, attitudes, and current/future requirements.

A systematic approach to customer research should proceed as follows:

1. Define the customer.
2. Select a sampling method.
3. Obtain the data.
4. Analyze and check the data.
5. Communicate and utilize the findings.

Several tools are available to acquire market research data. The best method is direct personal contact with key decision makers. This step is essential to identify existing or emerging needs, potential threats, and trends within the program's service area. It also helps guide the development and enhance the understanding of quantifiable data obtained from traditional research tools such as the formal survey and emerging research tools such as customer relationship management and social media. Although traditional research tools are useful in defining and statistically analyzing market needs, emerging research tools may be more effective in engaging customers and may provide more meaningful qualitative data. Surveys can be accomplished either by telephone with preidentified individuals or using online applications (surveymonkey.com, zoomerang.com, questionpro.com) e-mailed to key decision players. For phone or in-person interviews, it may be helpful to e-mail the survey prior to the discussion so specific points can be discussed. Formal surveys require statistical reliability and should be well constructed. Questions should be worded carefully to avoid bias. Coding and analysis of open-ended questions should also be considered. Examples of sample survey questions are shown below in Table 13.1.

Table 13.1: Sample Survey Questions

1. Are you satisfied with the service provided by the transport program? If so, how? If not, why?
2. Is there anything you would like to change?
3. Compared with other transport services, what are the strengths of this program (eg, communications system, availability, rapidity, consultancy, clinical expertise, professionalism)
4. How likely are you to recommend the transport program?

Telephone and written surveys should be followed with a letter of appreciation for the respondent's participation. Follow-up communication is also effective as a means to refer customers to more information (ie, further advertising) such as a website or newsletter. Although many opportunities exist for obtaining data, personal contact allows the opportunity for developing relationships and networking with customers.

A contemporary and dynamic approach to market research utilizes customer relationship management (CRM). CRM is a commonly deployed tool that allows companies to interact with their customers and sales prospects. CRM initially was developed as a set of business processes but has become a tool that mostly uses "cloud" computing to manage customer conversations and information. By understanding the purchasing decisions and habits of customers, companies are better able to cater services to their needs and, thus, increase their sales. As technology continues to integrate into the tracking and delivery of transport medicine, CRM may develop into a plausible tool for transport market research in the future.

Social media is another modern tool by which customers share opinions and experiences with services. Because social media is uncensored, information can be very revealing about a particular product or service. The social media revolution has become a staple in marketing research for small businesses. Companies are incorporating social media tools as a regular business process, thus creating a direct tool for monitoring customer commentary. In transport medicine, social media may be more useful for feedback from end-users (patients/families), rather than the customers themselves. If you are considering incorporating social media monitoring, use as many inputs as possible to maximize strategic tactics and breadth of services. Consideration of statutes governing protected health information, such as the Health Information Portability and Accountability Act (HIPAA [Pub L No. 104-191]), should also be considered.

Market Research: Finding the Market Gap

After determining what your current and potential customers want from transport services, the next step is to determine what other opportunities exist in the marketplace. This market potential is called the market gap—needs in the marketplace that may not be best served by current suppliers. In transport medicine, the market gap may be the need for subspecialty services (eg, burn care, transplant services) or timeliness of transportation in certain hospitals or geographic areas. Depending on the program's mission, opportunities may exist for outsourcing transport services to third-party payers, such as shunt services for health maintenance organization (HMO) networks, military facilities, or nearby academic competitors. Although market gap analysis is typically a strategic tool, it affects the way marketing efforts are prioritized and leveraged.

Federal and state governments maintain publically available databases that can be data mined for market gap research. To assess the potential for an increased presence, especially in a competitive area, it may be advantageous to determine the geographic distribution of population demographics (ie, size and rate of growth, age distribution, ethnic mix, educational levels, etc), patterns of consumption of medical services, disease incidence, referral patterns, and distribution of subspecialty services. Depending on the competitive landscape, it may be advantageous to determine the geographic distribution of subspecialty services and potential for increased presence. Often, this includes hospitals farther than the typical catchment area, where referring physicians could be convinced that a farther travel to your facility is worth the added distance. Other available tools to explore market gap opportunities include: community and regional health needs assessments, and focus groups and formal interviews with various key constituents/groups of direct and indirect customers.

In some transport environments, market gaps may not exist. When strong affiliation agreements are in place, such as with academic, managed care, or military hospital networks, new market opportunities may not be possible. In these networks, efforts should be made to augment current services and to prevent competitors from taking market share.

Formulating a Marketing Plan: Marketing Basics

The term *marketing* is defined as a management process that facilitates the shift of goods and services from concept to customer. Marketing is a necessary tool to increase customer awareness and assist sales platforms to secure new customers while maintaining current clients. Further, strategic marketing practices help build lasting and sustainable customer relationships by prioritizing customer satisfaction.

The basic marketing cornerstones are the 4 P's—product, price, place, and promotion. The combination of these facets is the "marketing mix" that demonstrates an offering to customers. As it pertains to interfacility transport, the 4 P's can be described as follows:

- Product—what you offer: patient transport, customer service, packaging
- Price—what you charge for the service
- Place—your location and distribution channel: geographic network
- Promotion—how you are going to tell people about it: advertising, selling, and incentives

Another fundamental marketing principle is the product life cycle. Although this applies mostly for products that have a defined timeline before they expire or require redesign, life cycles should be considered for services (such as transport) that use innovative responses to service issues as well as innovative products such as patient monitoring equipment and communications devices. Marketing strategies differ depending on where products are in their respective life cycles.

Formulating a Marketing Plan: Program Assessment

Before promoting your service, it is essential to review what you can offer. This program assessment should be a review of the following:

- your service capabilities
- your service limitations
- referral trends
- customer history/relationships
- current marketing efforts

In addition to detailing your service offerings, it is important to supplement this information with data that can be used in your sales platform. The following data should be obtained:

- User (patient/family) satisfaction—social media monitoring, post-transport surveys
- Timeliness and reliability—average call-to-arrival times for ambulance and helicopter
- Volumes
- Safety record
- Demonstration of quality—tracking medical errors, quality assurance measures, case review
- Breadth of diagnoses transported (variety of disease processes, frequency, etc)
- Post-transport outcomes, if applicable

Formulating a Marketing Plan: Business Strategy

After assessing the market and analyzing what your program can offer, the next step is to define program goals in the context of the existing market. A commonly used method for this strategic planning is SWOT analysis (strengths, weaknesses, opportunities, threats). An example of SWOT analysis as it pertains to transport medicine is shown in Table 13.2.

A SWOT analysis helps determine how your service fits into the competitive landscape. This strategic technique allows programs to decide where/how to ration key marketing resources to either capture new market elements or prevent market share from being lost to competitors. This analysis should highlight areas that are underserved or inefficiently served.

Table 13.2: SWOT Analysis

S (Strengths) Strong reputation, capable staff Solid relationships with air and ground vendors Solid relationships with several referring facilities
W (Weaknesses) High cost structure Location of receiving facility Timeliness when transport queue is high
O (Opportunities) New technologies Possible merger with other facility
T (Threats) Tighter regulations Growing capabilities of competitor transport programs

Development of the Marketing Plan

The marketing plan is the written blueprint detailing how the message will be communicated to the customer. This plan identifies targets and details the strategies that will be necessary to successfully penetrate, capture, and maintain the market share of the program's referral area.

Key elements of the marketing plan include the following:

1. mission statement
2. market research and analysis
3. program goals and business strategy
4. marketing action plans
5. evaluation process

Because budget is an inherent limitation, it is imperative to prioritize the marketing goals based on necessity. Program directors should, therefore, consider the anticipated costs of available marketing strategies so that options can be weighed and resources can be identified. If sponsors are involved, directors should also consider return on investment.

A complete marketing plan utilizes multiple avenues to advertise and promote the transport services. This plan should be a combination of personal and traditional advertising techniques using media exposure and incentive services. Do not promise something that you cannot deliver.

Transport medicine has inevitable limitations, such as geographic distance, weather fronts, traffic patterns, and availability of programs. Recognized limitations of the program should be publicized to prevent unrealistic expectations (or potential litigation).

Marketing strategies include: branding, educating providers, and highlighting program accomplishments. Branding of the transport program is a key marketing tool that can enhance the program's reputation and build trust among customers. Consistency in the use of logos, colors, and uniforms is helpful to identify and increase the visibility of an institution or the transport program's service (Fig 13.1). When branding, it is helpful to use distinguishing colors and characteristics to distinguish the transport program from other ambulance teams in the local area. Use of slogans or visual images that are consistent with the referral hospital's corporate identity also can reinforce

Fig 13.1: Branding the Transport Program

Photos used with permission from El Paso Children's Hospital.

the marketing plan. Other strategies include the incorporation of customer service training in the transport program's education plan and highlighting the transport program's expertise, professional affiliations, safety awards, speeches, or recognition in newsletters or marketing brochures. Program members who actively attend or lead educational offerings or obtain special certifications may lend credence to the transport program's unique expertise. Examples of marketing strategies are shown in Table 13.3.

Implementation of the Marketing Plan

Before initiating a marketing plan, the marketing message must be presented to each level of the administrative and clinical teams involved with the transport program (and base facility). One individual (or a small group) should be responsible for monitoring and evaluating the implementation process. With each marketing action item, it is helpful to maintain either paper or online

Table 13.3: Marketing Strategies for Transport Medicine

Branding • Put logo (hospital or transport) on everything • Standardize uniforms
Media (Written and Internet) • Develop website featuring services, photos, news, etc. • Develop social media monitoring • Distribute business cards, brochures, form letters • Distribute newsletter (online or written) • Provide promotional items (e.g., magnets/stickers with contact information) • Arrange spots on TV/radio/webinars • Utilize Public Relations (PR) department to share special interest stories
Incentives: Education • Sponsor local transport conferences • Develop reporting system for case follow-up (final diagnosis, outcomes) • Develop outreach education, customized to hospital department need • Offer safety in-service classes
Demonstration of Services • Offer tours of helicopter/ambulance, communications center • Develop "business pitch" (video, powerpoint, etc) • Demonstrate advanced technologies (telemedicine, monitoring devices, etc)
Personal/Social Contact • Visit referring hospitals (develop name recognition of key personnel) • Invite referring facility to open houses, celebrations • Implement service recovery strategies to address customer concerns

records to track the expected timeline, evaluation, and maintenance requirements for a particular project. Table 13.4 show a sample record created with the implementation of several new marketing endeavors.

Table 13.4: Sample Marketing Plan

Action Program	Cost	Responsible Dept	Start Date	Completion Date	Maintenance Requirements	Evaluation
Phone Access						
Logo on Ambulance						
Brochures						
Safety Fair						

Maintenance and Evaluation of the Marketing Plan

Ultimately, the success of any marketing plan requires consistent evaluation of the perceptions of both direct and indirect customers in terms of program responsiveness, service excellence, and cost-effectiveness. In light of changing market conditions, every marketing plan requires continuous monitoring and analysis of performance as well as taking any necessary actions to keep the plan on track. Optimal response to customers requires awareness of their needs and their perceptions of the ability of the transport program to meet those needs.

Statistical analysis is an essential method to evaluate the effectiveness of the marketing plan. This requires ongoing data entry of all calls received and missions and transport accomplished. Data collection can be maintained using database software, such as Microsoft Access or FileMaker Pro, which can be easily queried to analyze specific variables. Analysis may include the following:

- Frequency of referral from certain institutions during a specified period.
- Review intervals (eg, 3 and 6 months and 1 year)
- Diagnostic categories, transports, response times, and consultations
- Volume assessment for time of day and day of week
- Comparisons can identify areas of change such as increased referrals (or decreased demand) from a particular hospital or unit
- Monitoring and reassessment should be consistent and ongoing

Using these quantitative (statistical) evaluation tools, the marketing plan should be evaluated periodically and can be revised based on changing needs and trends in the environment (both internal and external). The critical elements of the marketing process include emphasis on the quality of service and the importance of customer relations. Providing an excellent service, maintaining current data on the demand for service, sustaining a sound relationship with program users, and using consistent and quality promotion strategies all contribute to an effective marketing plan.

Maintaining marketing presence can be challenging. Although it is easy to maintain simple marketing tactics, such as displaying the brand image, it is sometimes difficult to remind referring facilities of the other advantages to your transport program, especially in busy settings while practitioners are providing acute care. Establishing a follow-up notification system can be an advantageous method to provide continuous communication with referring providers. Providing follow-up about outcome, final diagnoses, and management tactics helps remind referral facilities about the expertise and specialty diagnostic and therapeutic capabilities of your tertiary care center. Follow-up can be accomplished either through a Web/cloud-based system or by phone, letter, or e-mail communication (complying with HIPAA standards for patient privacy). Follow-up platforms offering regular feedback allows the transport team to have a regular communication channel to offer additional marketing tactics such as notifications of upcoming events, policy changes, new services, and medical education. Be careful that any follow-up system does not come across as judgmental, overly critical, or condescending. Some facilities and providers are more capable with neonatal-pediatric care than others, and this is the opportunity to educate. All follow-up communication should emphasize an appreciation for the referral. This is an immeasurable professional courtesy.

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CHAPTER 14

Outreach Education

Outline

- Outreach education
- Benefits of outreach education
- Learning styles
- Educational content
- Objectives and implementation

Outreach Education

An outreach educational program should be a key component of all transport programs. The medical, social, and legal complexities of interfacility transfer of critically ill or injured neonatal and pediatric patients make fertile ground for continuing education activities. All outreach should also be considered marketing (see Chapter 13). The outreach education program objectives also integrate and overlap with the marketing strategies of the transport program (Table 14.1). The ultimate goal of effective outreach education is to improve patient outcome. Frequently asked questions regarding transport outreach education are included in Table 14.2.

When considering developing a transport program, it is imperative that the transport leadership team spend time marketing the program to the hospitals in the local community and meeting the medical directors and medical

Table 14.1: Objectives of Transport Outreach Education

• Ensure knowledge of basic stabilization principles for neonatal and pediatric patients
• Teach recognition of neonatal and pediatric illness that requires transfer to a higher level of care
• Delineate how to access the transport system and obtain consultation and recommendations for stabilization
• Upgrade understanding of the physiologic basis for initiating care and stabilization for the unique transport environment before team arrival at the referring facility
• Develop a system to provide follow-up information on patient progress and outcome (constructive advice about patient care at the referring facility is helpful)
• Arrange for seminars and other educational activities on topics relevant to transport (see Table 14.3 and Appendix E)

Table 14.2: Frequently Asked Questions About Outreach Education

1. Why should my transport program become involved in outreach education?

It gives transport team members an opportunity to meet and interact with staff from referring institutions without the added stress of a critically ill or injured neonate or child. Staff at referring institutions want to know how to best care for their patients until a transport team arrives. Meeting that need and providing a low-stress environment in a learning environment and sharing the expertise of your team members is something the referring institutions will remember when faced with a critically ill or injured neonate or child. Outreach education is also an excellent marketing tool for any transport team.

2. What are the important steps in developing an outreach program within your institution?

- First, the leadership of the transport program needs to understand the concept of outreach education and the benefit to the team.
- Next, consider your resources. Who on your team is trained, experienced, and excited about teaching? What specific "expertise" exists or is needed in specific topics, diseases, and management? Who has experience speaking to small and large groups? A transport team may first have to invest in its staff to prepare them for effective outreach (ie, development of a presentation, public speaking, comportment within a referring agency while not engaged in a patient transport).
- Once you have identified resources within your institution or program, you are ready to consider marketing outreach education.

3. Who should be involved in an outreach program?

Any and all members of the transport team, as well as staff within the hospital (emergency department [ED], pediatric and neonatal intensive care units [PICU and NICU]). Some institutions may have an outreach coordinator who will help with the logistics, contact institutions, set up activities, and perhaps be an active member of the educational team.

4. What should we do before our first outreach program?

- Start local and small. Consider your geographic location. Are there multiple transport programs in your area?
- What is unique about your program, and how can you best market your specialty?
- With the assistance of your public relations department, you may develop a marketing strategy. Are there institutions in your geographic area that are not referring ill or injured children or neonates to your hospital at this time? Are there institutions that have been identified by members of your transport team as possibly benefiting from educational opportunities your team members could provide?
- Now it is time to make the initial contact to these "targeted" institutions, clinics, and offices. Consider contacting the medical and/or nursing director of the department (eg, ED, NICU). Introduce yourself, and offer the services of your team for outreach education. Has this physician or nurse identified an educational need among staff? Was there a specific case that referring staff might like your team to present with patient follow-up and possibly "lessons learned" or how to better manage the patient until the transport team arrives?

5. What about the national certification/resuscitation courses? How are they a benefit to an outreach program?

Nationally recognized programs can be a definite asset to any outreach program. All of these programs offer continuing education units for participants, and many also offer a verification card that is valid for 2 to 4 years, depending on the curriculum.

Many hospitals offer some type of financial bonus for their staff who successfully complete the curriculum. In many areas of the country, there are not enough courses offered to meet the requests from staff. Many community hospitals pride themselves market to their own community that 100% of their nurses on a specific unit (eg, ED, NICU) are certified in a particular area. These courses are another way for your transport staff to meet the need for staff education in community hospitals and clinics, which also can become a marketing tool for that community hospital. Most national courses require instructors to have taken the provider course and then an instructor course before being able to teach.

Table 14.2: Frequently Asked Questions About Outreach Education, continued

6. How do you measure success in an outreach educational program?

- Measuring success depends on many factors. Ideally, we would all like to see improved care delivery and new and increased referrals from the hospitals that were targeted for outreach educational efforts. This, however, may be unrealistic, because not all neonates and children need the services of a transport team.
- Evaluation forms provide immediate feedback of the learners' perception of success of the teaching program.
- Knowledge change can be measured with a pretest and posttest design.
- Patient outcome may be measured by morbidity and mortality reviews before and after the educational offering.
- Before starting an outreach program, your team and institution may want to obtain baseline data about current referral patterns, potentially targeting other institutions that are not referring or do not often refer patients to your facility.
- Reevaluate after a specified timeframe (6–9 months) to determine whether there has been an increase in referrals from individual institutions or requests from new institutions.
- Your outreach program may be considered successful when your team is able to report that the staff at the targeted hospitals was able to better stabilize the condition of and prepare a neonate or pediatric patient for transfer.
- Success in outreach education also can be measured in the trust and professional relationships that are developed over time between the transport team and community agency staff. Hopefully, when a critically ill or injured neonate or pediatric patient is admitted to their institution, the staff members will be able to manage the patient while they call your team for transport.

7. Why is it important to consider outreach educational activities to prehospital providers (emergency medical services [EMS] providers)?

There is a great need for neonatal and pediatric education in the prehospital setting. There is limited time devoted to neonatal and pediatric topics in any initial prehospital curriculum (basic life support [BLS], advanced life support [ALS]). Depending on the population, some EMS providers may transport few patients in any year, and the patients may or may not be critically ill or injured. These providers may benefit from the same type of educational opportunities as the staff at community hospitals and clinics. Many states have prehospital continuing education conferences annually.

We know that neonatal and pediatric patients may have subtle manifestations of serious, even life-threatening conditions. Sharing your expertise with EMS providers will sharpen their assessment skills and teach them to take neonatal and pediatric patients to the right hospital at the right time.

8. What are the financial issues to consider with an outreach program?

- The financial commitment will vary depending on your program goals and plans. Some transport teams include participation in outreach education as one of the requirements to be on the transport team. In this environment, the transport budget may include time for individual team members to prepare and present outreach topics.
- The financial commitment also will depend on whether you have a dedicated educational coordinator as part of the leadership of your team.
- If you do not have outreach education as a requirement for your team members, your institution's mission statement might include an educational component or an expectation that staff will participate in some volunteer efforts.
- Your commitment might need to include paying staff salaries for preparation, time presenting the educational curriculum, and travel expenses.
- Individual transport programs and institutions also can be creative in supporting outreach educational efforts by offering incentives to members who assist in outreach education.

9. What is the benefit to the referring agency to participate in an outreach educational program?

Referring institutions and agencies benefit because they have the opportunity to learn from and ask questions of transport team members who have expertise in specific areas, diseases, and management. Also, from case reviews, they have the opportunity to learn and be better prepared for the next neonates and children who need transport.

Table 14.3: Sample Topic List for a Transport-Related Outreach Education Program

- General topics (eg, stabilization of the patient's condition for transport)
- Respiratory (eg, upper and lower airway disease, structural anomalies such as diaphragmatic hernia, tracheoesophageal fistula)
- Cardiovascular (eg, shock, congenital heart disease, arrhythmias)
- Neurologic (eg, coma, seizures)
- Poisonings
- Trauma (accidental, nonaccidental, birth related)
- Metabolic (eg, diabetic ketoacidosis, congenital metabolic disorder)
- Hematologic-oncologic emergencies (eg, sickle cell crisis, primary and secondary hemorrhagic diathesis)
- Infection-related emergencies (eg, sepsis, meningitis)
- Renal (eg, renal failure)
- Surgical emergencies in addition to those involving the respiratory system
- Transport case reviews
- Management of accompanying and nonaccompanying family members

and nursing staffs of the emergency departments and inpatient pediatric and neonatal units. This initial contact not only introduces the team but also is an ideal opportunity to further assess the need for and offer outreach education.

An educational and training assessment, often part of a marketing survey, permits targeting of necessary and sought-after (the 2 are not always the same) education and training activities. Developing relationships with department educators and clinicians will assist in determining institution-specific educational needs. An assessment of institutional resources should be included when developing teaching goals and needs. There are many types of educational offerings that may be of interest to referring hospital staff. Consider asking referring facilities what educational offerings they might desire or need. Methods of inquiry include direct written or verbal communication during marketing visits; conversations with staff; managers, educators, and physicians; and/or written surveys, with a checklist of specific courses or individual lectures or skills content that are areas of expertise for the transport team members. Transport teams should also consider the role and value of social media (eg, Facebook, Twitter, Flickr, etc) in all forms of outreach. Transport teams can also determine educational opportunities in a more informal setting through casual conversations with physicians, educators, or individual staff members and when the transport team medical director and/or coordinator continue the marketing and public relations sessions with small groups at the referring centers. Post-transport follow-up phone calls, quality-improvement reviews, and identification of perceived deficiencies may direct the focus of education.

Informal discussions during initiation of transport, at the referring facility, and during the completion of the transport at the receiving facility also can assist in determining the required and requested education and training from people who will be attending the training sessions and applying the information to the transport environment. When transport team staff members are approachable and referring facility personnel become more comfortable and develop relationships with the transport team, they are more willing to approach transport team members, ask questions, and verbalize specific educational needs. Transport team members can gauge and influence the competency of referring personnel by participating as instructors in formal certificated training programs (activities), such as Pediatric Advanced Life Support (PALS), Pediatric Education for Prehospital Professionals (PEPP), Advanced Pediatric Life Support (APLS), and Neonatal Resuscitation Program (NRP) courses (see Appendix F).

Many times, referring facility personnel are interested in specific lectures or a combination of lectures and psychomotor skill practice. Topics might include basic ABCs (airway, breathing, and circulation), preparation and stabilization for transport, respiratory diseases, intravenous access with practice, conscious sedation, resuscitation, medication calculation and administration, management of diabetic ketoacidosis, management of seizures, pediatric assessment, and trauma. Faculty for this type of educational session can include a combination of physicians, nurses, and paramedics.

The need for well-prepared and experienced instructors is paramount. The initial impression of transport team members as out-reach educators can be a lasting one. Meeting the educational needs of many individuals also can be a challenge. As the transport team begins educational opportunities with individual health care facilities, the relationship with the team and the team's institution is strengthened. Transport teams should collaborate with their own marketing department in selecting specific promotional items bearing the team logo and contact information that can be distributed at educational sessions. These may include pens, pencils, key chains, note pads, posters, and drug dosage cards. One popular item is a small magnet, in the shape of an ambulance, with the team logo and contact information. Many referring facilities have magnetic patient tracking boards, and these magnets are used by the referring facility to "mark" transport patients when a transfer is in progress.

Benefits of Outreach Education

Education and training activities provide an opportunity to discuss issues associated with transport and expand the knowledge base of referring hospital personnel when stabilizing the condition of a neonatal or pediatric patient for transport. Many times, referring hospital personnel are anxious to learn more about the disease process and current management, as well as how they can better care for the patient until the transport team arrives. This is also a good opportunity for a team to develop important relationships and learn about its customers, their needs, and the transport team's performance and perception in the community. Delivering a well-developed case study with highlighted topics and care interventions of representative infants or children transported (or not) from a referring hospital provides an open forum for multidisciplinary discussion and possible improvements of care while strengthening community ties. Instructors must be trained, however, to avoid alienating the audience with perceived or real criticisms of care and personnel and to be able to solicit and graciously accept constructive criticism of their transport service. The outreach educator should always emphasize what was done well by the referring hospital and its staff.

Outreach education also benefits transport team members by refreshing their own knowledge base when preparing educational offerings. They may develop a better understanding of what referring facilities face when presented with a critically ill patient (few referring facilities will have the pediatric subspecialists and equipment immediately available that may be considered routine and necessary at the transport team's base facility). Increasing regional awareness of the transport team, its capabilities, and how to access the service will further enable overall program success. Most important, pretransport patient care may be improved, as may the overall patient outcomes.

Learning Styles

When implementing outreach education, adult learning styles need to be considered. Adult learners have accumulated knowledge and experience that serve as a foundation for future learning experiences. They are internally motivated to learn and seek application for the knowledge they gain. The education program needs to be consistent with the learners' current knowledge base and skills.

When contemplating outreach education, take into consideration the experience level of the learners and the topic to be presented. The educator should have a strong knowledge base for the topic to be presented. Being aware of the knowledge base of the learners on the topic to be presented can help the educator tailor the presentation of material to the level of training and experience of the attendees. An interactive approach may facilitate retention of material presented and elicit enthusiasm toward learning from the participants. Case studies can be an effective method of building on the knowledge base of adult learners. Information is presented in a manner in which learners can listen and visualize; then the information is applied in the case study by the learners and facilitated by the educator. Case-based discussions, with specific identifiers removed and presented in an educational, nonjudgmental manner, can be useful, especially with cases from the referring institution. Although presentations with paper-based handouts have been the traditional teaching method, other methods of facilitating learning may be more effective for adult learners.

Simulation-based training is an excellent method of facilitating interactive learning. The learner is placed in a realistic environment and actively participates in a medical scenario and a postsimulation debriefing. Technology-intensive, simulation-based training may be limited by availability and financial constraints. However, similar medical scenarios can be created with less expensive mannequins and the educator facilitating the scenario. This interactive, hands-on method allows learners to attain experience and gain confidence in a lower-stress environment. When distance, financial, and time constraints limit the number of educational offerings, videoconferencing may provide the opportunity to effectively reach a larger audience.

Referring hospital-staff rarely have the opportunity to view transport operations from the transporters' viewpoint. If your program permits, ride-along programs are a creative means of sharing the transport experience with clinical and managerial staff at the receiving and referring hospitals.

Education Content

Appendix E lists multiple certification courses that could be used for transport-related outreach education efforts. Table 14.3 lists more detailed topics for consideration. Members of the transport team should be encouraged to become qualified instructors of national certification/resuscitation courses and to teach these whenever possible. Transport team members should participate in the courses taught as community outreach. This may aid the transport team members in bedside teaching skills and confidence, an integral part of the educational process, and it should help maintain consistency in education.

Not all education topics listed in Appendix E and Table 14.3 can be offered to every referring facility. However, even if a transport team does not provide the course, it can encourage participation in national courses. For specific topics, the team can make suggestions or defer to the topics the referring facility considers the most important. When presenting selected topics, team members can leave references, scripts, videos, or summaries that supplement the information presented. When the team provides a brief (1- to 4-hour), nursing-focused outreach education program, it is helpful to offer it more than once in 1 day to reach staff from different shifts.

Objectives and Implementation

It is important to approach outreach education as an opportunity for positively influencing care for children. Transport team members may be concerned about criticizing patient management by referring hospital staff and the potential effects on future referrals. It is recommended that "ground rules" be presented and agreed on by all participants, including the confidentiality of any discussions held during case reviews. Education should be provided in a nonjudgmental manner, and the participants should be encouraged to offer their own experiences and cases and to point out to others any unique or unusual capabilities or configurations of their own facility.

Communication among transport team members and referring facility personnel at the time of a stressful neonatal or pediatric stabilization can be difficult. Professionals, often previously unknown to each other, must work together and trust each other in the interest of optimal patient care. The value of advanced preparation through outreach education cannot be overemphasized. There is a different quality of cooperation (hopefully improved) and mutual trust when a team member and staff member recognize each other from a previous nonstressful encounter.

Outreach education should not be limited to referring health care facilities. The transport team members are experts in pediatric and neonatal care. Developing relationships with local, regional, and/or state emergency medical services agencies also should be an important outreach activity. Well-prepared prehospital providers will become more comfortable with smaller patients and able to provide better care to pediatric and neonatal patients. Many EMS agencies offer regular continuing education conferences throughout the year, and the transport team members (physicians, nurses, respiratory therapists, and paramedics) can be the experts to bring some of the same formal courses or individual lectures and skills to prehospital providers at these conferences. Members of the transport team (physicians, nurses, and paramedics) also may be invited to participate on regional or state-wide prehospital committees, as advisors, and to share their expertise in developing and/or refining protocols. Outreach education may also incorporate expert testimony and lobbying at the local, state, and national governmental level and to other key policy makers including professional associations, advocacy groups, and nongovernmental organizations.

Outreach education programs are an essential component of a successful transport program. This is especially true in pediatrics, because referring facility staff may be less trained, inexperienced, or uncomfortable when faced with a critically ill neonate or child. Outreach education benefits the patients, transport team personnel, referring hospital personnel, and receiving hospital. Better stabilization of the patient's condition may occur, communication will improve, and referrals may increase.

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CHAPTER 15

Financial Considerations

Outline

- Review of the financial equations included in transport
- Billing, coding, and reimbursement
- Contractual options and vendor relationships
- Nonfinancial components of the transport service (goodwill, exposure, and branding)
- Carve-out options
- Economies of scale and scope

Transport capabilities are a necessity for regional neonatal and pediatric centers. Stand-alone or unit-based transport teams may not be financially desirable if evaluated as independent entities. The contribution of the transport service to the additional charges and revenue (including diagnostic, procedural, personnel, global, and ancillary charges) generated for the health care system by transported patients needs to be considered when evaluating the financial impact of a transport program. However, in the current environment, prospective diagnosis-related group (DRG) payment to the hospital is likely to mitigate the value of "downstream revenue." The value proposition for transport teams will need to change in light of the development of value-based payment plans and current third-party prospective payment plans. Still, the value of a reliable and efficient transport system cannot be overstated with respect to community perception and public relations. *Goodwill,* defined as an intangible asset that provides a competitive advantage, such as a strong brand or reputation or high employee morale, and an altruistic attitude, however, are not enough to keep a transport team solvent. Because most neonatal-pediatric transport teams exist as subsidiaries of larger organizations, it is important that transport team management personnel become and remain familiar with fiscal issues germane to transport and program management. In this chapter, a number of budgetary and fiscal issues are discussed. This is not an exhaustive review, and readers are encouraged to explore the noted references, readings, and other resources.

Review of the Financial Equations Included in Transport

Budgeting is an important part of planning for a transport program's organizational structure and resources. The budget is probably the most fundamental financial document any division of a health care organization develops and may be the first encounter that a health care manager has with accounting information. The budget is a basic tool for tying together the planning and implementation functions of management.

The budgeting process and the results of the approved budget plan serve to allocate limited organizational resources among competing users. Comparing actual results with budgeted results helps to evaluate the performance of individuals, contractual agreements, and system operations and illustrates the relative revenues and expenses and their respective variances.

When establishing a budget, managers should consider the fixed and variable costs of a transport program (Table 15.1). Fixed costs include buildings, utilities, compensation of salaried employees (including administrative

Table 15.1: Transport Costs

Fixed Costs

1. Facility costs
    - Utilities
    - Maintenance
2. Personnel costs (salaried employees)
    - Fringe benefits
    - Wages
3. Planned and scheduled equipment maintenance
4. Durable equipment depreciation and replacement
    - Transport vehicles (owned or leased by the institution)
    - Monitoring equipment
5. Contract requirements

Variable Costs

1. Disposable supplies
2. New equipment and preventive maintenance
3. Nonsalaried, variable personnel costs
    - Wages (hourly employees)
    - Fringe benefits (hourly employees)
    - Overtime wages
4. Vehicle usage costs
    - Unscheduled vehicular repair
    - Mileage costs
    - Fuel costs

personnel), physical plant maintenance, owned or leased transport vehicles, and existing equipment. Variable costs include supplies, new equipment, wages of part-time or registry employees, vehicle maintenance, mileage and fuel costs, and overtime wages.

To best understand the transport service's financial position, a comprehensive financial analysis is necessary to evaluate the strengths and weaknesses of the current transport team contracts. Each payer's contracted reimbursement rate needs to be evaluated and compared with the transport team's cost/charge ratio.

Transport team revenue and margins by payer class, segmented by Medicare, Medicaid, commercial, managed care, and self-paid categories, should be delineated. Transport cost/charge ratio trends and statistical comparisons with industry benchmarks should be developed. Collaboration with established experts within the institution will be important to understand and strategize regarding the impact of financial data.

Furthermore, transport costs per adjusted (a financial calculation and comparator that includes all of the hospital's inpatient and outpatient services) discharge and adjusted patient transport should be ascertained in addition to a statement of operations analyses and balance sheet analyses. Depending on the employee status of the transport team and the physicians at the institution, the highest reimbursement per transport may be if all charges (physician, nurse, nurse practitioner, respiratory care practitioner, supplies, and equipment) are billed to the patient and collected directly by the institution. The institution should evaluate whether the revenues will be sufficient to support the number of full-time-equivalent positions necessary to provide the coverage required for the transport team.

Billing, Coding, and Reimbursement

Transport teams can establish various types of relationships with institutions in the region they serve. One approach is interfacility agreements, which the institutions enter into with the understanding that the patient's transfer to the tertiary institution will be streamlined, as long as there are no insurance or other operational restraints. A second type of arrangement can be made whereby a tertiary transport team may contract with other institutions that have smaller units and may not have the volume necessary to maintain the skills or to make a transport program cost-effective. These contractual agreements may be made on a fixed dollar amount per transport or prorated on an hourly rate plus replacement of supplies.

When establishing a fixed rate per transport or an hourly rate, actual costs, depreciation of equipment, goodwill, and missed opportunities need to be accounted for and factored into the respective charges. The tertiary institution must be thorough and well versed on the appropriate billing codes, charges, and reimbursement opportunities for critical care transport. Depending on the transport team staff, there may be different potential charges that can be applied to each transport. If there is a supervising physician overseeing medical control or present on the transport, there are specific *Current Procedural Terminology* (CPT) transport codes that can be applied; they are noted here and summarized in Table 15.2:

- 99485: Supervision by a control physician of an interfacility transport care of the critically ill or critically injured pediatric patient, 24 months of age or younger, includes 2-way communication with transport team before transport, at the referring facility and during the transport, including data interpretation and report; first 30 minutes.
- 99486: Same as 99485 but used for each additional 30 minutes; list separately in addition to code for primary procedure.
- 99466: Physician constant attention of the critically ill or injured patient, younger than 24 months of age, during an interfacility transport (the first 30–74 minutes of direct contact [face-to-face] with the transport patient). Care of less than 30 minutes should not be reported with this code (instead use appropriate evaluation and management code).
- 99467: Physician constant attention of the critically ill or injured patient, younger than 24 months of age, during an interfacility transport (for each additional 30 minutes of direct care with the transport patient; use in conjunction with 99466)
- 99291: The first 30 to 74 minutes of critical care services provided by a physician to a patient older than 24 months. Care of less than 30 minutes should not be reported with this code (instead use appropriate evaluation and management code).
- 99292: Physician-provided critical care services for each 30-minute period beyond 74 minutes to a patient older than 24 months (for each additional 30 minutes of direct care with the transport patient; use in conjunction with 99291)

Table 15.2: CPT Codes for Transport Physician Involvement

Code	Service Provided	Time	Requirements to Bill for Service*
99485	Physician supervision of transport team (patient <24 mo of age)	First 30 minutes	Documentation of direct supervision of transport team, interpretation of results, labs, 2-way communications
99486	Physician supervision of transport team (patient <24 mo of age)	Each additional 30 minutes	Documentation of direct supervision of transport team, interpretation of results, labs, 2-way communications
99466	Physician presence during transport (patient <24 mo of age)	30–74 min	Constant physician attention during transport
99467	Physician presence during transport (patient <24 mo of age)	Additional 30 min after 74 min	Constant physician attention during transport
99291	Physician-provided critical care (patient >24 mo of age)	30–74 minutes	Constant physician attention; patient condition described as critical
99292	Physician-provided critical care (patient >24 mo of age)	Additional 30 min after 74 min	Constant physician attention; patient condition described as critical

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*The supervising physician cannot code the actual procedures and interventions provided by the team in the field unless the physician is physically present with the team during the transport. Charges for direct care begin when the physician assumes primary responsibility for the patient's care at the referring hospital. All procedures can be reported separately, but the time spent performing these procedures needs to be subtracted from the face-to-face time.

Note that the direct care codes may not be used until the physician has encountered the patient, and the times include only direct care, not preparation or transport time to the referring institution. Billing and payment usually are based on the CPT codes and the resource-based relative value scales offered by the federal government. Payers may have difficulty understanding the scope of these codes, and payer billing programs may not be updated frequently. As part of contract negotiations, an experienced coding expert may be useful to help all parties understand the guidelines that appear in the CPT codes (http://www.ama-assn.org/) and in *Coding for Pediatrics,* published by the American Academy of Pediatrics (http://www.aap.org/).

If the transport program employs nurse practitioners who will bill for their services, they may be required to receive a provider number under the specific state's Medicaid program, as the guidelines for coding and payment are state specific. Different rules may apply if the nurse practitioner is employed by a physician group. These nurse practitioners may bill for their services (under the direction of a physician) for Medicaid, managed care, and commercial insurance. If none of the nursing personnel are nurse practitioners, the hospital may bill a flat hourly fee for the nursing personnel as well as for respiratory care personnel. In addition, supplies and equipment used during the transport may be billed according to the hospital's respective charges, individually or in prebundled sets.

The Center for Medicare and Medicaid Services (CMS) provides payment for qualified emergency care at this writing. However, new payment plans are likely to have an effect on revenue generated by transported patients that will likely change the "value paradigm" under which most transport teams contribute to sponsoring institutions. Some time ago, the concept of downstream revenue provided an important justification for the institutional costs born by the sponsoring institution. As DRG-based payments become adopted by many third-party payers, additional downstream revenue is realized less frequently.

"Given that CMS policies have a transformative effect on the health care system, it is important to develop the tools necessary to create rational approaches to lessen health care cost growth and to identify and encourage care delivery patterns that are not only high quality, but also cost-efficient. To help address these concerns, CMS, during the current Administration and with direction from Congress (eg, through enactment of provisions in the Medicare Modernization Act, Deficit Reduction Act, and other provisions) has begun to transform itself from a passive payer of services into an active purchaser of higher-quality, affordable care. Further future efforts to link payment to the quality and efficiency of care provided would shift Medicare away from paying providers based solely on their volume of services. The catalyst for such change would be grounded in the creation of appropriate incentives encouraging all health care providers to deliver higher quality care at lower total costs. This is the underlying principle of value-based purchasing (VBP). The cornerstones of VBP are the development of a broad array of consensus-based clinical measures, effective resource utilization measurement, and the payment system redesign mentioned previously. The overarching goal would be to foster joint clinical and financial accountability in the health care system."[1]

Contractual Options and Vendor Relationships

Some programs find vendor services to be an efficient method of supplying essential but expensive services. Because transport vehicles are an expense that require additional certification and administrative oversight to operate, many programs find the efficiencies offered by vendors to be helpful in meeting transportation needs. Most businesses, hospitals included, use a number of outside (nonowned) service contractors to provide services. Expertise in managing service contracts should exist in the institution and should be included in all negotiations and contract management interactions. Before establishing a vendor relationship, the base facility should evaluate the availability of suppliers and the impact of the relationship on the program and the organization. A number of questions should be answered before beginning the formal search for the right supplier: Are there suppliers in the market that can provide the service? Are there suppliers in the market interested in forming a contractual relationship for services required? Will the relationship be valuable to the base facility (ie, will the expense of the supply contract be offset by potential benefits)? What is the base hospital willing to pay for the contracted service? What portion of the cost will be reimbursed by revenue generated as the hospital sells the contracted service to a third party? Do the suppliers in the area have expertise in managing service contracts with a health care organization? As one finds with transport in general, the benefit of the contract may reap more than financial benefits to both parties. The ability to provide efficient service to distant hospitals may promote goodwill that enhances marketing efforts to communities served.

Once the decision is made to find a vendor, a request for proposals (RFP) should be distributed to potential vendors. Potential vendors are identified through an evaluation of the potential candidates and a prescreening by the transport program and/or institution. Once the RFPs are returned from interested vendors, the review and interview process begins. In essence, the base facility and transport staff must find the best value. All vendors will be eager to tout their advantages, but limitations must be presented and understood. Understanding a vendor's limitations becomes as important as understanding its strengths. Once limitations are identified, the transport program must ask, "How will limitations be overcome?" It is not acceptable to jeopardize a patient's condition, and alternatives must be developed in advance. Financial arrangements are important to evaluate in advance. How does the vendor want to be paid? Will the vendor directly bill patients for services? What is the direct avenue for dispute management and resolution? Will the base facility receive a reduced rate as a result of a guaranteed volume? It is important at this stage to identify responsible people in the vendor's organization and determine the ability of the identified people to effect change if a contract is signed.

Vendor contracts require management throughout the life of the contract. An administrative official at the base facility should be a liaison between the transport team and the hospital's administration. This person, along with the transport program manager, should monitor financial and service components of the contracts on a regular basis. A clear line of communication and frequent interaction with a responsible member of the contract service provider's staff is essential.

Nonfinancial Components of the Transport Service (Goodwill, Exposure, and Branding)

By evaluating engineering firms in the United Kingdom, Maclaran and McGowan[2] made several observations of importance to small business that must compete in a market that includes competitors of varying sizes. Maclaran and McGowan evaluated how small firms that are disadvantaged owing to size compete favorably with larger firms able to take advantage of economies of scale and major investment in research and development. They determined that small firms differentiated themselves by providing better customer care and quality of service. Smaller firms maintained closer relations with clients, and as a result, they understood the client's philosophy and approach to business. When problems occurred, clients were able to approach a person at small firms directly and obtain rapid resolution. Because direct communication was possible, problems were solved quickly, and the client and the firm were more flexible. This improved customer care resulted in a positive image and significant customer loyalty.

The health care industry, in general, and transport services, in particular, could learn from these findings. Transport teams, by virtue of the fact that they are often relatively small-budget subsidiaries of larger organizations, are similar to the small businesses studied by Maclaran and McGowan.[2] Because transport teams deal with a finite and usually small number of referral centers, the opportunities to use personal interaction to improve customer care and, thereby, create loyalty and a positive image are significant. By association, it is reasonable to assume that the base or sponsoring facility will make gains in loyalty and image as well. In a sense, if this pattern is followed, improved customer care will result in promotional and marketing success, leaving the transport team and its sponsoring facility with a branded image associated with quality service.

Carve-out Options

Carving out is a strategy that separates a specialty service (the carve out) from other services provided by an organization. A specialty care provider that usually assumes some financial risk to provide the service then manages the carved-out service. This strategy can result in significant cost savings and decreased financial and, potentially, legal risks for the parent organization while providing the service for its customers.

Carve-out arrangements vary significantly in form, benefit design, provider network characteristics, fee arrangements, and management techniques. The mental health care industry has used carve outs for some time to provide and manage care. Carve outs potentially could be beneficial for transport teams by allowing them to provide the service for an organization that wants to provide the service but is uncomfortable with the potential financial or other risks. The advantage of carve outs to the parent organization is the ability to share or totally mitigate financial risk for services deemed important by its customers and stakeholders. Risk sharing in this situation can take a number of forms, including a vendor contract in which the transport team that provides the service functions as a clearly separate and independent agency or an arrangement in which an agency provides the service under the name of the parent organization. Risk is minimized in either case for the parent organization, because the agency providing the service agrees to manage the service and assumes responsibility for collectingpayments and for the cost of the program.

Economies of Scale and Scope

Economies of scale and scope are defined, respectively, as follows. Reduction in cost per unit resulting from increased production achieves economies of scale through operational efficiencies. Economies of scale occur because the cost of producing an additional unit of goods falls as production increases. Economy of scope arises when the cost of performing multiple business functions simultaneously proves more efficient than performing each business function independently. Economy of scale, therefore, occurs as an organization consolidates units serving the same or similar function. Economy of scope occurs as an organization improves throughput (provides more services with the same resources).

Economies of scale reduce costs by reducing waste. The assumption is that if the same resource can be used to support 2 or more functions, it is wasteful to duplicate that resource, and the functions should be merged so that all who require the resource can take advantage of it. With a merger, efficiencies may occur because a single unit was too small to take advantage of economies of scale and scope. Economies of scale and scope also can be realized by merging units in a large hospital that are underutilized. In a study that reviewed a number of hospital mergers that occurred in the late 1980s, Sinay[3] compared operating efficiencies 2 years after merger occurred in 2 groups of hospitals: hospitals in one group were the result of the merger of 2 hospitals, and the other was a group of hospitals that had not merged. Mergers occurred during a 4-year period. Sinay noted that merging hospitals revealed no diseconomies of scale premerger (waste), no economies of scale in the first year postmerger, and economies of scale in the second year post-merger. It appears that after the merger, hospitals needed to find and correct opportunities for saving. Differences in economies of scope were inconsistent between the control group and the merging hospital group.

This study may have some significant implications for transport services. Merging of units that provide the same function for different age groups of patients may be beneficial, because it allows managerial and logistical expenses to be shared and, thus, decreases the allocated fixed cost per transport. In the classic sense, it might be difficult to appreciate how economies of scale can be realized if each transport retains an individual cost that is multiplied by simultaneous transports, although as noted, fixed costs (eg, salaried personnel, vehicles) that are allocated over more transports will indeed bring the real cost of each transport down, if within the established capacity of the current fixed assets. Economies of scope may be achieved by making transport team members more productive at the base facility when not engaged transporting a patient. Nonengaged personnel, after transport preparation and other requirements are completed, could participate in other easily transferable hospital-based activities (such as assignment to care for intensive care unit patients in stable condition, in-house transport, or phlebotomy) that could be accomplished while awaiting transport need.

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CHAPTER 16

Database Development and Application

Outline

- Development of a database
- Database content
- Data acquisition
- Data storage
- Database query
- Database and the law

Introduction

The topic of database development and application in the setting of pediatric and neonatal transport is relevant, if not essential. A database, although described multiple ways, can simply be defined as an organized collection of logically related data. It is not the goal of this review to address the details of computer programming and database construction at the level of a computer scientist. Rather, this chapter should serve as a conceptual overview of databases and the types of databases that might apply to the setting of pediatric and neonatal transport, and most importantly, this chapter will attempt to elevate the priority of functional databases in optimizing each organization's clinical and systems-based practice. This chapter will not focus on the specifics of the software and hardware associated with the various proprietary electronic medical record platforms.

Historically, the concepts of thoughtful introspection and "expert" review as comprehensive evaluation tools of a transport team's performance have prevailed. In the modern era highlighting quality improvement and patient safety, these methods should only serve to complement a database that provides access and tracking of important barometers of individual and longitudinal team performance both internally and externally (for benchmarking purposes). Thus, databases within a transport organization can be informative to front-line staff (clinical care and outcomes), patient safety and quality improvement leadership (safety event tracking), billing and coding specialists, and administrative leadership (budgetary planning, resource utilization, marketing). Although each organization struggles with the time, energy, and resources necessary to build or optimize a local database to organize the massive information encountered each day, we are all reminded that as professionals, our goal is to seek order in the randomness of information that fosters our teams' improvement.

The following case illustrates many of the key clinical facts needing to be entered into a database record:

Case Scenario:

J.G. is a 9-week-old male infant who was brought to his local community hospital emergency department with respiratory distress, hypoxia, and a positive rapid respiratory syncytial virus antigen test. He was treated with oxygen and nebulized albuterol but remained distressed, and there was concern for impending respiratory failure. The decision was made to transport via the pediatric specialty care transport team (nurse, respiratory therapist, and paramedic), which was dispatched to travel the 46 miles by ground mobile intensive care unit and arrived to find the infant in impending respiratory failure. After a brief discussion with the online medical control physician (a pediatric intensivist in the intensive care unit at the tertiary children's hospital), the team proceeded with a protocol-based rapid sequence intubation, which included midazolam and succinylcholine. The initial intubation attempt by the respiratory therapist was unsuccessful (likely esophageal), resulting in no color change on the calorimetric end-tidal carbon dioxide detector and a brief desaturation as low as 72%. After reoxygenating the infant, the second intubation attempt was successful, the endotracheal tube was secured, and a chest radiograph confirmed good midtracheal tube position. The patient was secured on the stretcher and transported to the tertiary children's hospital, receiving 1 dose of midazolam and 1 dose of vecuronium during transport. The total on-scene time at the referring hospital was 73 minutes, with a 61-minute en-route time and a 65-minute return travel time. On arrival at the tertiary children's hospital, he was directly admitted, and care was transferred to the intensive care unit.

Possible questions suitable for database tracking and "benchmarking":

1. Criteria for use of specialty critical care transport team versus local emergency medical services (EMS)
2. Crew configuration
3. Air versus ground
4. Response times
5. Medications used for rapid sequence intubation
6. Intubation attempts and rates of intubation attempt failure
7. Influence of chest radiograph on tube repositioning

Development of the Database

Database Content

With a philosophical understanding of a "database" in hand, the remainder of the chapter should build into the tangible tools necessary to build and interface with a neonatal and/or pediatric transport database. The primary question driving the development of your database should be simple: "What are you trying to accomplish?" For example, if the goal of a database is target geographic areas for marketing, that database will likely include a detailed list of the specific referral hospital associated with each transport request or completed transport. This is a simple enough concept; however, this "marketing" database will not be adequate if the goal is to answer outcomes research questions. Outcomes research answers would come from 1 of 2 avenues: a separate database uniquely designed with an outcomes focus or a more comprehensive single database built to accomplish both marketing and outcomes research goals.

Building a locally useful database will be addressed shortly, but there are existing databases worthy of review. The Congenital Heart Surgeons Society is a group of 100 pediatric heart surgeons (65 institutions) whose members recognized in 1985 that pooled experience from multiple institutions was the only way that its members could improve their ability to determine the best methods of treating patients with congenital heart disease. That vision of what the pooled experience could accomplish was developed into the Congenital Heart Surgeons' Society Data Center (CHSSDC), with a mission to "improve care…through collaborative research" and a vision that "the data center is a research engine and an academic resource which serves to extract knowledge from the collective clinical experience of the membership."[1] The focus of the CHSSDC is clear. Other fields in medicine have embarked on database development, with varying effectiveness. Other examples of current databases relative to neonatal and pediatric care include the Vermont Oxford Network (VON) Database (neonates), Virtual PICU Systems (VPS LLC [pediatric intensive care]), and the Extracorporeal Life Support Organization (ELSO) Registry.[2–4] Databases need not be focused on a specific patient set or disease entity. The world's largest database of longitudinal medical records exists in the United Kingdom as the General Practice Research Database (GPRD), with more than 5 million active patients in 625 primary care offices.[5] The scope of databases in medicine is best represented in the work of Nick Black, with the directory of clinical databases (DoCDat).[6] Until the final updates of the DoCDat in December 2010, the directory of clinical databases listed 161 independent clinical databases in the United Kingdom alone.[7]

The most common databases in practice do not have fancy names or acronyms but rather live and work in front of many of us daily. The filing cabinet of monthly billing sheets or a Microsoft Excel spreadsheet tracking staff certifications or fleet maintenance schedules are both databases used regularly in many of transport programs. Although often small-scale, those local databases are built to accomplish focused tasks, and most do that effectively. Microsoft Access and FileMaker Pro are 2 of many platforms for custom databases, with both demonstrating relative ease of use and programmability. Beyond the scope of "homegrown" and custom-built databases are numerous proprietary database and electronic health records specific to EMS and/or the interfacility transport setting.

Data Acquisition

Harkening back to the simple principle that information needs should mirror organizational purpose, there must be focus in developing databases. In many ways, this is what separates electronic health records (EHRs) from operational databases. EHRs are generally comprehensive records of vast clinical data, inclusive of every piece of clinical data that was formerly found in the paper-based record.[8] Operational databases are structured collections of specifically selected pieces of data that permit both storage and accessibility of data. EHRs and operational databases can be further distinguished using the US Census analogy. The US Census database is effectively an operational database that highlights uniquely selected pieces of data. If the US Census were an HER, it might display what each surveyed individual had for lunch every day of the year, thus, a more granular look at the population. At the institutional level, EHRs sometimes serve the role of operational databases, as some fully functional EHRs permit ease of access to data via query. These might be dubbed "administrative report" functions by an EHR vendor, thus, blurring the distinction between EHRs and operational databases. At present, many institutions and critical care transport programs lack access to this higher-level EHR functionality.

At the operational level, databases are built with thoughtfully identified key topics, which are supported by fields. Database fields are categories of information that are stored—these must be organized for easy retrieval. A field represents a character, group of characters, or series of numbers that defines a person, place, or thing.[9] In health care databases, fields comprise the individual categories of information which are combined beneath the umbrella of a single encounter. Examples of encounters in a transport database might represent a single trip (trip #071452), with fields permitting the establishment of demographic data, operational data, clinical data, and ultimately, quality improvement data (Table 16.1). Data fields are, themselves, conceptually more granular, but the data in a field permit the extraction of the metric or actual topic of interest. For example, in our hypothetical transport database, a specific transport team may be interested in tracking the efficiency with which they respond to a trip request. Locally, that transport team has defined this time interval as the response time. Although the response time is the topic of interest, the data fields might support the entry of multiple raw times (ie, date of call, time of call, date of departure, time of departure). Subsequently, the database might derive the response time through a programmed algorithm (if date of call and date of departure are the same, then time of departure minus time of call equals response time) and display

Table 16.1: Categories of Patient Data Recommended for a Comprehensive Database

1. **Demographic data:** Case identification, patient age, referring facility identification and location within the facility and classification (can be preprogrammed for routine referral sources with prepopulated fields, although needs to be amendable if changes are needed), and referring and primary care physician identification.
2. **System data:** Mode of transport, staffing levels, use of specific personnel and equipment during transport, date and time of the transport and pretransport and intratransport times, and communication attempts and successes between medical control and referring hospital with times.
3. **Clinical and outcomes data:** Chief complaint, provisional diagnosis *(International Classification of Diseases, Ninth Revision, Clinical Modification [ICD-9-CM]),* procedures *(Current Procedural Terminology [CPT]),* reason(s) for transport, clinical status (eg, intubated, pressors required), adverse events, discharge diagnoses *(ICD-9-CM),* and disposition. Uniformity of coding will be facilitated by storing extracted lists of *ICD-9-CM* and *CPT* codes for diagnoses and procedures frequently encountered during transport and critical care. Financial data (including charges and submitted bills) also can be included in this database.
4. **Quality improvement:** Specific prospective or quality improvement monitors should be incorporated into the database. To understand the true effect of certain events or occurrences, these monitors should be capable of relating designated events to specific outcomes.

Credit: Hamilton Schwartz, MD, MPH, FAAP, and Michael T. Bigham, MD, FAAP, FCCM from Cincinnati Children's Hospital Medical Center.

the calculated result. For reference, a sample of database fields for a single-center custom database is represented in Table 16.2. This is the model whereby metrics are derived for analysis from discrete data fields—similarly stated data are facts, and information is the result of processing those facts to reveal its meaning.[9]

With the exception of only the most highly technically integrated organizations, databases often are still dependent on some indirect method of populating data fields. At the simplest level, databases can be effectively populated by pen and paper methodology. Data entry into simple electronic databases can also be accomplished easily, although electronic databases benefit from data validation to reduce data entry error and permit more accurate data extraction. An example in which data validation might be important is when a patient's date of birth and weight are entered into discrete database fields. An algorithm might be programmed that limits the allowable weight of an 11-month-old child from 5 kg to 20 kg. This would prevent entry with 10-fold errors (ie, erroneously entered weight of 100 kg for a 10-kg child) and possibly entries using pounds rather than kilograms. More advanced electronic databases extract information to populate fields from an existing EHR, thus, reducing some or all requirements for manual data entry. Similarly, there are overlapping interests in existing databases that might inform transport databases and lessen the overall efforts around patient outcomes if these are adequately tracked in an existing or parallel database. For example, a temperature measured at the conclusion of a neonatal transport will likely be tracked on both a transport database and a neonatal intensive care quality database. It is important, however, that the EHR or parallel database is often populated manually and is similarly at risk of transcription errors. In the data warehouse model, the batched "entry" of data fields into a centralized database may also occur manually. The most advanced futuristic database might be populated directly by "smart" equipment where, for example, vital signs are electronically transmitted from the bedside monitor to the EHR and then subsequently to the requisite database fields. This smart technology is in place in many areas, although the future is likely to be highly influenced by refinements to current technology and development of new technologies. Regardless of the tactics that result in population of data fields, compiling information in defined database fields requires appropriate data storage and permits content-specific data extraction and review.

Table 16.2: Sample Custom-Built Database Fields for a Clinical and Operational View of a Single Pediatric/Neonatal Critical Care Transport Team

General Information
Trip #
Date
Date of Birth
Referral Hospital
Pediatric/Neonatal
Working Diagnosis
Disposition (ED, ICU, general care)
Lights/Sirens
Air/Ground
Mileage
Time Intervals
Call Time
Page Time
Departure Time
Arrival at Referral
Assumed Care
Depart Bedside
Depart Referring
Airway
Intubated (referral/team)
Attempts
Failed intubation
Undetected esophageal intubation by referral
Chest x-ray obtained for ETT placement
Intervention after x-ray
Unplanned extubation

Safety/Operational
Death during transport
CPR upon arrival at referral
Diverted to another facility
Wait for delivery
Transport of patient other than original call
Arrive Base Hospital
Call-to-depart time
Page-to-depart time
Reason For Delay
Travel Time
On-scene time
Return Travel Time
IVs/Special Procedures
No IV
Reason for no IV
IV attempts
IV infiltration
Special procedures
Special procedures
Wait for MCP call >5 min
Adverse/near miss events
Protocol deviation
Inappropriate Team Configuration
Inappropriate Mode of Transport
Outcomes
Hospital length of stay (days)
Discharged within 24 hours
Intubated <2 hours after admit
Transfer to PICU within 24 hours
Patient discharged from ED
Death within 24 hours of admit

ED indicates emergency department; ICU, intensive care unit; IV, intravenous catheter; ETT, endotracheal tube; CPR, cardiopulmonary resuscitation; MCP, medical control physician.

Data Storage

Databases can vary significantly in size, from less than 1 megabyte (MB) to extremely large and complicated databases exceeding hundreds of terabytes or even petabytes of data.[10] Most local operational databases must meet several data storage needs: long-term storage, rapid retrieval of data, and backup system to protect from data loss. Data warehouse is a storage method designed to support analysis across individuals, often updated in batched functions rather than in real time.[10] For example, a hypothetical national transport database might serve as a data warehouse and be housed at a single center, yet it might be populated monthly with batched updates of data from all participating transport teams (Fig 16.1). This model has been popular amongst many national databases.

Database Query

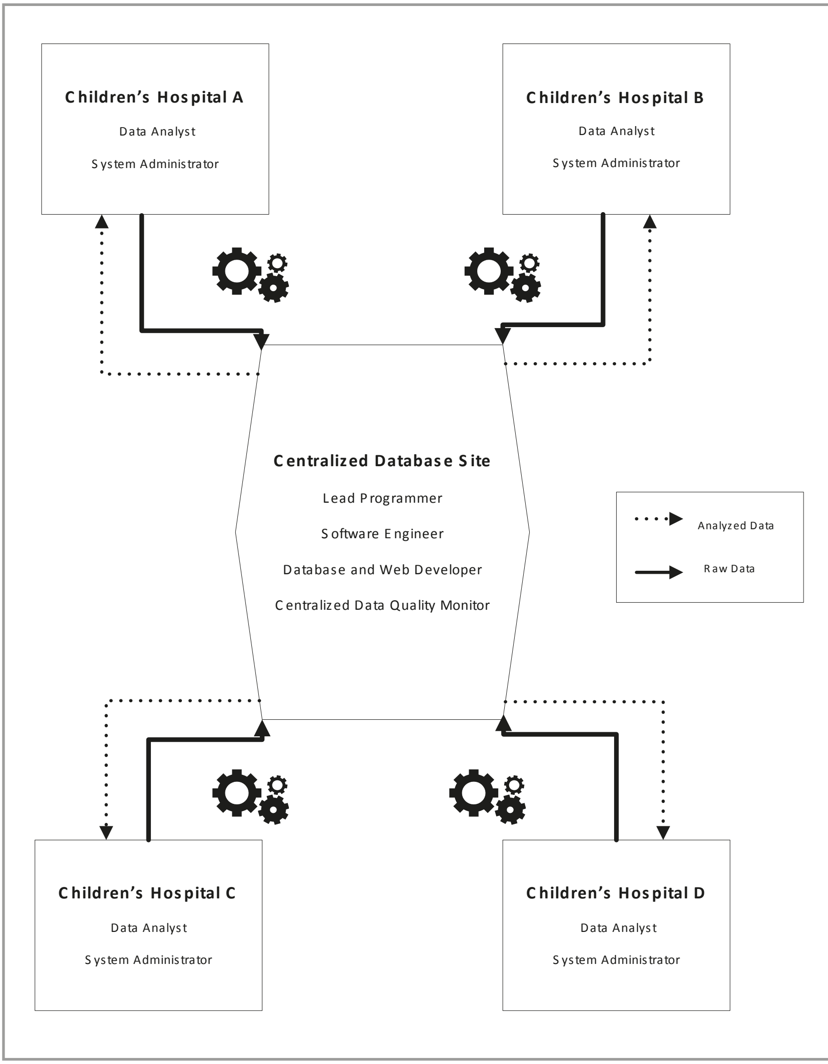
Once topics of interest are identified, data fields are defined, data entry is completed (either manually or electronically), and data are safely stored, the opportunity exists to learn from the database. Simply, a database query is a question posed to the database in a way that permits retrieval of specific information from the database. Classically, queries are constructed using structured query language (SQL). SQL is the declarative language designed for managing data in relational databases.[11] The details of SQL are beyond the scope of this chapter, although data query within the common database software programs are often intuitive. The results of a database query may be depicted as charts, graphs, or diagrams and serve as the “report” generated by the database query. A report depicting response times for a transport team is included as a sample report (Fig 16.2).

Databases and the Law

The Health Insurance Portability and Accountability Act

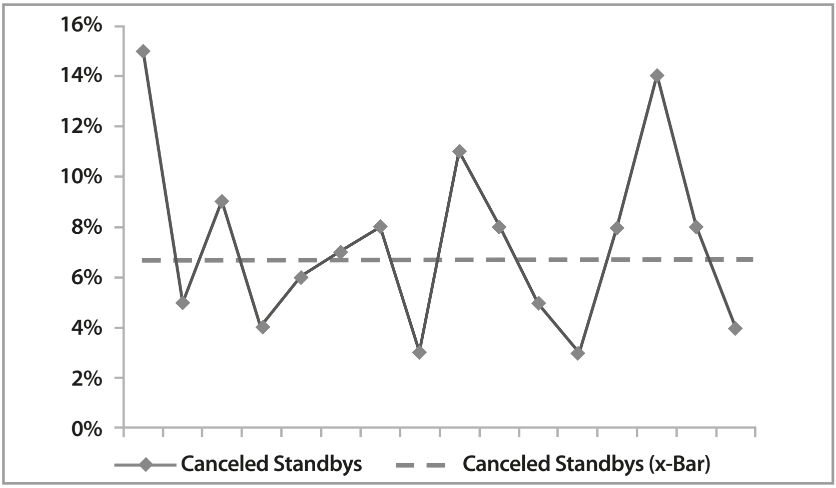
The Health Insurance Portability and Accountability Act of 1996 (HIPAA) was designed to protect health insurance coverage for workers who have lost or changed their jobs. Under the Administrative Simplification rules of HIPAA, the US Department of Health and Human Services was required by HIPAA to develop standards to protect certain health information. The results were the Standards for Privacy of Individually Identifiable Health Information (also known as the Privacy Rule).[12] The Privacy Rule established

Fig 16.1: Depiction of a database structure with a centralized database site (data warehouse) with multiple nodes, each representing a single transport organization



the standards to address the use and disclosure of individually identifiable health information, or protected health information (PHI). The advertised role of the Privacy Rule is to ensure the safety of PHI while permitting the

Fig 16.2.



This report, generated from a database query, depicts the percent (%) of trips in which the initial referring hospital has requested the critical care transport team, although the subsequent triage phone conversation with the transport medical control physician has resulted in a cancellation of the request for critical care transport (usually deferring to local EMS transport).

necessary exchange of health information necessary to promote high-quality health care. PHI includes information relating to:

- the individual's past, present, or future physical or mental health,
- the provision of health care to the individual
- the past, present, or future payment for the provision of health care to the individual and that identifies the individual.

Examples of identifiable PHI include the name, address, birth date, and Social Security number. Deidentified health information excludes the aforementioned "identifiers" and permits exchange of information without restriction. The 2 reported means for deidentification include either formal deidentification by a qualified statistician or the removal of specific identifiers, commonly with a reassignment of a generic "case number." Pertinent to most databases that are built and maintained, a limited data set may be used and disclosed, provided the recipient enters into a data use agreement promising specified safeguards for the PHI within the limited data set (often included in the transport consent language used locally). Written authorization provided by the individual or designee may be used to permit disclosure of PHI, often recognized as the "Release of Information" paperwork.

Additionally, the Department of Health and Human Services developed regulations on security standards for electronically transferred protected health information (e-PHI) dubbed the Security Standards for the Protection of Electronic Protected Health Information (also known as the Security Rule).[13] Simply, the Security Rule provides the operational framework necessary to maintain the protections outlined in the Privacy Rule by including technical and nontechnical safeguards around individuals' electronic health information. The Security Rule does not apply to written or orally transmitted health information. The Security Rule mandates an ongoing process to review access to e-PHI and requires limited access only to "minimum necessary" personnel (role-based access). Additionally, workstation and device security standards are addressed as are institutional network safeguards. To achieve compliance with the Security Rule, local transport databases should be housed on "protected" computers/networks, which are held to the aforementioned security standards. Databases should be password protected, and access for data review should be limited to the minimum number of necessary individuals. Any "shared" database information should be similarly protected.

Combined, the Privacy Rule and the Security Rule standards are rigorous although not prohibitive to the implementation of a transport database. A database can be constructed, populated and maintained within the HIPAA landscape while maintaining significant value toward transport operations and performance evaluations.

Legal Discovery of Databases

The concern with many organizations is the risk of participating in databases that extend beyond a single institution, because the sharing of even deidentified data may affect discoverability should litigation occur. The Patient Safety and Quality Improvement Act of 2005 (Pub L No. 109-41) amended the Public Health Service Act (42 USC Ch 6A) to designate patient safety work product as privileged and not subject to: (1) a subpoena or discovery in a civil or administrative disciplinary proceeding against a provider; (2) disclosure under the Freedom of Information Act (FOIA [5 USC §552]) or a similar law; (3) admission as evidence in any civil or administrative proceeding; or (4) admission in a professional disciplinary proceeding.[14] Although not fully challenged in the legal arena, the premise of the Patient Safety and Quality Improvement Act is sound and should enable necessary cooperation between institutions for joint databases and quality benchmarking.

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CHAPTER 17

Transport Research

Outline

- Medical advances studied for transport
- Potential topics for future transport research
- Funding and training in transport research

With the development of neonatal and pediatric transport medicine as a specialty during the last 75 years, there is an increasing need for evidence-based research to support clinical practice in the transport environment. Although it seems logical when developing a new program to simply apply neonatal intensive care unit (NICU), pediatric intensive care unit (PICU), and emergency department clinical protocols, most transport professionals quickly discover that many techniques and therapies used in the hospital need to be adapted to the unique ground and air transport environments.

Although neonatal-pediatric transport programs are often part of children's hospitals, many teams originate from general adult and pediatric programs, or in the case of unit-based neonatal teams, from available or interested NICU staff. Given the variability of training and experience among team members, it is of vital importance that there be more organized efforts on a national level to improve quality of care using evidence-based research. Much neonatal-pediatric transport clinical research has focused on justification and optimal composition of specialized neonatal-pediatric transport programs. Limited investigational reports, mostly single-center studies, during the last few decades, have analyzed the benefit and efficacy of key transport equipment and therapies. This chapter reviews some of the key pediatric advances that have been critically examined in the transport arena, lists potential areas for future research projects, and discusses funding and training opportunities to improve the quality of transport research.

Medical Advances Studied for Transport

Transport Risk Scores

Many teams have used the Pediatric Risk of Mortality (PRISM), Score for Neonatal Acute Physiology (SNAP and SNAP-II), and Glasgow Coma Scale (GCS) in their clinical practice; however, except for the Glasgow Coma Scale score, these assessment tools were developed primarily for in-hospital use. Several recent transport studies[1,2] used the PRISM instrument to account for case severity, thus illustrating the utility of a scoring tool in transport research. In 2001, Lee et al[3] reported the development and application of the Transport Risk Index of Physiologic Stability (TRIPS) instrument. This specific infant transport assessment tool, used on arrival of the transport team at the referring hospital and again after arrival at the referral center, includes clinical signs such as temperature, blood pressure, respiratory status, and response to noxious stimuli. These investigators report that their scoring model was a reliable predictor of short-term mortality (<7 days), total NICU mortality, and severe intraventricular hemorrhage.

In 2004, Broughton et al[4] reported on the Mortality Index for Neonatal Transportation (MINT) score, which is calculated at the initial telephone request for transport. The authors commented that this score was useful for deciding resource allocation (eg, the need for the most experienced transport team in the setting of a high score). Derived from 7 objective variables (pH, infant's age, 1-minute Apgar score, birth weight, partial pressure of oxygen in arterial blood [PaO_2], presence of a congenital abnormality [yes or no], and intubated [yes or no] at the time of the transport call), the maximum possible score was 40. Higher scores correlated with increased risk of mortality; 80% of infants with MINT scores >20 died. Results from these 2 studies support the usefulness of risk assessment and should be considered for inclusion in quality assurance activities to evaluate transport outcomes, including any potential influence of team configuration on outcomes.

Surfactant Administration

The use of exogenous natural surfactant is the standard of care for neonates with confirmed respiratory distress syndrome (RDS). There still is debate about the benefit of administering surfactant immediately after birth (prophylactically) or within the first few hours of life (for rescue). Regardless, multiple studies have shown consistently that early administration has benefit in preventing long-term mortality and morbidity for neonates with RDS.

Although it seems logical to give surfactant to appropriate patients by the transport team at the referring hospital, there have been only a small number of abstracts and studies reporting outcomes and complications with this practice. Clinical concerns of transport team members administering surfactant include the following: (1) level and experience of personnel training; (2) sudden hypoxemia; (3) plugged or displaced endotracheal tubes; (4) air leaks attributable to sudden increases in lung compliance; (5) pulmonary hemorrhage; and (6) hyperventilation. In addition to the fact that there may be limited resources at the referring hospital should a complication occur, the need to travel with the infant can make assessment and intervention more challenging following surfactant administration. In response, many teams have arbitrarily adopted a minimum 30-minute wait time after surfactant dosing before a neonate can be moved to adjust ventilator settings, including pressure limits and the fraction of inspired oxygen.

Three small retrospective studies have been conducted to evaluate the safety and efficacy of surfactant administration prior to transport.[5-7] Administration of surfactant has been demonstrated to be safe if vigilant intratransport monitoring of the infant is performed and ventilatory and oxygenation settings are adjusted to account for improvements in lung compliance following surfactant administration. However, there was no significant difference noted in morbidity and mortality of infants who received pretransport surfactant compared with those who did not.

Although surfactant treatment before interfacility transport offers potential opportunities for improving the outcomes of outborn infants, the safety concerns of surfactant administration prior to transport persist. Although not specifically studied in the transport environment, the results of several inpatient studies suggest that preterm infants treated early with surfactant during a brief period of intubation followed by nasal continuous positive airway pressure (CPAP) have improved outcomes and decreased need for mechanical ventilation.[8,9] The reduction in need for mechanical ventilation may be particularly advantageous in the transport setting, where monitoring for changes in lung compliance is difficult and may lead to an increased risk of hyperventilation and pneumothorax. If administration of surfactant prior to transport is not available or deemed not to be safe, the SUPPORT study group found that early CPAP reduced the need for intubation and was associated with a shorter duration of ventilation, suggesting that early CPAP should be considered as an alternative to intubation and surfactant in preterm neonates.[10]

Extracorporeal Membrane Oxygenation During Transport

Extracorporeal membrane oxygenation (ECMO) is a well-established method of providing cardiopulmonary support to neonates with life-threatening cardiac and/or respiratory failure. In general, safe performance of ECMO requires a team of medical professionals, including neonatologists, intensivists, pediatric surgeons, perfusionists, and NICU/PICU nursing and respiratory therapy staff. Because of the complexity of the equipment and the need for anticoagulation, only a few transport programs have developed the capability to initiate ECMO and transport patients during ECMO to tertiary centers. Two large descriptive studies report over a 20-year experience of interhospital transport of neonates and pediatric patients following ECMO cannulation.[11,12] These studies suggest that transport ECMO is feasible and can be safely performed in critically ill children, with survival rates comparable to those of in-house ECMO patients.

The number of critically ill neonates and pediatric patients requiring interhospital transport for ECMO has decreased over the last decade since the availability of inhaled nitric oxide (iNO) and high-frequency ventilation for treatment of patients with severe pulmonary disease. Mainali et al[13] demonstrated that high frequency jet ventilation with or without iNO was a safe and effective alternative for transporting pre-ECMO neonates.

Most ECMO centers encourage early identification and transport of patients with progressive respiratory failure who may require ECMO to prevent the patient's condition from becoming too unstable for travel. If an ECMO center is considering offering ECMO services during transport, it is essential to understand the potential morbidity of ECMO transports and the added number of specialists and specialized vehicles that will be required.

Inhaled Nitric Oxide

iNO has become the standard of care to treat severe hypoxic respiratory failure associated with pulmonary hypertension in term and near-term neonates. Nitric oxide is a selective pulmonary vasodilator with minimal systemic adverse effects. After reviewing many multicenter neonatal studies, the US Food and Drug Administration approved the use of iNO in term and near-term neonates older than 34 weeks' gestation. Although the off-label use of iNO has increased dramatically in the past decade,[14] a Cochrane systematic review found that iNO as a rescue therapy for respiratory failure in preterm neonates had no significant effect on mortality or bronchopulmonary dysplasia.[15]

A retrospective study by Lowe et al[16] suggests that initiating iNO at the referring hospital and continuing the administration during transport decreases the number of hospital days for surviving neonates with severe hypoxic respiratory failure who do not require ECMO. Further prospective, randomized controlled studies are needed to validate these findings.

Commercial equipment is available to provide iNO in conjunction with many transport ventilators and manual ventilation systems. Delivery of inhaled nitric oxide during transport can be technically challenging, and the consequences of increased or interrupted delivery can be dangerous. The American Academy of Pediatrics has published some key references detailing its clinical use.[17] Teams contemplating the use of iNO during transport should ensure the following: (1) training of personnel on the delivery of iNO in the NICU before transport; (2) availability of equipment for measuring dosage and monitoring for environmental exposure of personnel to gas by-products; and (3) a protocol developed with neonatal experts to determine whether patients are appropriate candidates for iNO therapy.

Therapeutic Hypothermia

Therapeutic hypothermia is a relatively new, evolving therapy for improving neurodevelopmental outcomes in term newborn infants with acute perinatal hypoxic-ischemic encephalopathy (HIE). Several randomized clinical trials have demonstrated both safety and efficacy of therapeutic hypothermia (cooling to a rectal or core temperature of 33°C–34°C for 72 hours) in improving neurodevelopmental outcomes in newborn infants with moderate to severe HIE. Because institution of hypothermia within 6 hours of birth is critical for optimal neuroprotection, cooling prior to or during transport is often necessary. Fairchild et al[18] reported a 4-year experience with therapeutic hypothermia on transport. Several smaller studies and case reports also discuss the initiation of passive cooling (withholding external heat sources) while awaiting transport or during interfacility transport.[19,20] Because a substantial risk of unintended overcooling may develop, these studies highlight the need for established protocols and education of referral and transport personnel as well as continuous monitoring of core temperature when passive cooling is used. Randomized-controlled trials are needed to further evaluate the safety and efficacy of therapeutic hypothermia on transport.

Neonatal Transport Team Workforce

A national survey of neonatal transport teams (NTTs) in the United States described characteristics of this workforce and evaluated whether there were any differences between unit-based and dedicated teams with regard to team training and a subset of complex procedures allowed on transport.[21,22] A total of 398 NTTs were located in the United States, and 335 completed the survey, for a total response rate of 84.2%. Two hundred twenty-nine (68.4%) of the NTTs were unit-based, and 106 (31.6%) were dedicated teams. Using the chi-square test, no differences were found between unit-based and dedicated teams for most of the items pertaining to orientation and procedures allowed on transport. However, statistically significant differences (P <.01) were detected for certain national certification courses (ie, Advanced Pediatric Life Support, Pediatric Advanced Life Support, Pediatric Education for Prehospital Professionals, and Pediatric & Neonatal Critical Care Transport) and adult transport and trauma courses (ie, Advanced Trauma Life Support and Transport Nurse Advanced Trauma). This survey result is likely explained by the fact that 63% of the dedicated NTTs also combined with pediatric or adult teams. For procedures allowed on transport, only pneumothorax evacuation by needle aspiration or chest tube insertion was significantly different (P <.025). Despite this result, the percentages of teams who could perform pneumothorax evacuation were similar; 84% of unit-based teams and 95.3% of dedicated teams performed needle aspiration or chest tube insertion in the critical care transport environment.

In this workforce survey of neonatal transport teams,[21,22] differences were also observed between unit-based and dedicated teams for one aspect of orientation curriculum that involved specialized transport training (ie, altitude physiology, noise on transport, emergency safety training, and team stress and crisis management). Again, this difference between team types can be at least partially explained by the much lower percentage of unit-based teams that transported neonates by helicopter (34.5% compared with 74.5% of the dedicated teams) or airplane (20.5% versus 67% of the dedicated teams). When the annual transport volume exceeded 200 neonates, the type of team was more likely dedicated in structure. Only 27.4%

of the dedicated teams transported fewer than 200 per year, whereas 85% of the unit-based teams indicated this was their transport volume. The median transport volumes reported in this study suggests that as many as 68 797 critically ill neonates are transported each year, with dedicated teams transporting 58% and unit-based teams transporting 42% of the infants.[21,22]

King et al[1] reported no difference in mortality, transport-related morbidity, and outcome (success) of procedures after changing from a nurse-physician team to a nurse-only team configuration. Transport nurses provided care equivalent to a team that included a resident or fellow physician; however, it should be noted that during the study period, a physician did accompany the nurse-only transport team to retrieve 15 patients with anticipated increased severity of illness; 4 of those patients died. Overall, team response time improved and transport times were significantly shorter with the nurse-only team compared with the prior transport structure of a physician-nurse team.

Pediatric Transport Team Workforce

Orr et al[2] evaluated survival rates and unplanned events during the transport process when patients were transported by either a pediatric critical care specialized team or by nonspecialized teams. Nonspecialized teams were identified as transport generalists, although it should be noted they were personnel from 4 competing air medical transport services, and all 4 services were fully accredited by the Commission on Accreditation of Medical Transport Systems. The nonspecialized teams had limited pediatric training and experience with pediatric emergencies, whereas pediatric critical care specialized teams were those with extensive training and experience in pediatric critical care. To estimate severity of illness, the PRISM score was calculated at 2 time points: at the referring hospital and during transport. Although 94% of the patients (n=1021) were transported by a pediatric specialty team, unplanned events occurred significantly more often among the 64 patients transported by nonspecialized teams. These morbidities included airway-related events, cardiopulmonary arrest, equipment failure, sustained hypotension, loss of intravenous access while inotropic support was required, and pneumothorax. The authors commented that the only variable that differed between the 2 populations was the transporting personnel. When patients were transported by nonspecialized teams, the transport times were shorter, which may have represented emphasis on a speedy transport rather than taking the time to perform an adequate stabilization. Death occurred significantly more often amongst patients transported by nonspecialized teams compared to specialized teams (23% versus 9%; $P < .001$). Data from this study confirm that patient safety and outcomes are improved when critically ill children are transported by specialized pediatric transport personnel.

Method of Transport and Effect on Outcomes

Evaluation of air versus ground transport on neonatal outcomes was studied by Killion and Stein.[23] Arrival at the referring hospital for the 138 air transports was 25% faster (72 ± 17 minutes) than for the 2957 transports by ground (95 ± 23 minutes); however, neonatal outcomes (mortality, chronic lung disease, oxygen at hospital discharge, grade 3 or 4 intraventricular hemorrhage, stage 3 or worse retinopathy of prematurity, length of hospital stay, and ventilator days) were no different when transported by air versus ground. The authors concluded that the time saved by transporting by air had no effect on patient outcome and that the riskier mode of air transport should be reserved for the sickest of patients who are located in referring hospitals the furthest away.

Potential Topics for Future Transport Research

Table 17.1 details, by category, some potential topics for future neonatal and pediatric transport studies. The list is only a starting point and should be expanded whenever possible.

Proposed research questions should be answerable and directly relevant to clinical transport medicine. Studies must be well designed; approved by appropriate institutional review boards; performed in a compliant, ethical manner; and appropriately peer-reviewed in presentation and/or publication venues (see Chapter 18). Research is needed to test new and existing equipment, therapies, and protocols for effectiveness and cost-efficacy. There is concern that some currently used transport equipment has not been optimally tested to determine whether it is compliant with national safety standards. Moreover, studies should be conducted to determine whether existing national safety guidelines are sufficient for neonates and children transported via specific modes of transport and with commercially available incubators and stretchers.

Table 17.1: Possible Topics for Neonatal and Pediatric Transport Research Studies

A. Administration and personnel

1. Team composition (eg, nurse, neonatal nurse practitioner, registered respiratory therapist, physician): are there optimal compositions that improve patient outcomes?
2. Do unit-based and dedicated transport teams deliver equivalent care as measured by patient outcomes?
3. Do protocols improve transport team care and patient outcomes?
4. Informed consent procedures: are they sufficient?
5. What are the risks/benefits of parents accompanying their children during a critical care transport?
6. Does telemedicine/video-conferencing assist with critical decision support for patient stabilization and improve outcomes?
7. Does telemedicine/video-conferencing decrease the need for transport?
8. Infectious disease protocols
9. Does accreditation improve quality and outcomes of air medical transports?
10. Does neonatal/pediatric transport team national certification improve patient outcomes?

B. Financial analysis

1. *Current Procedural Terminology* codes and reimbursement analysis
2. Cost justification of specialty transport teams

C. NICU medical therapies

1. Initiation of iNO during transport: does it make a difference?
2. Thermoregulation: analysis of different incubators and techniques
3. Surfactant: analysis of effectiveness and adverse effects
4. Maternal transfer after neonatal transport
5. Development and testing of acuity scoring models
6. Safety of neuroprotective hypothermia in the transport environment
7. Are there any benefits to initiation of cooling prior to admission to the NICU?

D. PICU and ED medical therapies

1. EMS, PICU, or ED team for pediatric and trauma transports
2. Initiation of shock treatment protocols and outcome analysis
3. Development and testing of acuity scoring models
4. Disaster management: effect of the Pediatric Regional Preparedness Network guidelines on mass casualty incidents: Is evacuation more efficient and safer and are patient outcomes improved?

E. Outcomes

1. Morbidity and mortality comparison of critically ill neonates born at a community vs a tertiary center
2. Adult vs specialty teams for pediatric patients
3. Air vs ground: triage scoring tools to assist decision-making about appropriate mode of transport, outcomes and costs
4. Reverse transport: practice, benefits, and limitations

NICU indicates neonatal intensive care unit; iNO, inhaled nitric oxide; PICU, pediatric intensive care unit; ED, emergency department; EMS, emergency medical services.

Funding and Training in Transport Research

Not until 1990 did transport medicine receive section status within the American Academy of Pediatrics. The Section on Transport Medicine and other national transport organizations have recently increased their focus on efforts to improve quality of care using evidenced-based research. Because transport proposals have not constituted a large percentage of granting agency requests for research study applications through Requests for Applications, many qualified projects have not been conducted because of lack of funds. Funding may be available through private foundations, national transport or pediatric health care organizations (Table 17.2), and some private corporations.

Table 17.2: Sources of Possible Grant Information and Support for Neonatal-Pediatric Transport Research

Name	Address
American Academy of Pediatrics	http://www.aap.org
Association of Air Medical Services	http://www.aams.org
National Association of EMS Educators	http://www.naemse.org
National Institutes of Health	http://www.nih.gov
Emergency Services for Children	http://www.ems-c.org
March of Dimes	http://www.modimes.org

In part because most transport programs have been primarily focused on the provision of clinical care, there has not been a strong emphasis on research and research funding. It is clear, however, that to improve the clinical care, quality, skilled, and funded research and researchers are required. Clinical research training (eg, study design, grant writing, biostatistics, and epidemiology) may be obtained at local medical schools or universities. In fact, many medical centers have established clinical research facilities and staff to support personnel in obtaining skills and conducting clinical studies.

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CHAPTER 18

Ethics

Outline

- Ethics of critical care patient management and interactions
- Ethical requirements to the patient
- Ethics of research during transport
- Consent and assent issues (consent fully covered in legal chapter)
- Ethical dilemmas that may occur during the referral, triage, or care periods
- Ethics/responsibilities of approach to less than optimal, poor care (or perceived malpractice) analysis and follow-up (how should one approach those dilemmas at local and outside institutions)
- Resources and educational activities related to ethics and medicine/transport

Ethics of Critical Care Patient Management and Interactions

Medical personnel involved with the transport of critically ill or injured children regularly encounter situations that require ethical consideration. A basic understanding of ethical precepts assists in forming a structured approach to responding to such situations. Applicable ethical precepts for consideration in the transport process include: obligations, consequences, rights (which includes the respect for autonomy), virtue, justice, and general moral constraints.

Obligations include those of a fiduciary nature to the patient and those of professional integrity. The term fiduciary refers to one who acts on behalf of another to promote their well-being. In medical settings, fiduciary obligations encompass the need to protect and promote the best health interest of the patient. This duty is expressed in the principles of beneficence and nonmaleficence. Beneficence refers to the principle of "doing good." Nonmaleficence involves the tenet of "first, do no harm." In any clinical setting, it is incumbent on the medical team to seek a balance of clinical good over clinical harm in the care of the patient. This can be a particularly important consideration in the transport of a critically ill/injured child, as the team weighs the benefit of more specialized care with the inherent dangers of transporting critical patients.

Consideration of the consequences of decisions made regarding transport is vital. Consequences surrounding decisions may be either long or short term, will involve all parties (eg, a particular patient, other patients, family, health care professionals, and health care organizations), and should be evaluated in regard to the seriousness of the individual action or nonaction:

- Irreversible
- Serious and far-reaching
- Probable—what is the likelihood of a consequence occurring?

The strongest of any consequence should govern actions to promote the best possible outcome and anticipate course of action, should they occur. Rights can be described as justified claims against individuals or institutions to act or not act in a specific manner. Perhaps the most venerated right in clinical medicine is respect for autonomy. Personal autonomy describes the moral right of people to choose and pursue their own plan for life. This is a particular challenge in pediatrics, because children are generally reliant on a surrogate in the decision-making process. Ethically, these surrogate decision makers should make choices on the basis of 2 things: (1) reliable information about the patient's own beliefs, values, and preferences; and (2) the patient's best interest. The latter standard implies that decisions will be made by the surrogate on the basis of the protection and promotion of the patient's health-related interests and that patient's autonomy. Also included in a discussion of rights are confidentiality and the virtues of honesty and respect.

Virtues are characteristics of an individual that focus on the interests of others and promote those interests by fulfilling our obligations to them. They include, but are not necessarily limited to, compassion, courage, integrity, and self-sacrifice as well as those noted previously.

Justice is the intention to be fair in the administration of both risks and benefits. Justice involves how competing needs are addressed in a setting of limited resources. Ethical obligations involving the concept of justice are sometimes difficult, because there is no single consensus concerning which of the 3 major interpretations of justice should be primary:

- Libertarian: health benefits are dispensed on the basis of what the patient can pay.
- Egalitarian: all should receive health care benefits in proportion to what the individual's actual medical needs require, without regard to cost.
- Basic decent minimum: medical benefits are provided in proportion to the individual's basic medical needs but not beyond. Any medical needs above the basic provision are in proportion to what the patient can pay.

Limited resources may affect the principle of justice, and other factors, such as need, possible benefit, and access, must be taken into account.

Moral constraints also limit what is ethically permissible in medical practice, independent of other ethical precepts. Moral constraints may be religious or secular in origin and may be cultural. Moral constraints may vary from one religion or culture compared with another. Although they should be treated as important factors weighed against other ethical considerations, these moral constraints should not necessarily hold sway, because they are not constant, whereas the other precepts enumerated previously are.

Finally, one must balance our obligations to patients against legitimate interests of our own. Self-interests of a health care professional include preserving the ability to provide appropriate care well and faithfulness to one's own personal values, beliefs, and moral convictions (ie, personal integrity) in spite of outside circumstances and demands.

This chapter addresses several ethical issues: those related to the patient, research, consent/assent, ethical dilemmas that may occur during the transport process, and perceived or real malpractice.

Ethical Requirements to the Patient

Ethical obligations to the patient exist in part from the parents or guardian of the patient, the medical care givers providing treatment to the patient (including the transport team), and the medical milieu of the patient (eg, hospital, clinic, ambulance). Although the pediatric patient does not have the right of autonomy per se, all of the surrogate decision makers should adhere to the best interest standard.

All ethical precepts should be considered and balanced against one another to determine an ethically appropriate approach to the patient. Both the short- and long-term consequences of transporting or not transporting a patient should be examined. The patient who is clearly dying and to whom further escalation of care would be futile may not be a candidate for transport. Similarly, that same patient may not wish to be transported. As much as possible, a patient has the right to participate in the decision-making role and to receive information. The American Academy of Pediatrics recommends that pediatric patients participate in decision making commensurate with their level of maturity, and assent should be sought to respect the pediatric patient's developing maturity and autonomy.

The virtues listed previously also will come into play. It is nearly impossible to have only one virtue considered to the exclusion of the rest, because virtues are often interdependent and interrelated. Furthermore, most patients are more concerned about feeling protected and cared for than they are about the technical abilities of their providers. Demonstrating compassion for the patient's pain, suffering, and circumstances takes courage, seeking to make the "right" decision and ignore or not be excessively swayed by the "correct" decision. To arrive at the right decision, integrity and honesty need to be considered: one's own personal and professional integrity as well as an honest assessment of the patient's condition. The latter assumes a nonjudgmental approach to the patient's medical needs. It also assumes the parents and guardians are never told anything false. However, caregivers should not speculate as to the prognosis or condition of the child, or indeed other patients. For example, "We'll take the best possible care of your child," provides an honest and reassuring statement without speculating about uncertain outcomes. This evaluation of the patient's needs, in turn, may invoke the principles of beneficence, or "doing good" and nonmaleficence, or "first, do no harm." These 2 principles should not be separated. In other words, nonmaleficence should not be used independent of beneficence.

Usually, justice does not play a role in transport decisions. However, in the case of limited resources (eg, lack of organs for transplant, limited availability of extracorporeal life support systems, multiple patients needing transport, need for air transport where only ground is available), taking into account the likelihood of need, benefit and cost should be explored prior to undertaking a transport. Any ethical issue that requires that a controversial decision be made has implications regarding the relevant ethical precepts that should be carefully considered so that the best ethically justified argument for a particular decision is made.

Ethics of Research During Transport

The future health of children depends on conducting clinical research in which children participate. Both ethical and legal requirements govern research with human participants. This is especially true of research that involves children and other vulnerable groups, particularly when those groups are in the midst of an emergency. Because of the inherent vulnerability of children, research must be designed carefully to ensure that the participants are not placed at excessive risk or unfairly denied potential benefit. Federal regulations governing research involving children and local institutional review boards (IRBs) exist to ensure that research involving children occurs in a way that protects their welfare. For research in the transport setting to satisfy ethical and legal requirements, it must be scientifically sound and significant; subject selection must be fair; approaching families for enrollment must avoid pressure; risks to participants cannot be excessive and must be minimized; risks must be justified by the benefits of the research; informed consent, parental permission, and assent must be obtained when appropriate; enrolled subjects must be respected; and the protocol must have been approved by an IRB. In most cases, the best source of information and guidance about research protocols will be the local IRB.

In some cases, research in the transport environment is designed to study emergency procedures that offer the prospect of direct benefit to potential participants. In this case, enrollment must take place immediately, and the parents or guardian may not be available to provide permission. This presents a special situation governed by special rules. Under these circumstances, the research can proceed without permission of the parents only under restricted guidelines outlined by federal regulation (Table 18.1). Public disclosure of study results also is required by law in this situation.

Consent and Assent Issues

The requirement to obtain informed consent from a patient or legal guardian before providing medical care is a central feature of health law and ethics. A person may not be touched, treated, or transported without his or her consent. The Joint Commission has stated that, “A properly executed informed consent contains documentation of a patient’s mutual understanding of and agreement for care, treatment, or services through written signature, electronic signature, or, when a patient is unable to provide a signature, documentation of the verbal agreement by the patient or surrogate decision

Table 18.1: IRB Criteria for Research Performed Without Informed Consent—FDA Final Rule (FDA Final Rule: 21 CFR Part 50.24. Adapted from the FDA Information Sheet)

- The subject is facing a life-threatening or permanently disabling situation for which the only known therapy is investigational, unproven, or unsatisfactory and the collection of valid scientific evidence is necessary to determine the safety and effectiveness of a particular intervention;
- The child is incapable or unable to provide valid consent and the parents cannot be reached for permission before the time the investigational treatment must be started;
- The experimental treatment has a realistic probability of benefit that equals or exceeds that of standard care;
- The risks of the experimental therapy are reasonable in comparison with the patient's condition and standard therapy;
- There is minimal added risk from participation in the research protocol;
- There is no possibility of obtaining prospective consent from individuals likely to need the experimental therapy;
- The therapeutic window is defined and the principal investigator is committed to attempting to contact legally authorized representative within that narrow window of time;
- Participants and/or parents will be provided with all pertinent information about the study as soon as possible;
- Once the legal surrogate decision maker has been informed of the research, he or she may choose to discontinue participation at any time after being fully informed of the consequences of doing so;
- Federal regulations require that input from community representatives be sought about the protocol before IRB approval to gain a form of "community consent" to proceed with the research and that public disclosure of the research and its risks and benefits be made to the community from which potential participants will be enrolled before initiation of the research; and
- Alteration or waiver of consent will not adversely affect the rights and welfare of the subjects.

maker." Minors (children younger than 18 years) present a special situation, because they do not have the legal authority to give consent, unless emancipated or designated as a mature minor. Therefore, a surrogate, usually a parent or legal guardian, must give permission before a minor can be medically treated or transported. In situations in which a minor has a condition that represents a threat to life or health and a legal guardian is not readily available to provide consent, transport team members can assess the child, provide necessary medical treatment, and transport the child. The legal basis for taking action in an emergency when consent is not available is known as the *emergency exception rule.*

The emergency exception rule also is known as the *doctrine of implied consent.* For minors, this doctrine means that transport team members can presume consent and proceed with appropriate treatment and transport if the following 4 conditions are met:

1. The child has an emergency condition that places his or her life or health in danger.
2. The child's legal guardian is unavailable or unable to provide consent for treatment or transport.

3. Treatment or transport cannot be delayed safely until consent can be obtained.
4. The transport team administers only treatment for emergency conditions that pose an immediate threat to the child.

This emergency exception rule is based on the assumption that reasonable people would consent to emergency care if able to do so and that if the parents or legal guardian knew the severity of the emergency, they would consent to medical treatment of the child. Any time a minor is treated without consent, the burden of proof falls on any professional treating or transporting the child to justify that the emergency actions were necessary. The transport team must clearly document in the child's record the nature of the medical emergency and the reason the minor required immediate treatment and/or transport.

If possible, interfacility transport team members should contact online medical control for assistance when consent is unclear or unavailable. If the guardian is unavailable and cannot be notified, information about the destination emergency department should be provided to the most responsible person on scene with instructions to pass the information on to the minor's legal guardians. As a general rule, when the transport professional's authority to act is in doubt, team members should always do what they believe to be in the best interest of the patient.

Ethical Dilemmas That May Occur During the Referral, Triage, or Care Periods

Ethical dilemmas may occur related to the consequence of transporting or not transporting the pediatric patient. Triage decisions regarding the availability and type of facilities available to care for the patient after transport brings forward the issues of justice. Similarly, there is a balance between acts that address beneficence and those that address nonmaleficence. The natural urge to help ("do good") for a patient must be weighed against protecting the patient and family ("first do no harm").

Medical information is considered private, and personal health information is protected by law. Careless or inadvertent revealing of identifiable information are risks that transport team members face, as they frequently care for ill or injured people in a public environment. Team members have a fiduciary responsibility to protect and promote a patient's health related interests. Moreover, there is an ethical appeal to the duty of respect and sensitivity for the patient's vulnerability. It is essential that transport team members remain aware of the potentially sensitive nature of identifiable information and take every possible precaution as they care for patients, including children. Sensitive discussions should, when possible, occur where bystanders cannot overhear them. The use of last names should be avoided if possible at the scene. Private information should not be shared with any other than those legally responsible for the patient. Finally, because radio communication systems may be monitored, use of names should be avoided unless absolutely essential to the receiving hospital. If use of names is important, then a telephone should be used at the scene rather than a radio.

A particularly challenging situation occurs when transport team members are faced with parents or a legal guardian who refuses to give permission for further medical treatment or transport of a child or are mentally incapacitated (eg, intoxicated). As long as those individuals are alert, oriented, and mentally competent, they have the right to refuse medical care for their child. However, this should be informed refusal. In other words, the risks and benefits of refusal should be clearly communicated in language that can be understood by the parent or legal guardian and documented in the medical record. Moreover, the guardian is required to act in the best interest of the child and not what is the best interest of the parent or guardian.

The American Academy of Pediatrics has clearly stated that physicians should be prepared, "to seek legal intervention when parental refusal places the patient at clear and substantial risk." Such circumstances require that the transport team notify on-site or online medical control for guidance. The medical control physician might speak directly with the legal guardian. When the legal guardian still refuses to consent to medical care or transport that is necessary to prevent death, disability, or serious harm to the child, it is both legally and ethically appropriate to notify social service agencies and/or the court to intervene under local and state child abuse and neglect laws as the child may need to be placed in temporary protective custody. Likewise, when parents or a legal guardian seem to be intoxicated or otherwise impaired, involvement of law enforcement officers or the court may be necessary. In these rare situations, the hospital attorney or legal office at the referring and receiving facilities also should be notified after the safety of the child has been ensured.

Although temporary protective custody may allow the transport team to transport a minor to a medical facility for purposes of further emergency medical evaluation and care, it does not give medical professionals the right to treat a minor for medical conditions that are not serious or life threatening. A medical professional can provide medical treatment without consent only when the child has a medical condition that poses a risk of death or serious harm, when immediate treatment is necessary to prevent that harm, and when only the treatments necessary to prevent the harm are provided. The transport team should discuss these situations with medical control before initiating treatment whenever possible and clearly document these decisions in the medical record.

In the aforementioned situations, team members should attempt to establish whether the caregiver refuses all care and transport or only certain aspects of care. One should also evaluate the ethical tenets that may underlie those refusals. General moral constraints, such as opposition to forms of medical treatment because of religious tradition, may play a role (eg, refusal of blood transfusion by Jehovah's Witnesses), as can language barriers. Although language barriers are usually thought of as 2 different languages and the misunderstanding that can occur when people do not have fluency in each language, lack of health literacy may result in the family and/or the patient not understanding the need for medical care and transport of the patient. Written patient information materials must be written at a level (4th to 6th grade) to enhance comprehension. Miscommunications can have a significant effect on a child's care, especially if transport team members are unable to obtain information about a child's underlying medical conditions, allergies, current medications, and other relevant and important information. Transport team members should be familiar with the resources locally available to provide professional translation and interpretation in a timely manner. If such services are not available, a family member or neighbor might be available to assist with a rough interpretation. Transport team members should be aware, however, that the interpretation may not be accurate when a trained interpreter is not used.

If all attempts at improving communication are unsuccessful and the child can be transported safely without initiating care, the parent's or guardian's wishes concerning treatment may be respected. It also may be appropriate for the caregiver of a child with a terminal illness or significant disabilities to restrict or request certain kinds of care for the child, thus invoking the concepts of beneficence and nonmaleficence.

On rare occasions, parents or guardians may disagree among themselves whether to consent to treatment and transport of a sick or injured child. In these cases, it is important to establish whether one or both has legal decision-making authority on behalf of the child. Because state laws vary with regard to the legal authority of the father when parents are unmarried, transport team members should be familiar with state and local laws that govern this situation. If both caregivers have legal authority, transport team members may need to negotiate a plan that is acceptable to both and respects the rights of all. Focus should be on the child's needs and the ethical goals of compassion and self-sacrifice to assist the child. Self-sacrifice in this context would mean taking a risk to the caregivers own self-interest in terms of time spent and convenience to protect and promote the interest of the patient. This strategy can deflect attention away from the disagreement and may be successful in resolving the issue.

To respect the autonomy of others, transport team members should always remain nonjudgmental and respect those requests that may stem from cultural or religious beliefs. They should acknowledge the importance of these requests, and attempt to accommodate them when they do not pose a risk to the child. When the transport team cannot accommodate requests that are based on cultural or religious beliefs because they would put a child at risk of serious harm, they should respectfully explain the reasons for being unable to accommodate the requests.

One of the most difficult ethical situations involves the patient who is terminally ill. If there is a do-not-resuscitate (DNR) order in place, signed by a physician, it informs the provider that cardiopulmonary resuscitation should not be initiated or should be of limited scope in a cardiopulmonary arrest. Only some jurisdictions recognize prehospital DNR orders as valid for children. It is very important that transport team members clarify the limits of the DNR laws governing their service areas and develop protocols for dealing with them. Regardless of the nature of DNR laws, a parent of legal guardian generally may revoke a DNR order written on behalf of a child. When faced with a valid DNR order written for a child and a legal guardian requests that the child be resuscitated, the legal guardian's wishes generally should be followed. Some DNR orders are for "partial DNR," so it is important to discuss with the parents or legal guardian what kinds of interventions they have arranged to be provided and which they have not. For example, oxygen delivery may be acceptable, but transport and hospital admission may not. Discussion with on-site and online medical control and consultants may help transport personnel deal with these issues.

In the course of stabilizing the patient prior to transport, resuscitation may be required. The wishes of the surrogate decision maker will usually guide the extent and duration of the process. To maintain professional and personnel integrity as well as a respect for the patient, local resuscitation policy should define circumstances when cardiopulmonary resuscitation should be initiated, when it may be withheld, and when it may be stopped. If resuscitation is ineffective or not indicated (ie, the patient is clearly dead), it is ethically permissible to stop or not initiate the process. For pediatric cases, the policy should favor resuscitation in questionable cases, but allow appropriate withholding of resuscitation to focus on grief management and family interaction. This may be emotionally difficult for transport team members, but the aforementioned ethical precepts of integrity and respect as well as the virtue of honesty should guide their actions.

The practice of allowing family members to be present during resuscitation remains somewhat controversial. However, available data overwhelmingly suggest that families want to be given the opportunity to be present for the resuscitation of a child or loved one, that they do not interfere with the staff, that staff do not feel excess stress when family members are present, and that family members may deal with grief in a more healthy manner if they were present during a resuscitation attempt after which a loved one died. Families are also reassured that everything was done for their child that could be done. Therefore, family members should be given the opportunity to be present during resuscitation and transport, if they desire and it does not interfere with patient care (see Chapter 12). Having a dedicated staff person identified and available to support family members during resuscitation is helpful and recommended.

Ethics/Responsibilities of Approach to Less-Than-Optimal or Poor Care (or Perceived Malpractice), Analysis, and Follow-Up

Policies, such as contracts, should be developed between the agency that provides the transport team and the organization (eg, hospital, clinic) that request transport that clearly define the responsibilities of each during the course of the transport. In this manner, members of the transport team will not find themselves in disagreement with the referring physician about care to be provided to the child before or during transport. This arrangement respects the autonomy of all and clearly delineates responsibility for decision making. With clear delineation, the following could be avoided: the transport team may believe intubation is necessary for a safe transport, and the referring physician may disagree and not allow them to perform the procedure. In the absence of such policies, transport team members should attempt to engage the individuals with whom they disagree in a respectful and honest discussion about the differences in the transport environment that require procedures not necessary in the inpatient environment to be performed. If patient condition allows, this discussion should occur away from the child and the child's family to maintain confidentiality. The welfare of the child should always remain the primary focus. If an agreement cannot be reached through respectful dialogue, the transport team should contact medical control and have the medical control physician speak with the referring physician.

Occasionally, transport team members will have concerns about clinical care given to a patient before or during transport. They may have questions about their obligations to provide feedback to the person who gave the care in question or to notify the patient or family that they suspect harmful or deficient care was given or that mistakes were made.

Although honesty and transparency regarding mistakes is important, transport team members rarely have a full understanding of the many factors that may have affected care provided before their arrival. In most cases, transport team members should avoid making premature and misinformed judgments about the care given by others. The focus initially should be on the care of the patient and stabilization of the patient's condition. Once transport has been completed, there should be a clear and direct mechanism for communicating concerns to the provider in question, collecting the necessary data to determine whether care was appropriate, and providing a formal means for review of the data and remediation, if necessary. Family members should be notified about errors or deficient care, but only after an adequate investigation of the facts has determined that this occurred.

Resources and Educational Activities Related to Ethics and Medicine/Transport

The most important step in establishing ethics as a priority in transport is encouraging the exploration and discussion of morally challenging scenarios. Providing teams with a safe, confidential environment where questions and concerns about patient care and team function can be shared sets the framework for developing practices that advance the ethical and effective treatment of patients and their families. There are several basic texts that explain the basic tenets of clinical ethics and case studies in ethics (see Selected Readings). Additionally, there are many online workshops, case-based education modules, and group discussion guides for exploring ethics in clinical practice.

Below are some hypothetical scenarios for consideration and discussion surrounding ethical precepts in transport.

Scenario One: Discussion of beneficence and nonmaleficence

A child with a devastating head injury is initially taken to a small community hospital. A team is dispatched to transport the child to the regional trauma center. On team arrival, the child is obviously moribund. The extended family has arrived and is huddled together. A ground transport would take 3 hours, and there is only room for 1 parent.

Scenario Two: Protecting confidentiality

Two teams are dispatched to a first aid station at a fairground to transport preterm twins who were precipitously delivered at a local event. There is a large group of friends and family, as well as curious onlookers, gathered at the facility, anxious for any updates. As the infants are being loaded, members of the group approach the ambulances, asking to glance at the infants and requesting an update. The care team needs to communicate about the status of the infants and details of the transport, but tearful and concerned people are surrounding the teams.

Scenario Three: Respect for autonomy—patient

A team is summoned to a rural hospital to transport a chronically ill teenager who is acutely ill. The patient is refusing transport and states, “I don’t care if I die, I don’t want to go to the hospital.” The parents of the child are insisting that the child go for evaluation. As the team arrives, the family is loudly arguing and the teen is becoming combative.

Scenario Four: Respect for autonomy—guardians

A team is dispatched to a community emergency department to transport a child for evaluation of suspected abuse. On arrival, the parents, who are obviously intoxicated, declare that they want to take the child home. They are loud and using obscenities and threaten a lawsuit if the child is not released to their care. The child is appears frightened and is begging to go home.

Scenario Five: Justice

All area transport teams are alerted of a mass casualty event involving a bus accident. Four teams are available to respond. On arrival, the teams discover 12 children and 2 adults with critical injuries. The teams must decide which patients to transport and how to manage the remaining victims during the delay.

Scenario Six: Personal integrity

A team is called to a pediatric emergency department to transfer a child status post full arrest to the tertiary care hospital for intensive care. On arrival, the child is now stable on a ventilator, but requiring support with blood pressure medications and intravenous fluids. The child is prepared for transport and report is taken from the referring physician and nursing team as a group. Just as the team is ready to depart, one of the nurses approaches the team and asks to speak to them confidentially. She confides that the child was stable on arrival but deteriorated as care was delayed. She communicates that the attending physician was paged numerous times but did not respond to the requests to evaluate the child. She goes on to explain that when the child became unstable, the physician finally evaluated the child but never acknowledged the delay in care or explained the lapse. She requests that this information not be shared; she simply wanted to make sure the team knew the full situation.

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CHAPTER 19

Accreditation

I. Accreditation purpose and history
II. Mission statement, vision, values and transport organization expectations
III. Member organizations
    A. Listing of twenty member organizations
    B. Board members' role
IV. Accreditation standards
    A. Measurable criteria
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Accreditation is a voluntary process that provides a means to demonstrate a level of quality. The Commission on Accreditation of Air Medical Services (CAAMS) was initiated in 1990 as a direct response to the unacceptable number of air medical accidents in the 1980s. Specific standards were developed for air medical transport to address safety and patient care issues that form the foundation for accreditation. The Joint Commission (formerly the Joint Commission on Accreditation of Healthcare Organizations) was developed out of similar circumstances. In 1915, the American College of Surgeons (ACS) allocated $500 to establish standards for quality patient care in hospitals as a result of a study that demonstrated dismal outcomes for hospitalized patients. These *Minimum Standards for Hospitals* eventually led to voluntary accreditation for hospitals by The Joint Commission on Accreditation of Healthcare Organizations, chartered in 1951.[1]

The other agency in the United States that accredits ground medical transport services is the Commission on Accreditation of Ambulance Services (CAAS). CAAS was initiated in 1990 to offer voluntary accreditation to Advanced Life Support (ALS)-Basic Life Support (BLS) ground transport services, mostly 911 response systems. In 1996, the Commission on Fire Accreditation International (CFAI) was initiated to offer accreditation to fire and emergency services throughout the world. Neither CAAS nor CFAI address air medical transport, and neither agency focuses on critical care transport.

In 1997, the mission and scope of CAAMS expanded to meet the needs of ground critical care transport services and led to the name change to Commission on Accreditation of Medical Transport Systems (CAMTS). There were already extensive standards addressing medical direction and education of critical care teams. Many of the operational standards could also be applied to ground transport. Additional standards were developed specifically for the ground transport vehicle. This expansion was specifically designed for the pediatric and neonatal transport teams, who were requesting an accreditation process that addressed the full scope of their practice. In addition, many air medical services were adding ground transport to meet their transport needs when aircraft were not available because of weather or maintenance, for example.

Mission and Goals of CAMTS

The following mission statement, vision, values, and transport organization expectations were approved by the CAMTS Board of Directors in 2009.

Mission Statement

CAMTS is a peer review organization dedicated to improving patient care and transport safety by providing a dynamic accreditation process through the development of standards, education, and services that support our vision.

Vision Statement

All patients are transported safely by qualified personnel using the appropriate mode of transport.

CAMTS Values

Fair

Ethical

Consistent

Accountable

Patient and Safety Focused

Transport Organization Expectations
Honest Self Assessment
Ethical Business Practices
Patient and Safety Focused
Continuous Quality Improvement
Transparency in the Accreditation Process

CAMTS—An Organization of Organizations

CAMTS is a nonprofit organization supported by 21 member organizations. Each member organization is required to send a representative to serve on the Board of Directors. In addition, there are 2 aviation experts representing the International Helicopter Safety Team's (IHST) Joint Helicopter Safety Implementation Team (JHSIT). There are also 2 voting Board members who represent the public. Board members are directly responsible for accreditation decisions, policies, and procedures as well as marketing and budgeting. The CAMTS board meets 4 times a year.

The diversity and experience level of Board representatives provide CAMTS with the integrity to offer accreditation in North America and abroad. The following is the current list of member organizations:

Aerospace Medical Association (AsMA)
Air & Surface Transport Nurses Association (ASTNA)
Air Medical Operators Association (AMOA)
Air Medical Physicians Association (AMPA)
American Academy of Pediatrics (AAP)
American Association of Critical Care Nurses (AACN)
American Association of Respiratory Care (AARC)
American College of Emergency Physicians (ACEP)
American College of Surgeons (ACS)
Association of Air Medical Services (AAMS)
Association of Critical Care Transport (ACCT)
Emergency Nurses Association (ENA)
European HEMS and Air Ambulance Committee
International Association of Flight Paramedics (IAFP)
National Air Transportation Association (NATA)
National Association of Air Medical Communications Specialists (NAACS)
National Association of EMS Physicians (NAEMSP)

National Association of Neonatal Nurses (NANN)
National Association of State EMS Officials (NASEMSO)
National EMS Pilots Association (NEMSPA)
United States Transportation Command (US TransCom)

Accreditation Standards[2]

The entire accreditation process is based on compliance with accreditation standards. The standards are revised every 2 or 3 years to reflect the dynamic evolution of medical transport. Medical transport services that achieve accreditation must meet substantial compliance with the accreditation standards. Each standard is supported by measurable interpretations to address the general topics below:

01.00.00 Management and Quality
- Mission Statement and Scope of Care
- Financial Commitment
- Marketing and Education for the Public
- Ethical Business Practices
- Compliance
- Management/Policies
- Mission Types and Professional Licensure
- Staffing
- Physical Well- Being
- Meetings, Records and Policies
- Utilization Review
- Quality Management

02.00.00 Patient Care
- Medical Direction
- Clinical Care Supervisor
- Program Manager
- Orientation, Training and Continuing Education Program Requirements
- Medical Configuration of the Aircraft/Ambulance
- Infection Control

03.00.00 Communications
- The FAA Part 135 Certificate Holder
- Communications Equipment
- Communications Specialists

Communications QM Program
Shift Briefings
Post Flight Debrief
Formal Meetings
Communications Policies
Flight Following
Communications Center

04.00.00 Safety and Environment

Safety Education
Equipment and Operations Around the Aircraft/Ambulance
Safety Management System[3]

The above sections are pertinent to all Critical Care services in addition to the following sections that address components specific to each mode of transport provided.

05.00.00 Rotorwing
06.00.00 Fixed Wing
07.00.00 Ground Interfacility

The Accreditation Standards also address:

08.00.00–11.00.00 ALS-BLS Ground
12.00.00–15.00.00 Medical Escort

An ALS-BLS ground service may apply for CAMTS accreditation if it is part of an air or ground critical care service. A service that only provides medical escorts on commercial airlines may apply for accreditation without having other transport components.

Compliance With Accreditation Standards

The Accreditation Standards address many issues that are designed to provide the highest level of care in the safest manner while moving a patient from a stable hospital environment with many back up resources to in an environment that depends on the skills of a few and the equipment and supplies available in the helicopter, airplane, or ground ambulance. Each mode has its own inherent risks, and it is important to mitigate those risks as much as possible.

Everything that occurs or *could* occur during a transport depends on experience, training, and preparation for the mission.

For specialty teams that may transport on an infrequent basis, it is essential to be prepared and become familiar with the aircraft or ambulance and its idiosyncrasies and capabilities prior to taking off for a mission. If a regularly scheduled team member does not accompany the specialty team, it is even more imperative that the specialty team become familiar with the aircraft or ambulance, medical configuration, communications systems, and emergency procedures. For example, some aircraft may not have an on-board invertor—a power source to support the incubator—or may not have sufficient gases to meet the needs of the ventilator for the entire distance of the transport including ground transport at each end if it is a fixed-wing transport. For long-distance fixed-wing transports (defined as any patient leg in excess of 3 hours—measured in time, not distance because of winds—where there are no alternative capabilities for patient care needs or aviation operations), preparation is imperative to make sure there is sufficient oxygen, backup supplies, and redundant oxygen and suction in case the on-board systems fail or the transport takes longer than predicted.

The Accreditation Standards specify education, medical configurations, and safety precautions necessary for transport. Below are listed some of the most frequently cited deficiencies regarding these standards.

Frequently Cited Deficiencies Regarding Specialty Teams

Deficiencies are areas that do not meet compliance with the accreditation standards. In reviewing many specialty teams over the past 20 years, the following list of standards represent the most frequently cited contingencies found among neonatal and pediatric teams.

Accreditation Standard 01.09.01 Physical well-being is promoted through:

3. Protective clothing and dress code pertinent to:
   b. Safe operations, which *may* include the following, unless specified as "required" below:
   - Boots or sturdy footwear for on-scene operations (*required)*
   - Wearing reflective material or striping on uniforms for night operations
   - High visibility reflective vests or appropriate Department of Transportation (DOT) approved clothing must be worn by flight and ground crews according to the ANSI-SEA 107 standard or equivalent national standard (required)
   - Flame-retardant clothing

- Appropriate outerwear pertinent to survival in the environment (*required)*
- Flight helmets—*required* for all crews including specialty teams (RW)

In addition to wearing helmets, specialty teams frequently do not follow the dress code of the regularly scheduled team. Wearing scrubs and unsuitable footwear is not appropriate in the event of an unexpected landing or survivable crash in rough terrain and weather.

Accreditation Standard 04.03.05 Securing equipment and supplies—All aircraft equipment (including specialized equipment) and supplies must be secured according to national aviation regulations. (Use of bungee cords is not considered appropriate when securing equipment and supplies). Ambulance equipment must be secured by an appropriate clamp, strap, or other mechanism to the vehicle or stretcher/incubator to prevent movement during a crash or abrupt stop.

All equipment and supplies must be secured. Often, teams have a tendency to store a supply bag under a stretcher without securing it with an appropriate tie-down and even more frequently, medical teams forget that unsecured equipment or supplies in an ambulance can be just as lethal as in an aircraft.

Accreditation Standard 04.03.08 Use of occupant restraint devices:

1. Air medical personnel must be in seat belts (and shoulder harnesses if installed) that are properly worn and secured for all takeoffs and landings according to national aviation regulations. A policy defines when seat belts/shoulder harnesses can be unfastened. (RW/FW)
2. Ambulance personnel must be seat belted when the ambulance is in motion unless emergent patient condition precludes it. (G)
   a. Front-seat occupants must always be belted.
   b. Overhead grab rails must be present in the patient care area.
   c. It is strongly encouraged to have forward and aft facing individual seats. Side-facing bench seats are not recommended. If the ambulance has side-facing bench seats, seat belt mountings must be situated at the pelvic level to restrain personnel/passengers. Shoulder harnesses should not be used on side-facing bench seats.[4]

Most personnel remember or are reminded by the pilot to fasten restraints in a helicopter or airplane, but many in the back of the ambulance forget to wear seatbelts or choose not to wear them because of the interior design (unable to perform patient care if restrained).

Accreditation Standard 04.02.01 Education Specific to the In-Flight and Ground Transport Environment

1. *Completion of all the following educational components should be documented for each of the flight medical personnel.* These components should be included in *initial* education as well as reviewed on *an annual basis* with all regularly scheduled, part-time, or temporarily scheduled medical personnel and specialty care providers as appropriate for the mission statement and scope of care of the medical service.
    a. Medical patient transport considerations (assessment/treatment/preparation handling/equipment)
    b. Day- and night-flying protocols
    c. Emergency medical services (EMS) communications (radios) and familiarization with EMS system
    d. Extrication devices and rescue operations (ranging from familiarity to explicit training depending on the service's mission statement) (RW)
    e. General aircraft safety. (It is strongly recommended to have the aircraft physically present when providing this training.) This training addresses: (RW/FW)
        - Aircraft evacuation procedures (exits and emergency release mechanisms) to include emergency shutdown of engines, radios, fuel switches, electrical and oxygen
        - Aviation terminology and communication procedures to include knowledge of emergency communications knowledge of emergency communications frequency
        - In-flight and ground fire suppression procedures (use of fire extinguishers)
        - In-flight emergency and emergency landing procedures (ie, position, oxygen, securing equipment)
        - Safety in and around the aircraft, including national aviation rules and regulations pertinent to for medical team members, patient(s), and lay individuals
        - Specific capabilities, limitations and safety measures for each aircraft used, which includes specific training for backup or occasionally used aircraft
        - Use of emergency locator transmitter (ELT)

- Minimal safety requirements on ground support ambulances used away from base for fixed wing operations, for example, adequate number and functioning seat belts for all team members, no loose equipment

f. Ground operations (RW)
   - Landing sites
     — On-scene requirements
     — Hospital landing site changes or special needs review
   - Patient loading and unloading—policy for rapid loading/unloading procedures
   - Refueling policy for normal and emergency situations

g. Hazardous materials recognition and response. (Even if not part of the service's mission statement, personnel should be able to recognize a hazardous materials situation if encountered.)

h. Highway scene safety management

i. Survival training/techniques/equipment that is pertinent to the environment/geographic coverage area of the medical service. (Includes water egress survival training* if en-route travels are routinely over large bodies of water such as rivers, lakes, bay areas based on the program risk assessment)
   - Smoke in the cockpit/cabin, firefighting in the cockpit/cabin
   - Emergency evacuation of crew(s) and patient(s)

**Water egress survival training should include: hazards to aircraft and personnel during overwater operations; pre-ditching considerations and procedures; emergency ditching and evacuation procedures; upright emergency evacuation; emergency evacuation; surface water survival; and rescue water skills. Fixed-wing services that are required by Federal Aviation Regulations (FARs) to carry emergency equipment, such as inflatable rafts, must provide this training.*

Annual safety training is required to include general aircraft and ambulance safety and emergency procedures unless the specialty team is always accompanied by a regularly scheduled crewmember (see Table 19.1).[1]

Table 19.1: Safety Training Checklist

Type of Team	Verify Critical Care Education Requirements	Verify Annual Safety Training	Safety Briefing Only	Verify Dress Code
Independent specialty team—part of the transport service— but fly alone	X	X		X
Specialty team—part of the service but always accompanied by the flight team	X	X		X
Specialty team that contracts for transport—not part of the service but fly alone		X		X
Specialty team that contracts for transport—not part of the service but always accompanied by flight team			X	X

Applying for Accreditation

Neonatal and pediatric specialty teams in the United States provide transport in several different ways:

- The dedicated team has its own identity and operates its own aircraft or ambulance or contracts with an operator (for air and/or ground).
- The dedicated team may contract with another medical transport service(s) for the mode of transport. This medical transport service may be part of the same health care system or it may use a community based private service (not part of any health care system).
- The team could be nondedicated in that medical professionals from a neonatal intensive care unit or pediatric intensive care unit occasionally accompany a patient during transport (from one hospital to another hospital with a higher level of care or a back-home transport where the patient, who is no longer critically ill, is returned to a local community hospital).

Currently, 90% of the accredited services transport pediatric or neonatal patients or both according to one of the examples listed previously. The first 2 examples in that list are eligible to apply for CAMTS accreditation even if they contract with another transport service for the aviation or ground ambulance. Of the 152 services currently listed as accredited, 6% are dedicated children's transport teams that are CAMTS accredited under their own identity.

There is currently a pool of 60 site surveyors who are independent contractors and perform at least 2 site visits per year. Site surveyors must have at least 4 years of current experience in the medical transport profession as medical, communication, or aviation professionals and must have a management background. Site surveyors are interviewed and selected based on their level of experience and positive interface with the selection committee during interviews. If selected, site surveyors are then required to attend a course provided by the Board of Directors before being assigned to a site visit with an experienced surveyor. The CAMTS office schedules site surveyors according to their experience with types of patients (age groups, for example) and modes of transport (rotor-wing, fixed-wing, or ground).

To apply for CAMTS accreditation, a transport service would request an initial application and then:

1. Complete the initial application.
2. Return it to the CAMTS office with a $750 application fee.
3. The program then receives a Program Information Form (PIF) by email. The PIF includes a Standards Compliance Tool. This is a self-study document that asks the program to score compliance with each of the standards and requires certain attachments to be included with the submission. In addition, the program completes a demographic section that incudes statistics for the previous year.
4. The program has up to 1 year to complete the PIF.
5. The PIF and the attachments are submitted electronically.
6. A Safety Culture Survey is emailed to each employee. These surveys are submitted anonymously and tabulated electronically to evaluate the safety culture of the service about to be site visited.
7. A site visit will be scheduled within 4 to 6 weeks of receiving the PIF.
8. An accreditation decision will be made at the next Board of Directors meeting. The Board meets 4 times a year.

Conclusion

There are many incentives to become accredited. Financial incentives include: potential savings on aviation insurance; contracts awarded to CAMTS accredited services by the government and big industry, and reimbursement incentives from managed care organizations. Several states require CAMTS accreditation. Most importantly, the process provides a very comprehensive evaluation of the transport service by experts in the transport profession and provides a framework for improvement to ensure safe and competent patient transport.

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CHAPTER 20

Special Considerations for Neonatal-Pediatric Transport

Outline

- Pediatric emergency department considerations
- Pediatric ICU considerations
- Neonatal ICU considerations

The practice of categorizing hospitals and units by their staffing and other resources is often the basis for regulatory or procedural rules regarding interfacility transport. Regionalization of specialty services requires that critical care transport programs be familiar with the specific capabilities of sending and receiving facilities. By serving as a resource for referring physicians and hospitals, the transport program can facilitate appropriate triage and streamline communication. Furthermore, proactive development of transfer algorithms and agreements for specific types of patients can improve system efficiency.

Pediatric Emergency Department Considerations

Emergency Department Capabilities

It is estimated that fewer than 10% of hospitals in the United States have dedicated pediatric emergency departments (EDs), but almost 20% of all ED visits are for children. The majority of pediatric emergency care, therefore, is provided in EDs that serve adults *and* children. The American Academy of Pediatrics (AAP), American College of Emergency Physicians (ACEP), and Emergency Nurses Association have published joint guidelines for the care of children in the ED, addressing medical and nursing oversight, personnel, equipment, and policies and procedures. At present, there is no uniformly accepted method of categorizing EDs on the basis of their capabilities with regard to pediatric emergency care.

Trauma Centers

Trauma is the leading cause of death for children between the ages of 6 months and 14 years; consequently, the interfacility transport of critically injured children is an essential component of a quality system for pediatric trauma care. It is essential that pediatric transport staff be familiar with the trauma capabilities of receiving institutions. The American College of Surgeons Committee on Trauma (ACSCOT) classifies trauma center levels on the basis of predefined criteria for staffing, facilities, and other resources and confirms their presence through a voluntary verification visit. Guidelines for transport destination based on trauma center level typically are determined by state or regional protocols. Pediatric trauma patients may or may not be given special consideration within a state's trauma system, depending on the availability and accessibility of pediatric trauma centers in the region.

The ACSCOT criteria for trauma center levels are included in Table 20.1. Most trauma centers undergo biannual surveys to maintain verification. Trauma centers are classified as trauma centers, level I, II, or III (formerly adult trauma centers), or pediatric trauma centers, level I or II. Institutions applying to be a level I trauma center and a level I pediatric trauma center must fulfill criteria for both and undergo separate verification visits. As expected, there are additional requirements for pediatric medical and surgical specialists for facilities designated as level I pediatric trauma centers, as well as a minimum volume (200) of annual admissions of injured children younger than 15 years.

Most pediatric trauma patients have blunt injuries and are managed nonsurgically. Trauma resuscitation focuses on airway management, ventilatory support, and restoration of intravascular volume. Approximately 3% to 5% of children will undergo surgery within the first 24 hours after injury, the majority for stabilization of orthopedic injuries. An even smaller number will require emergency surgical procedures on arrival to a trauma center, such as patients with an expanding epidural hematoma or penetrating thoracic trauma. In these cases, it is important that transport programs work with receiving hospitals to develop procedures for expedited transfer of selected patients to the operating room (OR) or other appropriate assessment or interventional location. Components of a "direct to the OR" protocol include a communication system to notify the appropriate surgical service(s) and essential personnel (eg, anesthesia, OR nursing, blood bank, radiology). In addition, the option for preregistration is important so that all required

Table 20.1: American College of Surgeons Criteria for Pediatric Trauma Centers

	Level I Pediatric Trauma Center	**Level II Pediatric Trauma Center**
Annual admissions of injured children <15 years of age	>200	>100
Pediatric trauma program manager and pediatric trauma registrar	Required	Required
Pediatric trauma performance improvement and patient safety (PIPS) program	Required	Required
Pediatric surgeons	Minimum of 2 board-certified or board-eligible in pediatric surgery	Minimum of 1 board-certified or board-eligible in pediatric surgery
Pediatric orthopedic surgeons and pediatric neurosurgeons	Minimum of 1 each, board-certified or board-eligible with pediatric fellowship training	No specific criteria
Pediatric critical care medicine	Minimum of 2 board-certified or board-eligible in pediatric critical care medicine OR in pediatric surgery and surgical critical care	No specific criteria
Pediatric trauma medical director	Board-certified in general surgery and board-certified or board–eligible in pediatric surgery	Board-certified in general surgery and board-certified or board–eligible in pediatric surgery
Nonpediatric trained surgeons	Permissible with specific criteria	Permissible with specific criteria
Trauma surgeon availability	Present within 15 minutes of patient arrival for highest level of activation	Present within 15 minutes of patient arrival for highest level of activation
Multidisciplinary peer review committee	Required	Required
Resident rotation in trauma surgery	Required	Not required

materials and medications are available and consents can be obtained before or immediately on patient arrival. In most cases, patients transported directly to the OR already have a secure airway, and will have completed any imaging that would be essential before surgery (eg, computed tomography scan).

Accidental Hypothermia

Another emergency situation that requires rapid mobilization of the receiving hospital's resources is the management of pulseless patients with severe hypothermia from exposure or cold-water drowning. Pediatric patients with core temperatures less than 30°C and no pulse are unlikely to respond to efforts at rewarming without the use of extracorporeal life support (ECLS). Referring institutions should be advised to avoid delays for efforts at less effective types of rewarming therapy in place of rapid transfer to a center that can provide pediatric cardiopulmonary bypass or extracorporeal membrane oxygenation (ECMO). In general, ECLS is not indicated for patients with documented submersion of >2 hours or those with a core temperature <10°C, and a pH <6.5 or potassium concentration >10 meq/L are considered poor prognostic factors. Receiving hospitals should individually determine criteria for extracorporeal rewarming and whether these patients will best be resuscitated in the OR, ED, or intensive care unit (ICU).

Poisoning and Poison Centers

Toxic ingestions are a common reason for interfacility transport of pediatric patients. Regional poison centers serve as a valuable resource for the management of poisoned children and should be consulted by the transport team if not already done by the referring institution. Specific toxic ingestions may require antidotes or emergency therapies that are available only at a limited number of centers, such as fomepizole for ethylene glycol ingestion, intravenous *N*-acetylcysteine for acetaminophen ingestion, and hemodialysis for aspirin intoxication. In general, the ingestion of a potentially hepatotoxic substance (eg, acetaminophen or mushrooms) is not an indication for primary transport to a pediatric transplant facility, given the low frequency with which transplant actually is required in these situations.

The American Association of Poison Control Centers (http://www.aapcc.org) maintains a toll-free number, (800) 222-1222, through which any of the participating poison centers in the United States, Puerto Rico, and the US Virgin Islands can be accessed.

Children With Special Health Care Needs

Children with special health care needs are those who have or are at risk of chronic physical, developmental, behavioral, or emotional conditions and who also require health and related services of a type or amount not usually required by children. This definition includes children with congenital or acquired developmental disabilities or other chronic health problems, with or without technology or device dependence. Because many children with underlying health problems have been transitioned from acute care hospitals to rehabilitation facilities or to their homes, they are frequent users of EMS, EDs, transport teams, and pediatric ICUs. Many children with complex health needs will obtain their primary medical care from a tertiary children's hospital, which may be remote from their home. As a result, critical care transport teams may be asked to transfer a patient from a community hospital to a pediatric facility at which the child's specialists or subspecialists practice.

There have been several initiatives to improve the coordination of emergency care for children with special health care needs. The Emergency Medical Services for Children Program (EMS-C), the AAP, and the ACEP have all developed emergency information forms or data sets and templates for emergency care plans to be used as resources for health care providers who are unfamiliar with a child with special health care needs who has an emergency medical condition. Of course, this documentation must be updated and verified by parents and health care providers on a regular basis to ensure it is current and accurate (Fig 20.1).

The transport of a child with special health care needs may be complicated by several factors, including the following:

- Need for specialized devices or medications not typically available to critical care transport teams (eg, left ventricular assist device pumps, Huber needles, custom-designed tracheostomy tubes, and prostacyclin infusions for primary pulmonary hypertension)
- Need for specialized equipment (eg, portable ventilators) that must be adequately secured in the transport vehicle
- Immobility or physical limitations on positioning (eg, spica casts)
- Importance of transporting parents or home health care providers who are familiar with the patient's baseline condition and usual problems and their management

The AAP has issued a policy statement titled "Transporting Children With Special Health Care Needs." This document can serve as a resource for EMS providers and transport professionals who may care for children with special needs.

Mental Health or Behavioral Emergencies

Although a patient with a primary mental health emergency is less likely to be transferred by a critical care transport team, underlying or concomitant psychological conditions may complicate an acute illness or injury. For example, an adolescent injured in a single-car crash may have intended

Fig 20.1. Sample emergency information form for children with special health care needs

Emergency Information Form For Children With Special Health Care Needs

Patient ID

Today's date		Who is completing this form? You must confirm consent to use this form:	
Your name		Is this a new form or just an update?	○ Update ◉ New
CONSENT REQUIRED →		I (above named person) confirm that parent/guardian consents to the use of this form	☐ Consent
Patient's name		Address	
Birthdate		Nickname	
Primary language		Parent/guardian	
Contact phones		Emergency contacts	

Facilities & Providers

Care Provider	Provider's Name	Specialties	All contact phone numbres (E-mail optional)	Fax
Primary Care				
Specialist-1				
Specialist-2				
Specialist-3				
Specialist-4				
Specialist-5				
Others				

Primary Pharmacy (branch, phone, other)	
Anticipated primary emergency department (name, phone, other)	
Anticipated tertiary care center (name, phone, other)	

Clinical Baseline

Diagnoses/problem list (list all) starting with most important	
Baseline physical findings	
Baseline vital signs	
Baseline neurologic status	
Immunologic competency status	
Synopsis of clinical status	
Medications (doses, purpose)	
Antibiotic prophylaxis (drug, dose, indication)	
Significant baseline lab/imaging/diagnostic studies	
Prostheses, appliances, advanced technology devices, life support	
Allergies: Medications, foods, substances to be avoided and why	
Advanced directives (include date of last review)	
Procedures to be avoided and why	

ED Management

Describe common presenting problems/findings		Suggested studies	Treatment recommendations
Problem-1			
Problem-2			
Problem-3			
Problem-4			
Problem-5			
Problems-other			

Comments on child, family, or other specific medical issues	

Immunizations

DPT dates		Varicella status	
Dtap dates		Hep B dates	
OPV or IPV dates		Hep A dates	
MMR dates		Meningococcal	specify which one if possible
HiB dates		TB status	
Pneumococcal-7		HP virus	
Other		Other	

Disaster Planning & Drills

Check or enter at least two of the most likely disasters that could affect this patient:

- ☐ Power failure
- ☐ Hurricane
- ☐ Tornado
- ☐ Earthquake
- ☐ Flood
- ☐ Tsunami
- ☐ Blizzard
- ☐ Avalanche
- ☐ Land/Mud slide
- ☐ Fire, forest fire
- ☐ Infrastructure (roads, communication) damage
- ☐ Shelter structure damage
- ☐ Food and water supply compromise
- ☐ Medication, supplies, equipment compromise
- ☐ Nuclear radiation accident (fallout, meltdown, contamination, detonation, etc.)
- ☐ Explosion, blast, Other (e.g., terrorism, biological accident, chemical accident, other weat
- ☐ Other (e.g., terrorism, biological epidemic/accident, chemical accident, other weather event)

Other (describe)	Other (describe)

Disaster drills reviewed or practiced with patient. Documentation of completed drills and planned dates for future drills.

Date	Disaster type	Example drills:	Describe type of drill
		verbal review	
		paper review	
		table top model	
		computer simulation	
		hand on practice	
		equipment review	
		in home review	
		alternate electrical power	
		electric generator use	

suicide, or a patient with seizures and hyperthermia may be under the influence of mind-altering medications, such as "ecstasy" (3,4-methylenedioxy-N-methylamphetamine [MDMA]). Critical care transport team members, especially those who primarily transport infants and children, may be unprepared for a patient who unexpectedly becomes violent. In these situations, team safety is paramount, and consideration should be given to physical and/or pharmacologic restraint before transport. If it is not feasible to use pharmacologic methods because of the nature of the patient's condition, appropriate physical restraints are indicated. Specialized restraints such as leather wrist and ankle binders should be applied by trained law enforcement or security personnel, who should accompany the transport team in case the restraints must be removed for patient care. If referring hospital or local law enforcement policies prohibit their staff to participate in the transport process, then the team may refuse to perform the transport owing to safety concerns. When used, the description of and justification for restraints applied during transport should be documented in the medical record. Guidelines and protocols for consideration, implementation, and frequent assessment and documentation of restraints should be available and adhered to by the transport team.

Chemical, Biological, and Radiological Hazards

The concern about acts of terrorism or use of weapons of mass destruction has led many institutions to develop training programs, policies and procedures, and specialized resources for the management of these potentially hazardous situations. Transport teams should be included in educational programs or practice drills that address recognition and management of patients who may require special handling or decontamination. To protect transport team members, communications and medical personnel who participate in the intake process should notify the team members of any possible concern for hazardous conditions. Likewise, to protect the receiving hospital staff and patients, the transport team must take the necessary precautions when transferring the patient and coordinate with the medical control physician and hospital officials about patient disposition, especially the need for isolation or decontamination.

The Occupational Safety and Health Administration (OSHA) develops standards for workplaces and worker training with which transport program administrators should be familiar. OSHA standard 29 CFR 1910.120, referred to as the Hazardous Waste Operations and Emergency Response (HAZWOPER) standard, describes training requirements for employees who may be involved in emergency response operations that include the potential release of hazardous substances. These include the following:

- Names of personnel and alternates responsible for site safety and health
- Safety, health, and other hazards present on the site
- Use of personal protective equipment (PPE)
- Work practices by which the employee can minimize risks from hazards
- Medical surveillance requirements, including recognition of symptoms and signs that might indicate exposure to hazards
- Specific contents of the site safety and health plan, including decontamination procedures, PPE, confined space entry procedures, and spill-containment program

The requirements for emergency providers are much less stringent than for personnel involved in clean-up operations and include an "initial briefing at the site prior to their participation in any emergency response. The initial briefing shall include instruction in the wearing of appropriate personal protective equipment (PPE), what chemical hazards are involved, and what duties are to be performed." OSHA has published a document titled, "Best Practices for Protecting EMS Responders during Treatment and Transport of Victims of Hazardous Substance Releases" with recommendations for training, PPE, and decontamination of personnel and ambulances.

The AAP (http://www.aap.org) also has published guidelines for the isolation and treatment of children exposed to bioterrorism or chemical hazards.

Infection Control

Similar to other health care providers, transport team members may be exposed to patients or family members with contagious diseases. In general, transport personnel always should use standard precautions, including gloves and frequent hand washing, as their primary means to avoid disease transmission. The availability of alcohol-based hand washes and gels eliminates the need for a source of running water, making it more practical for transport team members to maintain hand hygiene in a mobile environment. When transporting a patient with a suspected contagious disease, the transport team should communicate with the receiving facility so that the patient can be triaged to an appropriate point of entry and/or an isolation area, as indicated.

Certain patient conditions require additional measures to protect health care providers and/or prevent disease transmission to other patients. For example, when treating patients who are colonized or infected with multidrug-resistant organisms, such as methicillin-resistant *Staphylococcus aureus* (MRSA) or vancomycin-resistant enterococci (VRE), transport team members should wear disposable gowns over their clothes or uniforms to avoid contact. Patients may have known or suspected infectious conditions that are transmitted by respiratory secretions or droplets, such as meningococcal disease and varicella, necessitating the use of masks to prevent transmission. When highly virulent diseases are suspected, such as severe acute respiratory syndrome (SARS), the use of disposable high-filtration respirators is indicated. Information on specific diseases and recommendations for health care providers can be found on the Centers for Disease Control and Prevention Web site at http://www.cdc.gov.

Transport team members should consider obtaining available immunizations for certain contagious diseases to which they may be exposed. Vaccinations are available against hepatitis A and B, influenza, mumps, measles, rubella, *Meningococcus* species (certain strains), varicella, polio, tetanus, diphtheria, and pertussis. People who are not vaccinated or naturally immune also can receive postexposure passive immunization for hepatitis A, hepatitis B, tetanus, and varicella. Antibiotic prophylaxis may be indicated after a significant exposure to a patient with meningococcal disease. Transport team members should undergo OSHA-approved training regarding prevention and management of exposure to blood and body fluids. Health care workers should be familiar with institutional procedures in the event of an accidental needlestick or blood or body fluid exposure because of the potential indication for passive immunization against tetanus or hepatitis B or postexposure prophylaxis against human immunodeficiency virus.

Pediatric ICU Considerations

Pediatric ICU Levels

As with trauma centers and neonatal ICUs, pediatric ICUs may be classified by level based on their resources and capabilities. Classifications for pediatric ICUs have been developed by the AAP and the Society of Critical Care Medicine (SCCM). Level I facilities provide a full range of pediatric subspecialty services and meet specific requirements for availability of personnel, equipment, and support services on a 24-hour basis. For level II facilities, some of these resources are considered optional, although there are still minimum requirements for staffing and other services. In most states, the classification of pediatric ICUs is an informal practice that does not have any bearing on patient triage or transfer and does not affect the type or complexity of care that is permitted at a particular institution. The availability of certain services, however, may be regulated by a state agency, such as the department of public health, which may have the authority to license ICU beds, approve expansion of services and physical facilities, and control expenditures for capital resources. For example, these types of regulations may specify that hospital-based transport programs must demonstrate sufficient need in the region or state to expand physical facilities or enact major purchases, such as aircraft.

It has been demonstrated that critically ill or injured children admitted to a pediatric ICU, with its concentration of specialized personnel and resources, have an improved outcome compared with pediatric patients admitted to an adult ICU. Despite this, approximately 7% of hospitals in the United States report that they routinely admit children requiring intensive care to an adult ICU rather than transferring them to a pediatric facility. The practice seems to be more common with trauma patients, in which up to 10% of hospitals have reported a practice of admitting critically injured children to an adult ICU.

Burn Centers

The management of pediatric burn patients may require specific resources, because serious burns are uncommon and highly complex. Although adult burn units commonly are found at major medical centers, specialized care for pediatric burn patients is concentrated among a small number of facilities, such as the nationwide Shriner's Hospital system. Transfer to a pediatric burn center is often a secondary or even tertiary transport following resuscitation and/or stabilization at a community hospital or pediatric institution without a burn unit.

For the most part, pediatric burn centers are accustomed to receiving patients in transfer from other institutions, although some may be prepared to accept patients directly from the field under certain circumstances. Critical care transport programs should work with the closest regional pediatric burn center to develop procedures for the triage of seriously burned children directly to the burn center or in secondary transfer following resuscitation and stabilization at another facility. The American Burn Association has developed guidelines for transfer of pediatric patients to a pediatric burn center, as shown in Table 20.2 (http://www.ameriburn.org).

Burn patients are often transported by helicopter, but in many cases, air transport may be unnecessary because of an observed practice of "over-triage." Studies have demonstrated that referring physicians regularly over-estimate burn size, favoring the use of air transport and increasing the costs of acute burn care.

Table 20.2: American Burn Association Burn Unit Referral Criteria

1. Partial-thickness burns greater than 10% total body surface area (TBSA)
2. Burns that involve the face, hands, feet, genitalia, perineum, or major joints
3. Third-degree burns in any age group
4. Electrical burns, including lightning injuries
5. Chemical burns
6. Inhalation injury
7. Burn injury in patients with preexisting medical disorders that could complicate management, prolong recovery, or affect mortality
8. Any patients with burns and concomitant trauma (eg, fractures) in which the burn injury poses the greatest risk of morbidity or mortality. In such cases, the patient's condition may be initially stabilized in a trauma center before transfer to a burn unit. Physician judgment will be necessary in such situations and should be in concert with the regional medical control plan and triage protocols.
9. Burned children in hospitals without qualified personnel or equipment for the care of children
10. Burn injury in patients who will require special social, emotional, or long-term rehabilitative intervention

Adapted from American College of Surgeons, Committee on Trauma. Guidelines for the operations of burn units. In: *Resources for Optimal Care of the Injured Patient*. Chicago, IL: American College of Surgeons; 2006:79–86.

Hyperbaric Oxygen Therapy

Treatment in a hyperbaric oxygen chamber is available at selected centers in the United States. The most common indications for emergency use of hyperbaric oxygen therapy are acute carbon monoxide (CO) poisoning and cerebral air embolism ("the bends") from decompression accidents, as occur with scuba diving. For patients with CO poisoning, arterial oxygen content is reduced by the very high affinity of CO for hemoglobin. Administration of 100% oxygen at atmospheric pressure will reduce the level of carboxyhemoglobin in the blood over several hours' time. Hyperbaric oxygen therapy (HBOT) has the theoretical additional benefits of accelerating the reduction in carboxyhemoglobin and increasing the concentration of dissolved oxygen in the blood, thus improving oxygen delivery to the tissues, especially the brain. In decompression sickness, patients who breathe pressurized gas mixtures and return to atmospheric pressure too quickly may be harmed by the formation of gas bubbles in the tissues as the solubility of the gas in the blood decreases. In these cases, treatment of the patient under hyperbaric conditions will permit the gas to redissolve in the blood, after which the rate of decompression can be carefully controlled.

As with all emergency care, standard resuscitation and stabilization measures take priority over adjunctive therapies such as HBOT. For example, a patient with CO exposure from a house fire also might have thermal burns, inhalation injury, and/or cyanide toxicity and should be treated first for problems with the airway, breathing, and circulation. After the immediate life-threatening problems have been identified and treated, the risks and benefits of additional therapies such as HBOT should be considered on the basis of the patient's condition and the severity of the suspected CO intoxication.

In general, patients who are unconscious after exposure to CO or those with a carboxyhemoglobin concentration of more than 40%, are considered candidates for HBOT. However, a patient with acute lung injury may be served best by admission to an ICU for expert management of mechanical ventilation. Given that controversy exists about the efficacy of HBOT in preventing or ameliorating the neuropsychiatric sequelae of CO intoxication, especially in pediatric patients, the transport destination should not routinely be determined by the availability of a hyperbaric oxygen chamber. Guidelines should be developed, in concert with the HBOT medical director and personnel, regarding when direct transport to HBOT should be considered, with an emphasis on ensuring optimal pediatric assessment and monitoring in the HBOT location. This should include expectations for which physicians, nurses, and technicians will attend to the patient during the treatments, at the bedside and outside the chamber.

Implantable Pacemakers and Automated Internal Cardiac Defibrillators

Although primary cardiac disease is encountered less frequently in children than in adults, there is a population of children with congenital or acquired heart disease for whom there may be special considerations during critical care transport. Children with conduction system abnormalities often require placement of an implantable pacemaker, even during the neonatal period. These devices typically are placed subcutaneously in the abdomen because of the limited size and expandability of the chest wall in infants and young children. Automated internal cardiac defibrillators (AICDs) may be placed in children at high risk of developing life-threatening ventricular arrhythmias. These larger devices also are placed in the abdominal region; to date, the youngest recipient weighed ~5 kg. Malfunction of an implanted pacemaker or AICD can lead to serious complications in children, as in adults. Device failure can be managed by externally providing any therapy that is being inadequately performed, such as use of transthoracic pacing. Device mishaps, such as inappropriate discharges, may require that the device be disabled for the patient's safety. This can be accomplished by placing a specialized magnet over the device. Fortunately, most hospital EDs have access to magnets because of the more widespread use of pacemakers and AICDs in adult patients.

Organ Procurement and Transplantation

Solid organ transplantation is a highly specialized area of medicine that requires the close cooperation of multiple agencies, programs, and personnel. In most states, there is a mandatory requirement to notify the regional organ procurement organization (OPO) when a diagnosis of brain death is considered or when a patient dies. The success of an organ transplant procedure is determined by many factors, among which are time to procurement and time to transplant following harvest (ischemic time). Most patients who are evaluated and listed for organ transplantation are required to relocate to the vicinity of the transplant center so that they can respond rapidly for surgery in case an organ becomes available. More often than not, however, it is necessary for the transplant team to travel to procure the organ and transport it back to the transplant center. In certain cases, transport teams may be requested to facilitate the transport of medical personnel or of the organs themselves because of the time-sensitive nature of the process. The United Network for Organ Sharing (UNOS) has published guidelines for the transport of organs for transplantation within the United States. In general, it is the responsibility of the "host" OPO (ie, the organization that makes the organ available) to make arrangements to transport the organ to the receiving facility. Interestingly, the costs of transporting a kidney are borne by the host OPO, whereas the costs associated with the transport of other organs are the responsibility of the recipient facility. Transport team members should not be expected to package, label, or handle the organ for transplantation, which is the responsibility of the host OPO.

Neonatal ICU Considerations

Neonatal ICU Levels

Unlike trauma centers or pediatric ICUs, neonatal ICUs typically are licensed by the individual state to provide a specific level of services for neonatal patients. The level of neonatal ICU care usually is designated by the state's hospital regulatory agency, such as the department of public health, whose definitions may vary from state to state. The AAP recommends a uniform classification and subclassification of neonatal ICUs based on their capabilities:

- Level I (basic): neonatal resuscitation, postnatal care of healthy neonates, care of infants born at 35 to 37 weeks' gestation who are physiologically stable, and stabilization of the condition of sick neonates or those who are less than 35 weeks' gestational age before transfer to a higher level facility.
- Level II (specialty): neonatal resuscitation, postnatal care of infants born at more than 32 weeks' gestation and birth weight more than 1500 g, care of neonates who are moderately ill and do not require urgent subspecialty services, and care of preterm infants who are convalescing after a course in a level III nursery.
- Level III (subspecialty): neonatal resuscitation and postnatal care that includes advanced life support and/or comprehensive care for high-risk or critically ill neonates.

ECMO and Inhaled Nitric Oxide

The Extracorporeal Life Support Organization (ELSO) categorizes ECMO centers on the basis of the type of patients served: neonatal pulmonary, pediatric pulmonary, adult pulmonary, cardiac (all ages), and extracorporeal cardiopulmonary resuscitation (E-CPR). There are approximately 115 ECMO centers in the United States, a number that has decreased during the past 15 years. For the neonatal and pediatric population, this reflects the decreased demand for ECLS because of the use of therapies such as high-frequency oscillatory ventilation, inhaled nitric oxide (iNO), and surfactant replacement.

ELSO, based at the University of Michigan, promulgates guidelines for ECLS and maintains a registry of patients who have been treated with ECMO (http://www.elso.med.umich.edu). Neonates represent the largest treatment group to date. ELSO's materials indicate that the decision to transfer a neonate to an ECMO center should be influenced by a number of factors and states that there are no standard criteria. In general, ELSO recommends that a neonate whose condition is deteriorating be transferred at a time when the conversion to conventional ventilation still can be tolerated and suggests that an infant whose condition has not improved after 6 hours of high-frequency oscillatory ventilation be considered a candidate for expedient transfer. Individual institutions may use the alveolar-arterial oxygen difference, the oxygenation index, or the persistence of a PaO_2 of less than 50 torr as predictors of the need for ECMO. Unfortunately, published experience indicates that the transfer of neonates for ECMO often occurs after the patient has reached commonly agreed on criteria for cannulation.

The staff at the ECMO center who accept a neonate in transfer should clearly indicate to the referring physician that the patient is being transported as an ECMO candidate, without a guarantee that ECMO will be provided. This practice may diminish the likelihood that the referring hospital or the family will question the decision to transport in case ECMO is not required. Furthermore, it communicates the fact that the ECMO center will be evaluating the patient and determining whether the infant is an appropriate candidate for ECMO after arrival.

The decision to cannulate for ECMO may be facilitated by requesting that the referring facility perform certain diagnostic studies while the transport team is mobilizing and responding. These include cardiac echocardiography to evaluate for noncorrectable conditions or cyanotic heart disease that might have been misdiagnosed as pulmonary hypertension. In addition, results of recent cranial ultrasonography to assess for the presence of intracranial hemorrhage are helpful. Because the patient will need to undergo type and cross-matching for blood at the receiving facility, it is unnecessary to perform this at the referring hospital unless there is an anticipated need for transfusion of blood products during transport.

In 2000, the US Food and Drug Administration (FDA) approved the use of iNO for the treatment of hypoxic respiratory failure in term and near-term neonates with clinical or echocardiographic evidence of pulmonary hypertension. As a result, many neonatal ICUs routinely provide iNO therapy, including facilities that do not have ECMO capabilities. The initiation of iNO therapy in a non-ECMO center is controversial, because it may delay transfer to a facility with ECMO capability. This practice has major implications for critical care transport teams, who may be asked to urgently transfer a critically ill neonate who is already receiving maximal medical therapy, short of ECMO. In these situations the transport team is unlikely to have any additional therapies that may offset the instability precipitated by transitioning from high-frequency oscillatory ventilation to conventional ventilation or by the stress of a mobile or air-medical environment.

For these reasons, it is essential that non-ECMO centers that provide iNO therapy for neonatal respiratory failure work closely with an ECMO center to develop criteria for transfer to ensure that there is a "window of opportunity" during which the transport can be accomplished safely. These guidelines should be evaluated regularly by reviewing the outcome of infants transported for ECMO. A certain incidence of "unnecessary" transports (ie, neonates who are referred for but do not require ECMO) may be necessary if the transfer criteria are adequately conservative. Furthermore, any transport team that may be asked to transport a neonate who is already receiving iNO therapy must have the capability of providing iNO during transport because abrupt discontinuation may result in serious deleterious effects.

Because iNO is an FDA-approved therapy, transport teams also may choose to *initiate* iNO on transport under appropriate circumstances. Infants with hypoxic respiratory failure and clinical or echocardiographic evidence of pulmonary hypertension are candidates for iNO therapy. Of note, there is controversy about the administration of iNO without echocardiographic confirmation of the absence of structural heart disease. The source of the concern is the fact that iNO therapy may be harmful to neonates whose systemic blood flow is dependent on right-to-left flow through the ductus arteriosus, because the subsequent reduction in pulmonary vascular resistance may compromise systemic blood flow. Examples include left-sided obstructive lesions such as critical aortic stenosis, hypoplastic left heart syndrome, and interrupted aortic arch. At a minimum, protocols regarding the initiation of iNO during transport should specifically address the possibility of congenital heart disease and the appropriate steps to take if the patient's condition worsens while receiving iNO. The decision to initiate iNO during transport should reflect consideration of the potential risks and benefits of its use outside of the ICU, including the severity of illness and distance or time to the receiving facility. The practice of empirically initiating iNO during transport to facilitate the transition from high-frequency oscillatory ventilation to conventional mechanical ventilation has been reported, but there is no evidence that it improves patient safety or outcome.

Ideally, a neonate with hypoxic respiratory failure whose trajectory predicts the need for ECMO will be transferred to an ECMO center prior to meeting criteria for cannulation or before his or her condition becomes too unstable to permit transport. When this is not possible, a few select programs have the capability to respond to requests for transport by mobilizing an ECMO team that is capable of cannulating at the referring facility and then transporting the patient while receiving ECMO to the base institution. This practice, although labor-intensive, expensive, and high risk, has been carried out safely and successfully in civilian and military programs.

Extreme Prematurity

The threshold for viability of preterm infants has decreased progressively with improvements in perinatal care. Although survival rates for infants born between 22 and 25 weeks' gestation have improved progressively, there remains a significant incidence of neurodevelopmental disability and other chronic health problems. Parental counseling and decision making around the birth of an extremely preterm infant have medical, legal, and ethical considerations. A published survey of neonatologists in the New England region indicated that the decision to resuscitate at the lower limits of viability is based both on gestational age and parental wishes. For example, the majority of neonatologists surveyed indicated that they would consider resuscitation for infants born at less than $23\frac{0}{7}$ weeks to be futile, but one third would attempt resuscitation at the parents' request. For infants born at $25\frac{1}{7}$ weeks' gestation and later, most neonatologists reported that they would consider treatment clearly beneficial, and 91% would provide resuscitation, even if the parents requested to withhold treatment. Between $24\frac{1}{7}$ and $24\frac{6}{7}$ weeks' gestation, neonatologists were divided on the benefit of treatment, but the majority reported that they would defer to parental wishes with regard to resuscitation.

The AAP and the American College of Obstetricians and Gynecologists have published guidelines for decision making at the threshold of viability. The guidelines acknowledge that delivery room management is made more challenging by the narrow range of gestations during which prognosis can vary significantly. The most reliable indicator of estimated gestational age is the date of the mother's last menstrual period, followed by a first trimester ultrasonographic evaluation. The approximation of gestational age on the basis of estimated fetal weight at the time of presentation in preterm labor has a significant error rate of 15% to 20%. Furthermore, gestational age is a better marker of outcome than birth weight, as demonstrated by the outcome of infants who are growth-restricted but more mature than their birth weight suggests. In situations in which there has been inadequate prenatal care or when there is uncertainty about actual gestational age, it may be necessary to postpone decisions about resuscitation until the time of birth when the infant's physical appearance, weight, and condition can be assessed directly. The AAP's Neonatal Resuscitation Program states that it is appropriate to consider noninitiation of delivery room resuscitation when an infant is born at less than 23 weeks' gestation or a birth weight of less than 400 g. When there is doubt on the part of the clinician, most experts would recommend an initial trial of therapy, followed by reassessment and discussion with the parents about the risks and benefits of further life-sustaining care.

Transport teams are faced with several dilemmas when the birth of an extremely preterm infant is imminent. Whenever feasible, it is preferable for the referring institution to transfer the mother with the fetus in utero so that delivery can occur in a facility with experience in the care of preterm neonates. If delivery is imminent or maternal transfer is judged to be an unacceptably high risk to the mother or the fetus, delivery should occur in the referring institution. Neonatal transport teams may be requested to "stand by" to assist in the delivery room resuscitation of an extremely preterm infant who then will require transport after birth. The decision to mobilize a transport team for anticipated problems with a preterm neonate should be made in consultation with the referring providers, the medical control physician, and the transport team leadership. If the timing of delivery can be predicted with reasonable certainty (ie, decision to perform a cesarean delivery), the infant's estimated gestational age and weight indicate the potential for viability, and the referring facility has inadequate resources to manage the initial resuscitation and stabilization of an extremely preterm infant, it may be appropriate to dispatch the transport team before the infant's birth. The transport team may need to be augmented with additional personnel if expectations of assessments and/or interventions could exceed the standard team's level of expertise or scope of practice. Issues surrounding level of involvement and credentialing should be anticipated and agreed on before need. On the other hand, it is usually not appropriate to dispatch the team if there will be an unpredictable period of waiting for a vaginal delivery, if there is a high likelihood that the infant is not viable, or if there are providers who can perform initial resuscitation and stabilization before the transport team's arrival.

Surfactant Replacement Therapy

One of the most significant advances in the care of preterm newborns in the past 3 decades was the availability of surfactant replacement therapies for prevention or treatment of respiratory distress syndrome (RDS). Both animal-based and synthetic surfactant preparations have been shown to improve survival for preterm infants. Infants born at less than 30 weeks' gestation who receive prophylactic surfactant prior to the onset of respiratory symptoms have a lower incidence and severity of RDS as well as decreased mortality and morbidity (ie, pneumothorax, pulmonary interstitial emphysema). These findings have implications for preterm infants born in a non-tertiary care environment, where surfactant replacement therapy may or may not be available, and should be one factor taken into consideration when determining whether a transport team is to be dispatched prior to delivery. The AAP recommends that surfactant be administered as soon as possible to preterm infants with RDS, and that prophylactic surfactant should be considered for extremely low birth weight infants who are at high risk of RDS, especially those who have not been exposed to antenatal steroids. When providing surfactant replacement therapy during transport, neonatal teams must be cognizant of the potential for rapid changes in pulmonary compliance during the return transport when the team's ability to assess and monitor the infant may be hindered in the mobile environment. These potential risks must be weighed against the use of higher pressures and oxygen concentrations during the transport that could injure the infant's lungs. A recent study looking at over 200 surfactant-treated, transported preterm neonates found a low rate of pneumothorax (2.9%) but a relatively high rate of excessive ventilation on admission to the neonatal intensive care unit (18.9%).

Hypothermia for Hypoxic Ischemic Encephalopathy

Therapeutic hypothermia (either by whole body or selective head cooling methods) is now standard of care for selected newborn infants with moderate to severe hypoxic ischemic encephalopathy (HIE). Multiple studies have shown that efficacy of treatment is enhanced by meeting early inclusion criteria and starting cooling before 6 hours of life. Hence, starting cooling prior to and on transport is a natural extension, because in many cases, the appropriate window to commence treatment may already pass before a neonate is transported and admitted to a tertiary center. There are limited data suggesting how to perform cooling during transport, either passively or by certain manufactured or home-built cooling methods. Programs should work in close connection with their neurologists and intensivists to arrive at an agreed-on method, and appropriate training should be documented for all team personnel. Through outreach education, referring centers should be aware of uniform inclusion criteria and delivery methods. The largest study published in 2013 by the California Perinatal Quality Care Collaborative confirmed earlier observations that there is variability in delivery method, most patients do not achieve target temperature by the time of arrival at the accepting cooling center. Manufactured cooling devices and not passive cooling methods is the recommended mode on transport. Outcome studies now show that infants with moderate HIE may benefit more than those with severe HIE.

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CHAPTER 21

Telemedicine in Transport

Outline

- Equipment and telecommunications
- Telemedicine on transport and in other clinical settings
- Regulations and reimbursement

Introduction

Telemedicine is defined as the use of medical information exchanged from one site to another via electronic communications for the health and education of patients or health care providers. The purpose of telemedicine is to improve patient care by enhancing the medical communication process between health care providers by using video interfacing capabilities. These systems can also include interactions for consultative, diagnostic, and treatment services. There are 3 general types of telemedicine. “Interactive” telemedicine (otherwise known as “synchronous telemedicine”) involves 2 videoconferencing units (1 at each site) and some telecommunications connection between the units capable of transmitting simultaneous video and audio. “Store and forward” telemedicine (otherwise known as “asynchronous” telemedicine) involves electronic transfer of images and/or video for medical review and interpretation at some later time. “Remote monitoring” telemedicine can be a combination of interactive and store-and-forward technologies that allows medical professionals to monitor patients remotely and is most often used for managing chronic diseases or specific conditions, such as heart disease, diabetes mellitus, or asthma.

Equipment and Telecommunications

Telemedicine videoconferencing units that are used for interactive telemedicine can range from low-end, software-based systems to high-end, turnkey systems. Software-based systems can be used with a personal computer and a Web cam, so that the computer makes the call and uses the Web cam as the video source. The turnkey systems incorporate the video, audio, and the software into 1 unit. These turnkey units can be connected to a video monitor and microphone and often use a remote control to make calls.

Two videoconferencing units can then be linked by a variety of telecommunication connection methods. In general, a minimum, clinically useful connectivity speed of 384 kilobits per second (kbps) is recommended for standard video, and 1 megabits per second (mbps) is recommended for high-definition video. Currently, most long-range connections are made using high-speed Internet, Integrated Services Digital Network (ISDN) lines, T1 lines (or fractionated T1 lines), or satellite. More recently, cellular telecommunications technologies are being used as higher-connection speeds become more available and more widespread. Each of these has advantages and disadvantages in terms of cost, feasibility, and reliability. If the Internet or cellular telecommunications are used, connection speeds can vary, and resulting audio-video quality may be unreliable. Further, to use the Internet, modifications to allow encryption must be made so that the connections are compliant with the Health Insurance Portability and Accountability Act (HIPAA [Pub L No. 104-191]). A common solution is the use the turnkey systems' built-in encryption or to establish a virtual private network (VPN) tunnel. An alternative solution is to choose a connection method that is naturally more secure, like a point-to-point connection used by ISDN or T1 lines. A point-to-point connection is one where only the 2 end points can use the connection to communicate, unlike a shared connection such as the Internet.

New Improved Telemedicine Delivery System and Incorporation Into the Transport Process

With the development of smart phones, tablets, and video conferencing, telemedicine has taken a more dramatic use in pediatric transport. The days of fixed systems being wheeled into units between parties are gone, and transport has now become easier and less cumbersome. The current land line base system is superior in quality, but for the transport teams and their base unit communication, it is now more than just purely verbal communication between parties, teams have incorporated file transfers (eg, radiographs, computed tomography scans, ultrasonographic images) and video chatting as the way of new transport communications process. Various transport systems have, through their legal departments, have set up protocols, communication policies, HIPAA guideline compliance, and most importantly, ways for this video/file sharing to be stored for a set period of time for quality assurance and other processes. This file sharing and video chatting by the transport teams to the base unit (medical control unit: pediatric emergency department, pediatric intensive care unit, and the neonatal unit) has, per reports from various pediatric transport teams' medical directors (Vanderbilt pediatric and neonatal transport program and other programs), improved efficiency for medical interventions, triaging, pediatric trauma leveling, and utilization or activation of the surgical teams/operating room. Certain transport programs have incorporated file sharing and video chatting into the initial phase of the transport process between the referring and receiving units by using smartphones to e-mail or text with attached video/picture or to video chat. Setting up these systems must be approved by both units' compliance offices and legal departments and incorporated into their transfer agreements between the parties. As technology improves, the role of telemedicine will take a dramatic new direction with more use, easier application, improved transport triaging, and great efficiency in the care delivered to the critical ill and injured pediatric and neonatal patients. Communications between transport programs using this new method of telemedicine have an obligation to communicate their process for this new wave of telemedicine with other transport programs to increase the use and overall improvement in pediatric and neonatal transport system. Before transport programs begin using smartphones and video chatting, they must have all aspects review by their legal and compliance programs. In the following section, the land base system will be discussed for current transport programs that have not incorporated the smartphone/video chatting process.

With any new adaption or improvement to the transport process, research into the benefits of these new forms of communication needs to be performed and published by the various transport programs.

The Use of Telemedicine in Pediatrics

The use of telemedicine has been continuing to increase in recent years. This is related to improved videoconferencing equipment and telecommunications quality, more affordable equipment and telecommunications systems, and increased patient and provider comfort with these technologies. Further, because of the increased recognition of the effectiveness of telemedicine, particularly in terms of addressing barriers to access for those living in remote and/or underserved communities, there has been an increase in interest and investments by governments (federal, state, and local) as well as health care systems and health insurers.

It is common that children living in rural and underserved communities have limited access to specialists and other regionalized care, compared with children living in suburban and urban communities.[1–3] As a result, telemedicine in pediatrics is used in many settings to enhance or expedite health care services. Most commonly, telemedicine is used in the delivery of outpatient specialty consultations to children in rural communities and focuses on children with special health care needs.[4–9] However, telemedicine is increasingly being used to assist in emergency and critical clinical scenarios. For example, in rural and underserved hospitals, disparities in access to pediatric emergency and critical care specialists may lead to delays in care, particularly among children who are acutely ill and injured; therefore, the use of critical care and emergency telemedicine consultation in emergency departments and intensive care units is increasing.[10–13]

The Use of Telemedicine in Transport Medicine

The use of telemedicine technologies to deliver real-time patient information, electronically monitored data, and/or video for transport medicine is in its infancy. These technologies may have the potential to improve care at any point during emergency medical services for children: from the scene of a medical emergency, during transport to the closest emergency department, during the initial emergency department resuscitation, during the arrival of the pediatric transport team, and during transport to the children's hospital offering definitive care.

Scene Telemedicine

To enable videoconferencing from the scene of an accident, mass casualty, or other disaster that would require medical triage, telemedicine could be deployed in a variety of ways.[14] Videoconferencing equipment could be delivered by any first responder, including helicopter for remote or difficult to get to locations. Once delivered, broadband telecommunications is needed to connect to an emergency department or command center. Currently, broadband telecommunications access is limited in remote locations and, in most circumstances, would require satellite connectivity. More recently, telecommunication systems that aggregate wireless data connections have been tested as a means of providing broadband connectivity to mobile and/or remote locations.[15,16] Once deployed, telemedicine could be used to assist in first responder therapies as well as triaging. As one can imagine, scene telemedicine would have theoretical advantages in cases of medical emergencies involving infectious, biological or chemical emergencies. Several projects have demonstrated the feasibility of telemedicine at simulated scenes of mass casualty emergencies.[17,18]

Telemedicine During Transport

There are several programs in the United States that have incorporated videoconferencing and telemedicine during medical transport. Standard medical monitoring devices and/or videoconferencing equipment have the capability of transmitting data and video if adequate bandwidth is available to the moving vehicle transporting the patient. One option used by some emergency medical services systems is to use wide area wireless networks, such as the ones established in Tucson, AZ, and Baton Rouge, LA. In these cities, first responders are connected to a city wide Wi-Fi network to be able to transmit medical data to regional emergency departments. Another option to provide mobile broadband is to use the collective bandwidth of cellular providers.[15,16] Presumably, over time, newer technologies will allow for easier and less expensive mobile broadband telecommunication solutions.

The utility of telemedicine during transport has not yet been defined. Despite several city and county emergency medical systems enabling the use of this technology for transmission of videoconferencing during transport, little data exists that demonstrates this impacts quality of care and/or patient outcomes. Research will be needed to identify which types of transports, which modes of transports, and for which types of patients this technology may assist in transport medicine.

Telemedicine in Emergency Departments

There have been several studies that have investigated the use of telemedicine to provide consultations to children and/or adults seeking care in remote emergency departments that otherwise lack access to specialty providers. Most publications have been descriptive, reporting feasibility and anecdotal results; however, more recent investigations are demonstrating improvements in emergency department quality of care when videoconferencing is used to incorporate regionalized consultants.[19–25] In some instances, the installation of videoconferencing systems in critical access hospitals have created a new model of emergency care in which emergency medicine physicians can assist physician extenders who work in underserved or critical access hospitals.[26–28] Similar to scene telemedicine, emergency department telemedicine can be used to assist emergency medicine physicians in the stabilization and initiation of critical care therapies, particularly if subspecialty physicians can be of service. Telemedicine could also be used to assist in determining the need and appropriateness for admission and best mode of transport for those requiring transfer to a regionalized medical center. Several studies have suggested that the use of this technology can assist in patient triage and, in some circumstances, has resulted in reducing the unnecessary use of air medical transports.[29–33] In addition to standard videoconferencing with a room camera, peripheral medical devices can be connected to turnkey systems to transmit data from devices such as stethoscopes, ultrasonography machines, slit lamps, and laryngoscopes.[34,35]

Regulations and Reimbursement

Liability Insurance

Liability is frequently a concern of providers making themselves available for consultation over telemedicine; however, this concern is often overstated. Most medical malpractice insurance companies do require that providers disclose whether or not they are providing consultations over telemedicine, but often this disclosure does not result in an increased policy premium. A comprehensive or "umbrella" medical liability policy may cover providers for when they practice telemedicine. In fact, compared with telephone consultations, the use of telemedicine technologies may reduce exposure to malpractice lawsuits, because the consultant may be able to obtain a more comprehensive evaluation of the patient.[36] This is particularly true for practitioners providing consultations to remote patients in emergency situations, in which telephone consultations are common and a thorough evaluation cannot be conducted.

A standard recommendation for those practicing telemedicine is to contact the insurance provider to disclose that consultations are being provided over telemedicine and allow the insurance provider determine whether additional coverage is needed.[37] A primary concern would be if consultations are provided across state lines, where liability legislation, such as malpractice insurance caps, may vary.[37] If a medical provider is not insured by a personal or group policy, there are several insurance companies that provide telemedicine specific malpractice coverage for those not otherwise covered by a more comprehensive policy.

Credentialing and Privileging

In 2010, the Centers for Medicare and Medicaid Services (CMS) enacted legislation defining rules regarding credentialing and privileging for physicians and practitioners providing telemedicine services. These new rules streamline the process that hospitals partnering to deliver telemedicine services use to credential and grant privileges to telemedicine physicians. A hospital that provides telemedicine services to its patients via an agreement with another hospital is now allowed to rely on information furnished by the hospital where the consultant is located (often the larger medical center). This new ruling reduces the burden and duplicative nature of the traditional credentialing and privileging process for hospitals that are engaged in telemedicine agreements, while still assuring accountability to the process.

Reimbursement

Practitioners are able to bill Medicare for telemedicine reimbursement (HR 5661 and HR 6331) for specified *Current Procedural Terminology* (CPT) codes[38,39]; however, some restrictions apply, including that the patient receiving the telemedicine consultation must be located outside of a metropolitan area. Similarly, for Medicaid, services rendered via telemedicine can be billable and reimbursed at similar rates as in-person medical services, provided the state has passed legislation expanding their Medicaid services to include telemedicine. Currently, more than half of the states have expanded Medicaid to cover telemedicine services, but there are often varying stipulations.[40,41] Reimbursement from private insurance companies vary but most often are similar to Medicare and local state Medicaid guidelines.[42,43]

The Future of Telemedicine

As the telemedicine technologies and telecommunications improve, it is expected that the use of telemedicine in transport medicine will continue to increase and become more incorporated in the way that providers practice pediatric medicine. The CMS and related federal and state agencies, including the Agency for Healthcare Research and Quality (AHRQ), are increasingly recognizing the utility of telemedicine in increasing access to care, improving quality of care, and increasing the efficiency with which regionalized care can be delivered. Many pediatric academic medical centers are already using telemedicine to extend their reach, extending the delivery of their care outside the walls of their physical facilities. It is anticipated that as federal, state, and more local regulatory bodies continue to update reimbursement, licensure, and credentialing policies and as more research data are published on the efficacy of telemedicine, telemedicine will become a critical tool for all personnel involved in emergency medical services for children, including those involved in pediatric transport medicine.

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CHAPTER 22

Stress Management, Debriefing, and Team Health

Outline

- Identifying contributing factors
- Stress-management programs
- Personal responsibilities

Transport professionals face stressful situations every day. Indeed, transport professionals actually thrive on stress, referred to as eustress. Eustress is the positive stress that challenges but also offers a sense of accomplishment or fulfillment. Distress is negative stress that is related to anxiety or depression and is not easily resolved. The best way to manage distress is to recognize it and prevent stress as much as possible. The Commission on Accreditation of Medical Transport Services, an organization of nonprofit transport professional associations, such as the American Academy of Pediatrics, requires stress recognition and management as part of the initial and ongoing competencies for transport personnel. Behaviors that are known to mediate stress are healthy habits, such as proper nutrition, adequate rest, exercise, and other elements of self-care.

Identifying Contributing Factors

Each team may have sources of stress that are unique to their program related to geography, patient population, referral and receiving staff, team composition, customer service, cultural diversity, or other expectations. There are universal stressors related to transport, such as weather, limited resources, various modes of transport, changing team composition, communication, and equipment failure/malfunction.

Strategies shown to improve communication, conflict resolution, and team work, such as Air Medical Resource Management (AMRM), Crew Resource Management (CRM), *Medical Team Training,* and *Team Steps,* contribute to reducing stress and increasing job satisfaction. One critical feature of these programs is "flattening of the hierarchy," allowing any member of the team to freely voice concerns. A familiar example of this is a surgical technician "stopping the line," requiring everyone in the operating room (physicians, nurses, everyone present), to stop and address a situation before proceeding with the case. Another education program/strategy, "Just Culture" focuses on system design and behavioral choices, not specific errors and adverse outcomes. Just Culture focuses on acknowledgement of risk and risk management within the specific definitions of human error, at-risk behavior, and risky behavior on the basis of shared organizational and professional values. Just Culture provides a detailed algorithm with learning strategies and well-defined actions to be taken with the system and individual in the response to identified risk.

Stress-Management Programs

Many emergency medical services and transport teams have developed programs based on the Critical Incident Stress Management model. Although well accepted in the emergency medical culture, the effectiveness of this intervention has been questioned. Some view it as potentially harmful and cite lack of randomized clinical trials. Indeed, there is controversy on what exactly constitutes a critical incident, when and who should be debriefing, who should attend, and how to identify and provide additional support when needed.[1,2]

Devilly & Cotton[2] offer broad guidelines to address stress in the workplace. First, have an organizational critical incident management policy that reflects current evidence. This policy may address unique stressors to the team. Define what constitutes a critical incident for your team and update it as necessary. For example, a hospital merger may be more appropriately addressed by a consultant in organizational structure and change, whereas a patient or team member death would be addressed as a critical incident. Second, facilitate access to immediate and practical support, as the situation warrants, including food and shelter to timely expressions of concern and support from managers or peers. Third, provide access to employee assistance or wellness programs. This initial contact is not to be considered clinical intervention but social support, an opportunity for screening and familiarity if symptoms appear and intervention is indicated. Most transport programs have access to wellness programs, employee assistance programs, or other support that may also include professionals such as clergy, social workers, psychologists, or other mental health care professionals. Fourth, provide factual information when incidents occur. Fifth, promote ongoing conflict resolution and problem solving skills, with one of the aforementioned programs or something similar. Last, monitor and screen for “at-risk” behaviors and provide support as indicated by current evidence and reflected in the policy. Talk to other transport teams; attend presentations of teams who have not only survived but learned from tragic experiences building a stronger and more resilient team.

Every team is different, and each transport is different. The stress from some calls can be neutralized by a conversation with a supportive colleague. Others may be resolved participating in social activities after the shift has ended, and some may benefit from professional support, as mentioned previously. Ideally, a variety of voluntary resources are available to team members. Transport situations triggering a quality review, such as patient instability, equipment failure/malfunction may also provide opportunities for team members to discuss stressful incidents or stresses within the team.

Personal Responsibilities

In addition to exercising self-care, maintaining healthy habits and establishing proper communications within the team, other aspects of individual accountability have important roles for minimizing tensions within the workplace. Among these are self-awareness, attendance, respect for other team members, emotional intelligence, accountability, adherence to program policies, and involvement in peer evaluation and performance reviews.

The transport arena is full of emotions for everyone involved: patients, families, referral hospital staff, and transport team members. Although transport professionals are expected to keep emotions in check, feelings are often revealed by nonverbal or verbal (tone, pitch, and pacing of the voice) communications. Emotional intelligence and self-awareness are essential. Stress of both forms (eustress and distress) is dependent on individual perception and may vary from day to day and situation to situation. Knowledge of one’s personal motivators, strengths, and vulnerabilities allows the individual to develop mechanisms for dealing with predictable sources of stress. Some common triggers are known by the acronym and the phrase “do not get too hungry, angry, lonely, and tired” or HALT. An individual sensitive to hunger may choose to keep an energy bar available for busy days, and all should recognize that lack of sleep will make adaptation to distress more difficult. A team member who is neat by nature may need to adopt a more relaxed attitude when paired with a partner with messy tendencies. Perspective and a positive outlook can mediate stress. Does the messy partner provide good patient care and excellent customer service? Focus on the positive attributes may promote self-reflection to question: how important is neatness? However, in a different setting, if a partner is not behaving/performing in a patient-/family-centered manner, is not clinically skilled, or is not communicating effectively, then participating in the peer evaluation and performance programs is indicated. The principle of Just Culture provides a format to clearly set expectations and define consequences for failure to meet standards on the basis of shared organizational and professional values. Managers and medical directors cannot be present on every transport. Peers must be accountable and hold each other accountable in a respectful manner. From the customer service perspective, the transport program is only as good as the last transport. A negative impression from one transport can jeopardize referral patterns and business models for the entire team and institution.

Stressful situations, difficult conversations, and challenging medical conditions are often recreated through simulation education. These educational forums allow team members to develop and practice strategies to better prepare for those “unexpected” challenges common to all transport teams. Simulation scenarios and debriefings can also be used to address team and individual work behaviors. With supportive facilitation, team members may identify stress- inducing work habits and begin developing coping mechanisms. By preventing distress, the transport professional can capitalize on the eustress that provides motivation to continue in a job that is inherently “stressful.”

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CHAPTER 23

Involvement and Integration With EMS

Outline

- Intersections of critical care transport and EMS systems
- Integrating CCITTs with EMS
- Unexpected medical encounters
- Long-term entrapment
- Triage
- Disasters
- Training opportunities

OVERVIEW

Because of the nature of their employment, nurses, physicians, respiratory therapists, and technicians with pediatric critical care interfacility transport teams (CCITTs) may have little involvement or integration (cooperative training or practice) with the local emergency medical services (EMS) system, although to the public eye, they often are considered components of the same emergency transport system. Each has a tremendous amount to gain from the expertise of the other. This chapter discusses how sharing some of these perspectives and skills can be an advantage to EMS and CCITTs as they perform their mission of providing mobile patient care.

If one takes a closer look at both disciplines, the similarities in the way they provide care are striking. The CCITT performs telephone triage and evaluation and management of the patient, which, in many ways, is the interfacility transport version of 911. If the decision to accept the transfer is made, the CCITT is dispatched and, on arrival at the referring hospital (or on scene for EMS), performs on-site triage and evaluation, management, and stabilization of the patient's condition. It then is the responsibility of the CCITT, like EMS, to successfully transport the patient to the receiving facility while continuing ongoing efforts at stabilization.

There are also differences between CCITTs and EMS. For example, in most cases, patients referred to the CCITT have been triaged, assessed, and often treated by advanced medical providers, usually physicians. This is rarely the case when EMS is involved. EMS providers are often the first and only responders on scene, and, depending on the availability of online medical direction, they provide the highest level of care the patient is likely to receive before hospital arrival.

Integrating CCITTS With EMS

There often is a casual integration with EMS as the CCITT performs its job. This integration may range from using the same parking spaces outside of the emergency department to the use of EMS providers or vehicles as a core component of the CCITT. Further efforts and development of this relationship can be mutually beneficial. There are many areas of expertise in the EMS system that can be invaluable for the CCITT, including the following:

- Emergency vehicle operations
- Communications
- Use of an incident command (IC) system
- Continuing education specific to the prehospital environment
- Triage of multiple patients
- Rapid and efficient on-scene triage, evaluation, and management of patients
- Consistent, effective, and outcome-driven phone triage algorithms
- Mass casualty preparedness

There also are many areas of expertise within the critical care transport environment that could be shared with EMS providers, such as the following:

- Phone direction of advanced care
- Advanced and thorough medical assessments and care provision
- Integration with hospital personnel
- Anticipation of next steps in critical care patient management
- Provision of thorough care with complete written and verbal patient care reports
- Ability to use hospital-based resources and educational opportunities
- Access to academic and tertiary medical settings and the opportunity to work with students, residents, and fellows
- Nationally standardized education, training, licensing, and certification of providers

- Consistent advanced medical control
- Implementation and use of research protocols
- Successful integration of effective quality assurance programs into medical practice

Integration between groups requires an understanding of educational backgrounds and care capabilities. The standard levels of EMS training and personnel in the prehospital environment are as follows:

- First responders: can assist with basic first aid, use an automated external defibrillator, and perform cardiopulmonary resuscitation and very basic airway support; typically have approximately 40 hours of training
- Emergency medical technician-basic (EMT-B): can perform the preceding skills and immobilization, extrication, oxygen support, and patient transport in an ambulance; typically have approximately 100 hours of training
- Emergency medical technician-intermediate (EMT-I): can perform preceding skills and may have advanced airway skills, such as intubation, and the ability to obtain intravenous access; relatively few EMTs are trained and have wide variability in skills performed; training time, approximately 200 hours
- Emergency medical technician-paramedic (EMT-P): have advanced skills and can perform advanced airway support and administer medications in the field; training of more than 1000 hours (often closer to 2000 hours) with extensive field internships that are integral to the certification process
- "Critical care transport" EMS provider: available in some areas; training builds on the skills of an EMT-B, EMT-I, or EMT-P; courses usually presented in a modular format over several months and include didactic and clinical instruction

The different levels of EMTs can be confusing. When teaming with an EMS provider, it is important to clarify professional capabilities and personal comfort level with expected involvement.

Whether it is through day-to-day casual encounters, ride-alongs (strongly encouraged as a learning opportunity), or an integrated educational and training program, the importance of sharing expertise between EMS and CCITTs cannot be overstated. This sharing should start with a better understanding of one another's modes of operations. For example, hospital transport and other medical professionals may not be aware of the education, capabilities, or scope of practice of prehospital providers. The converse is often true for EMS providers, who typically work in the field and may not regularly interact with CCITT members. Understanding one another's roles and responsibilities is especially important during high-volume and high-acuity situations or in the case of limited care availability (such as a mass casualty or evacuation with use of both resources), when the distinctions between EMS and CCITT may blur. Situations such as mass casualty incidents or disasters of any kind may demand that the CCITT move into a role to which it is unaccustomed. Issues such as definitions of words used can add to confusion and communication difficulties for teams working together without previous training. For example, "casualty" may mean something different to an EMS-trained provider than to a transport team member (death vs an injured patient, respectively). Operational training in the aspects of EMS will be of a great benefit to the CCITT if it is needed to integrate into EMS-level care. In addition, it is always in the best interests of the CCITT and the EMS to have predesignated plans of action for these types of situations. Examples where this may be useful are described in the following section.

Unexpected Medical Encounters

It is likely that the CCITT eventually will be the first to arrive at a vehicle accident or medical emergency in the field. It is in the best interests of the CCITT to have a predesignated plan of action for these situations. Policies should be developed for when the ambulance has a patient in transit, is on the way to pick up a patient, and is returning from a transport without another commitment. These policies should be made with legal input and should combine the employment and other jurisdictional requirements of the specific transport personnel and other participants in the process (eg, EMT driver).

Because CCITT members might not have prehospital credentials as do EMTs, they should know whether their state's Good Samaritan laws protect on-duty health care professionals and whether they are required to stop and provide care. Many teams stop and provide emergency care as needed and simultaneously contact 911. The decision to do so when transporting a patient or en route to pick up a patient depends on multiple factors, including the status of the patient, the condition of the accident scene and victims, team policy, and the opinion of medical control, if applicable. The condition of the patient the CCITT has agreed to transport must be continuously monitored and care maintained regardless of any external situation and must remain the team's top priority. A poor outcome possibly linked to a delay in care or transport may be grounds for legal action (see Chapter 7).

A. **Interfacing the EMS Transport of Pediatric Patients With CCITT "Scene Response"**: In a changing health care environment, the most effective utilization of health care services may be to incorporate or combine transporting teams into one central transporting service (adult and pediatrics; adult, pediatric, and EMS; or pediatric and paramedic-paramedic pediatric transport services [more for pediatric patients with greater technology needs]). With combined pediatric and adult transport services, there is potentially or more likely direct interface between the CCITT services and EMS crews transporting a critically ill child. This combined system increases likelihood of the CCITT services to perform pediatric critical care scene response management. This is a new environment for the CCITT crew in terms of their knowledge base and inherent organizational system. A successful CCITT-EMS interface would include the CCITT becoming familiar with this EMS transport environment, training of the CCITT crew for EMS systems, CCITT understanding of the pediatric knowledge base by the EMS crews, and most importantly, understanding the experience of the EMS crew with pediatric critically ill and injured patients. The CCITT crew must also be familiar with the environmental stresses that occur during these patient-EMS interfaces—cold, rain, terrain, and actual limitations of transferring the patient. This pediatric scene response is new to certain urban CCITTs, but certain CCITT services that transport over long distances or rural environments have become experts by trial and error in this type of transport.

B. **Interfacing the EMS Transport of Pediatric Patients with CCITT Services**: There may be variations of "EMS Scene Response." In certain situations utilized by CCITT teams-whether ground, rotor-wing or fixed-wing services-the ability to transport these critically ill and injured neonates and or children may be limited because of availability of service capabilities or teams. In certain situations, this can be a limiting factor for optimizing transport for critically ill neonates and or child. In the realm of transport adaptability, flexibility, ingenuity, and thinking outside the box, many transport services have encountered these type of cases, and some of these particular patients are frequent participants. CCITT services must develop systems, pathways, or protocols for handling these types of particular pediatric or neonatal patient transfers.

The CCITT systems or services must develop an integrating process or protocol for the local or appropriate EMS services with the most appropriate transfer process for these patients to either a fixed referral center or a designated rendezvous point for the CCITT team to accept and transport these patients between the 2 services. In CCITT services that have long transport distances or are located in rural areas, these types of transports are common. They have developed a process integrating the local or most appropriate EMS services for these particular patients. These teams have developed or adapted this mode of pediatric/neonatal patient transfer very effectively.

The caveat in this mode of transport is that both the referral, local EMS services, and medical control of the CCITT services must all be in mutual agreement that this is the most optimal transfer process for this particular patient. These particular pediatric or neonatal transports must be individualized, emphasizing the best care for the child while using the most efficient transporting process or integration of services that shortens transfer time while improving overall survival with decreasing morbidity and mortality. These types of transports should be part of any CCITT services that deals with rural areas or limited access capabilities by referral centers for these types of pediatric/neonatal patients. The philosophy of EMS just transporting this particular patient because of the inability of CCITT to immediately transport will, in a majority of cases, be the best optimal process. In this new health care environment with increasing survival rate for the neonatal and pediatric patients with complex diseases and special high-tech requirements, these types of EMS services can be taxed or limited. The knowledge base or expertise, equipment needs, or vehicles by local EMS that is required to transport these particular "high-tech or specialized" pediatric or neonatal patients may be very limited to none; therefore, CCITT involvement is strongly encouraged in the patient discharge process and for continued care with the referral center. The CCITT system must be constantly adapting and integrating these types of patients into their database of specialized patients, transfer process, and education with local EMS referral centers and have to provide medical control for these particular types of patients.

Local, regional, or state disaster response plans of any CCITT service should include pediatric/neonatal pediatric transport protocols.

C. **Key Aspects of the Interface Between the CCITT and EMS the "Scene Response Arena"**:

1. **Patient Handoff Environment Between EMS and CCITT**: These 2 services need to come to a mutual understanding of the knowledge base and limitations of each service as well as their expectations. The CCITT team must have an extensive knowledge base for the various EMS crews with which they may interface, which will decrease missed communications, decrease patient handoff time, and improve efficiency of medical services rendered at the scene and overall decrease transport time. With improved CCITT understanding of the EMS services, the team will improve its critical thinking process for the anticipation and/or expectation of the medical needs/interventions that will be required for the patient.
2. **Expectations Between the EMS and CCITT Teams**: The major critical error in patient handoff is the lack of understanding or interpreting the level of care/experience between the 2 services. An understanding of the environment in a training level between the 2 services greatly reduces resuscitation needs and expectations, reduces unnecessary interventions, and improves overall patient outcome. The expectation between these 2 parties needs to be addressed in the initial phase of patient transfer. The CCITT's first interface with the EMS crew should be focused on a concise and brief chief complaint, the crew's initial assessment of the patient, situational or environmental factors, critical thinking of the EMS crew's assessment, interventions or therapeutic interventions with the resultant patient's response, and current cardiovascular status of the patient. The CCITT must always be cognizant of the stress factors by the EMS crew. They must be respectful and courteous to the crew and commend the crew for their services. During the patient transfer or handoff, acknowledgment of the EMS services with positive feedback is encouraged. If issues occur during patient transfer, they should be addressed in a more appropriate environment and with appropriate educational needs by the teams. This process of patient handoff can be incorporated as part of the CCITT educational outreach services with the referring centers and EMS.

Environmental Issues Affecting the Medical Response by Transporting Teams: The environmental factors can be weather related or terrain, patient access, or personnel limitations. These environmental issues necessitate the crew's alteration in critical thinking process and interventions. These environmental factors play a role in the mode of transport between these 2 services. Environmental factors could necessitate a rotor-wing base service utilizing a ground service to interface with an active EMS transporting service. This would necessitate an adjustment in CCITT method or mode of transport back to the accepting facility. Example: a rotor-wing team flies out to scene response activated by EMS crew, and weather changes prevents the helicopter return to the accepting facility. The solution would necessitate the helicopter team returning to the facility using the EMS service as a ground unit. In pediatric transport, as in the adult realm, using critical thinking processes in a changing transport environment is the key aspect to success.

Long-Term Entrapment

It is possible that a CCITT may be asked to bring specialty care to the scene of a prolonged entrapment that requires ongoing medical management or a critical intervention, such as an amputation. Under these circumstances, the CCITT must know how to function under the incident command (IC) system for safety and accountability. Every team member should understand the basic concepts of IC and understand that scene work or evaluation of multiple patients demands a level of personal and team awareness and communication that may not be realized in routine daily single-patient or transfer operations. Some states require that CCITT members have EMT-B certification (or higher), which helps to prepare the interfacility participant for EMS activities. Some CCITTs will require nursing or other members to obtain EMT-B, EMT-I, or EMT-P certification in addition to their primary academic preparation to help prepare for potential EMS activities. In Pennsylvania, for example, a critical care transport nurse is required to have additional EMS certification, which leads to a recognized designation as a prehospital registered nurse (PHRN). This helps ensure that these nurses possess the necessary skills to function in the prehospital environment on a routine and an emergency basis.

Triage

During the first phases of an ongoing emergency, especially involving large numbers of children, the neonatal-pediatric CCITT may be asked to assume a role in triage and stabilization of patients' conditions in the field.

CCITT members are often the highest medically trained participants in mobile medical care who are available on an emergency basis, and unusual (eg, EMS participation and triage) requests may be made of them in a crisis, such as a local disaster or mass casualty situation. Basic awareness and training in a triage protocol, such as JumpSTART or other mass casualty triage tools, greatly increases the efficiency by which CCITT members can assess and treat patients. The specific tool recommended or used by the local EMS and emergency preparedness groups should be the triage tool used for training. Introductory training in triage enables CCITT members to provide better assistance to EMS personnel, who are trained to triage in the most effective manner during a mass casualty. Drills with local EMS agencies and classroom training that typically is reserved for EMS providers are excellent opportunities to become exposed to and practice these skills.

Disasters

The CCITT may be asked to take a critical or even a leadership role in internal or external hospital disasters or events requiring patient movement within, to, or from the hospital. Depending on the scale and scope of the incident, outside fire and EMS agencies and personnel may be involved and in charge. A working knowledge of the IC system will be useful for assisting in maintaining command and control of the situation and for integration with the outside agencies.

The Federal Emergency Management Agency became part of the new US Department of Homeland Security in March 2003 and has championed a new disaster management structure. The National Incident Management System (NIMS), developed by the Secretary of Homeland Security, integrates effective practices in emergency preparedness and response into a comprehensive national framework for incident management (http://www.fema.gov/nims/). Understanding and participating in NIMS training should enable CCITT and EMS personnel to work together more effectively to manage domestic incidents no matter what the cause, size, or complexity.

The Hospital Emergency Incident Command System (HEICS) is a version of IC that is specific to hospital emergency planning and operations. CCITT members should be trained in how to operate within the HEICS system to function optimally and maintain accountability and safety when operating within the hospital system. If an incident involves special medical considerations, such as one with a biological or chemical agent, the CCITT may be involved as an important participant in providing organized and optimal care for large numbers of potentially exposed children. In such cases, it is important for the CCITT to rely on current training and have clear access to specific medical and logistical information and personnel for the appropriate and safe care of children in this environment. It is in the best interest of CCITT members to hold themselves to the highest standard in terms of operational awareness and medical knowledge in situations involving weapons of mass destruction. Even if CCITT members do not serve as a resource in this role on a day-to-day basis, they likely will be considered experts if a crisis develops. Hospitals may be so overwhelmed that they cease to be a resource for EMS, so CCITT members may need to provide care in the field and perform primary triage, care, and transport, especially during the first hours of a crisis. An excellent resource for disaster preparedness is the AAP Web site on Children and Disasters (http://www.aap.org/en-us/advocacy-and-policy/aap-health-initiatives/Children-and-Disasters/Pages/default.aspx).

In an evolving disaster plan, current systems need to focus on the volume of patients with specialized needs. Although fewer, critical pediatric and neonatal patients may pose added challenges and need to be considered in any well-rounded disaster plan. Integrated CCITTs must be utilized for the specialized or high-tech pediatric patients. In any response plan, these CCITTs could be used for back transport for the less severe pediatric patients to non disaster hospitals that can appropriately manage pediatric patients. The integration of various CCITTs into the state or regional plans must have active participation by the medical physician and nursing director of the transporting services in the regional and state disaster response systems.

As in the previous section, the needs of the "high tech or specialized" pediatric and neonatal warrants particular integration by the CCITT service for their needs during disaster planning or implementation. Also, these particular pediatric/neonatal patient transports should be developed and integrated into any CCITT service as part of their disaster response for local, regional, or state response plan.

Training Opportunities

Many opportunities exist to overlap the training of EMS and CCITT personnel. Routine standardized certification classes, such as Pediatric Advanced Life Support (PALS), Advanced Cardiac Life Support (ACLS), Pediatric Education for the Prehospital Professional (PEPP), and Advanced, Basic, and Prehospital Trauma Life Support (ATLS, BTLS, and PHTLS), help CCITT and EMS personnel in attaining the goals of standardizing and improving patient assessment and emergency treatment. The principles, knowledge, and skills learned in these courses apply seamlessly across the prehospital and hospital environments. Neonatal-pediatric CCITT members must be proficient in these skills and must be flexible enough to respond to unexpected circumstances, such as pregnant adult or pediatric patient. When they have attained this level, members can participate as instructors and reinforce their own skills while forging new relationships with EMS providers.

Specialized training in EMS and emergency operations is also an important consideration for CCITT members. By developing a relationship with EMS providers, it may be possible for CCITT members to participate in EMS training, such as teaching EMT classes, participating in IC classes, and participating in community first responder classes, such as the community emergency response teams (CERTs). Prehospital and CCITT personnel can benefit from participation in organizations, such as federal disaster medical assistance teams (DMATs) or the local CERT. In these specialized environments, all levels of providers from inside and outside the hospital environment can serve together with a common goal.

CCITTT team members can create educational programs for EMS providers to disseminate pediatric and neonatal education information. This can be accomplished by various educational venues. Examples include pediatric and neonatal case simulations for the various EMS agencies that service common peripheral centers, as well as EMS providers riding with the CCITT teams during patient transport runs. These courses or sessions will increase the pediatric and neonatal educational knowledge base for these EMS crews and referral centers. These sessions will also improve communication between the parties and expectations that each party is to render. The CCITT teams can also use recent problematic pediatric/neonatal transport cases in an informative educational session between the EMS crews and referral centers and the accepting facilities. The goal of these educational sessions is to improve communication and expectations and decrease pediatric and neonatal morbidity and mortality associated with transport. The educational benefits by using the team in the paramedic outreach program will enhance the 911 care for pediatrics and enhance a stable referral base.

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APPENDIX A

Sample Position Descriptions

1. **Critical Care Transport Transport Nurse**
2. **Critical Care Transport Respiratory Therapist**
3. **Critical Care Transport Emergency Medical Technician-Paramedic**
4. **Transport Emergency Medical Technician-Basic**
5. **Critical Care Transport Physician**
6. **Critical Care Transport Medical Control Physician**

The following are provided as examples of position descriptions from neonatal and pediatric transport programs. Licensing and practice regulations vary considerably from state to state. Transport programs should take into consideration local regulatory and licensure requirements and individual program policies when configuring their team composition, defining practice parameters, and developing position descriptions.

1. Sample Position Description—Critical Care Transport Nurse

Position Description

- Practices in accordance with philosophy, policies, procedures, and standards of the hospital; functions within the guidelines of the protocols for the transport program that are reviewed and agreed on by medical and nursing directors.
- Functions include the identification, planning, implementation, and evaluation of emergency care for acutely ill neonates, infants, children, and/or adolescents in collaboration with the medical control physician (MCP; sometimes called medical control officer, or MCO). This person is responsible for obtaining pertinent maternal, neonatal, and childhood histories, performing physical examinations (neonates through adolescents), and formulating differential diagnoses and care management plans. Responsibilities include performing necessary diagnostic and therapeutic procedures as indicated for identification and management of problems,

including, but not limited to, umbilical line placement, peripheral or central venous access, endotracheal tube placement, needle aspiration, chest tube placement, and interpretation of laboratory and radiographic data.
- Also important is the need to provide family-centered care, including psychosocial support, education, and transfer planning in conjunction with referral staff.
- Represents the hospital to health care professionals in referring hospitals.
- Maintains effective communication with referral staff and families.
- Educates referral staff through informal teaching and planned educational conferences.
- Initiates and participates in educational, research, professional, and organizational activities that contribute to improving patient care, the transport program operation, and the individual's own professional development.

Reporting Relationship

Reports to:
- Medical director of the transport program for supervision and guidance in expanded role function.
- MCP as designated for medical supervision concerning the management of individual neonatal and pediatric patients during transport.
- Nursing (or program) director or designee for care and administrative aspects of practice.

Requirements

1. Requires a minimum of 3 years of neonatal intensive care unit (NICU) or pediatric intensive care unit (PICU) or pediatric emergency department experience within the last 5 years. Critical care transport experience preferred.
2. Current in Basic Life Support for the Health Care Provider, Advanced Cardiac Life Support, and Pediatric Advanced Life Support. Certification in Neonatal Resuscitation Program (NRP) and Trauma Nursing Core Course (TNCC) or Advanced Trauma Life Support (ATLS) preferred.
3. BSN-prepared at a minimum.
4. State licensure as a registered nurse.
5. Computer literacy.

6. Holds current passport or is eligible to apply for one if program will be doing international transports.
7. Demonstrates strong written and verbal communication skills at staff, patient, and family levels.

Major Responsibilities and Duties

I. Patient care activities
   A. Obtains pertinent maternal, neonatal, and pediatric histories with emphasis on risk factors and their implications for problems.
   B. Performs pertinent physical examination using techniques of observation, inspection, auscultation, palpation, and percussion.
   C. Assesses patient weight for use in calibration of medication and fluid management.
   D. Formulates differential diagnosis and a plan for management of existing and potential problems in collaboration with the MCP.
   E. Performs necessary diagnostic and therapeutic procedures as indicated for identification and management for problems as indicated by protocol, including (but not limited to):
      1. Peripheral percutaneous arterial sampling and line placement
      2. Umbilical venous and arterial catheterization
      3. Airway management, including assessment, stabilization, bag-mask oxygenation and ventilation, endotracheal intubation, tracheostomy management, and rescue airways
      4. Needle aspiration of pleural space and chest tube placement
      5. Interpretation of routine laboratory and radiographic data
      6. Insertion of central venous catheters (femoral vein only)
      7. Insertion of intraosseous needle for emergency vascular access
      8. Spinal immobilization
      9. Trauma triage care
      10. Blood drawing (venous and arterial) and insertion of peripheral catheters
   F. Provides clinical management for resuscitation of the neonatal, pediatric, and/or adolescent patient, including necessary pharmacologic support.
   G. Performs in accordance with standing orders and accurately documents delivery of care.

H. Communicates information about the patient's "working" diagnosis, plan of management, and prognosis to the referring physician, parents, and other members of the health care team.
I. Assesses parents' psychosocial needs and initiates referral to appropriate consultants.
J. Obtains informed consent from parent(s)/guardian(s).
K. Provides ongoing monitoring, assessment, and appropriate interventions in transit.
L. Ensures patient safety in the transport process.
M. Completes documentation in an accurate and timely manner, and transfers care of the patient to the receiving hospital staff.

II. Education
A. Contributes to community outreach and education.
B. Assists in the assessment of staff developmental needs, and participates actively in plans to meet those needs.
C. Participates in teaching or coordination of in-service classes or workshops for the transport staff.
D. Serves as a preceptor in the training of future transport team members.

III. Operation of transport equipment
A. Demonstrates knowledge of operation and troubleshooting of all transport equipment. Ensures proper functioning and availability of equipment before transport.
B. Participates in the ongoing evaluation of transport equipment needs. Reports and documents transport equipment repairs as needed to biomedical engineering.
C. Demonstrates knowledge of aircraft and ambulance operating procedures and safety practices.

IV. Special assignments/project responsibilities
A. Assists with medical procedures in the NICU/PICU or emergency department on request.
B. Performs the following transport quality improvement activities:
   1. Maintains, supports, and documents evidence of a planned, systematic quality improvement program that includes effective mechanisms for monitoring and evaluating the patient care provided by the transport service.
   2. Ensures appropriate and adequate response to findings from quality improvement activities.

3. Maximizes the efficient use of resources available to provide neonatal-pediatric transports.
4. Identifies opportunities to improve care.

V. Leadership
   A. Initiates and participates in the implementation of change in transport nursing policy, procedures, and/or practice to enhance the quality of patient care.
   B. Participates with transport staff in problem identification, goal setting, and transport care delivery evaluation.
   C. Uses previous clinical experience and knowledge to identify potential patient care problems related to transport.
   D. Serves as a resource or consultant to nursing and medical staff regarding neonatal and pediatric transport.

VI. Professional accountability
   A. Demonstrates continued professional growth through continuing education and review of current literature pertaining to neonatal-pediatric transport.
   B. Maintains licensure, certifications, and competency through required training and/or education.
   C. Maintains professional relationships with community physicians, nurses, and other health care professionals.
   D. Participates in peer review of the transport team members and case reviews with the medical director.

VII. Research
   A. Identifies researchable patient and nursing care problems related to transport.
   B. Uses evidence-based research findings in patient care.
   C. Cooperates and/or collaborates with other health care team members in the conduct of research studies.

VIII. Physical capabilities
   A. Frequently requires sitting, standing, and walking for long periods. Requires bending, crouching, and kneeling. Requires use of hands, keyboarding, fine motor skills, frequent lifting up to 50 lb, occasional moving up to 250 lb. Must be able to work in small confined spaces and be able to work in a mobile environment, either ground or air.

B. There is a potential for regular exposure to patients with infectious diseases requiring observance of appropriate precautions.
C. Flexible working hours required to provide 24 hour/day, 7 day/week coverage, including rotating shifts, weekends, holidays, and on call.
D. Dependability in regard to attendance at work, team meetings, nursing meetings, committee meetings, etc.

IX. Environmental conditions
Indoor and outdoor environments with possible exposure to infectious, biological, and chemical agents. Occasionally requires working in proximity to sources of radiation. Work area includes riding in enclosed spaces, such as ambulances, helicopters, and airplanes. Work environment commonly provides exposure to high noise levels.

2. Sample Position Description—Critical Care Transport Respiratory Therapist

Position Description

- Practices in accordance with philosophy, policies, procedures, and standards of the hospital; functions within the guidelines of the protocols for the transport program that are reviewed and agreed on by medical, nursing, and respiratory care directors.
- Evaluates and maintains respiratory care services for all critically ill patients. Establishes patient care plans and collaborates with team members and MCP.
- Provides family-centered care to meet family needs, including psychosocial support, education, and transfer planning in conjunction with referral staff.
- Participates in the educational and professional development of transport team members.
- Represents the hospital to health care professionals in referring hospitals.
- Maintains effective communication with referral staff and families.
- Educates referral staff through informal teaching and planned educational conferences.
- Initiates and participates in educational, research, professional, and organizational activities that contribute to improving patient care, the transport program operation, and the individual's own professional development.

Reporting Relationship

Reports to:

- Medical director of the transport program for supervision and guidance in expanded role function.
- The MCP, as designated, for medical supervision concerning the management of individual neonatal and pediatric patients during transport.
- Transport program manager for administrative and care aspects of transport.
- Respiratory care director or designee for respiratory therapy and administrative aspects of practice. This designee is usually but not exclusively within the transport program.

Requirements

1. Requires a minimum of 3 years of NICU/PICU or pediatric emergency department experience within the last 5 years. Critical care transport experience preferred.
2. Current in Basic Life Support for the Health Care Provider, Advanced Cardiac Life Support, and Pediatric Advanced Life Support. Certification in NRP and ATLS preferred.
3. Requires National Board for Respiratory Care (NBRC) Registered Respiratory Therapist.
4. Requires degree from a Committee on Accreditation for Respiratory Care (CoARC)-accredited respiratory care program.
5. Requires NBRC neonatal-pediatric specialist examination.
6. State licensure (if required) as a registered respiratory therapist.
7. Computer literacy.
8. Holds current passport or is eligible to apply for one, if program participates in international transports.
9. Demonstrates strong written and verbal communication skills at staff, patient, and family levels.

Major Responsibilities and Duties

I. Patient care activities

   A. Assists in obtaining pertinent maternal, neonatal, and pediatric histories with emphasis on risk factors and their implications for problems.

B. Performs and/or assists with as appropriate pertinent physical examination of the respiratory system using techniques of observation, inspection, auscultation, and percussion.
C. Formulates a plan for management of existing and potential respiratory system problems in collaboration with the team leader and the MCP.
D. Performs necessary diagnostic and therapeutic procedures as indicated for identification and management of problems indicated in the program's protocols, including (but not limited to):
   1. Peripheral percutaneous arterial sampling
   2. Assist in umbilical venous and arterial catheterization
   3. Airway management, including assessment, stabilization, bag-mask oxygenation and ventilation, endotracheal intubation, tracheostomy management, and rescue airways
   4. Needle aspiration of pleural space
   5. Interpretation of routine laboratory and radiographic data
   6. Assist in spinal immobilization
   7. Assist in trauma triage care
E. Provides clinical management for resuscitation of neonatal, pediatric, and adolescent patients, including assisting in necessary pharmacologic support.
F. Performs in accordance with standing orders, and accurately documents delivery of care.
G. Provides ongoing monitoring, assessment, and appropriate respiratory care interventions in transit.
H. Ensures patient safety in the transport process.
I. Completes documentation in an accurate and timely manner, and transfers care of the patient to the receiving hospital staff.

II. Education
   A. Contributes to community outreach and education.
   B. Assists in the assessment of staff developmental needs, and participates actively in plans to meet those needs.
   C. Participates in teaching or coordination of in-service classes or workshops for the transport staff.
   D. Serves as a preceptor in the training of future transport team members.

III. Operation of transport equipment
   A. Demonstrates knowledge of operation and troubleshooting of all transport equipment, and ensures proper functioning before transport. Is primarily responsible for the respiratory care equipment, including ventilators, pulse oximeters, gas cylinders, and oxygen and other medical gas delivery devices.
   B. Participates in the ongoing evaluation of transport equipment needs. Reports and documents transport equipment repairs as needed to biomedical engineering.
   C. Demonstrates knowledge of aircraft and ambulance operating procedures and safety practices.

IV. Special assignments/project responsibilities
   A. Assists with medical procedures in the NICU/PICU or emergency department on request.
   B. Performs the following transport quality improvement activities:
      1. Maintains, supports, and documents evidence of a planned, systematic quality improvement program that includes effective mechanisms for monitoring and evaluating the patient care provided by the transport service.
      2. Ensures appropriate and adequate response to findings from quality improvement activities.
      3. Maximizes the efficient use of resources available to provide neonatal-pediatric transports.
      4. Identifies opportunities to improve care.

V. Leadership
   A. Initiates and participates in the implementation of change in transport respiratory therapy policies, procedures, and/or practice to enhance the quality of patient care.
   B. Participates with transport staff in problem identification, goal setting, and transport care delivery evaluation.
   C. Uses previous clinical experience and knowledge to identify potential patient care problems related to transport.
   D. Serves as a resource or consultant to nursing and medical staff regarding respiratory care aspects of neonatal and pediatric transport.

VI. Professional accountability
   A. Demonstrates continued professional growth through continuing education and review of current literature pertaining to neonatal-pediatric transport.
   B. Maintains licensure, certifications, and competency through required training and/or education.
   C. Maintains professional relationships with community physicians, nurses, respiratory therapists, and other health care professionals.
   D. Participates in peer review of the transport team members and case reviews with the medical director.

VII. Research
   A. Identifies researchable patient and respiratory care problems related to transport.
   B. Uses evidence-based research findings in patient care.
   C. Cooperates and/or collaborates with other health care team members in the conduct of research studies.

VIII. Physical capabilities
   A. Frequently requires sitting, standing, and walking for long periods. Requires bending, crouching, and kneeling. Requires use of hands, keyboarding, fine motor skills, frequent lifting up to 50 lb, occasional moving up to 250 lb. Must be able to work in small confined spaces and be able to work in a mobile environment, either ground or air.
   B. There is a potential for regular exposure to patients with infectious diseases requiring observance of appropriate precautions.
   C. Flexible working hours required to provide 24 hour/day, 7 day/week coverage, including rotating shifts, weekends, holidays, and on call.
   D. Dependability in regard to attendance at work, team meetings, respiratory care meetings, committee meetings, etc.

IX. Environmental conditions

Indoor and outdoor environments with possible exposure to infectious, biological, and chemical agents. Occasionally requires working in proximity to sources of radiation. Work area includes riding in enclosed spaces such as ambulances, helicopters, and airplanes. Work environment commonly provides exposure to high noise levels.

3. Sample Position Description—Critical Care Transport Emergency Medical Technician-Paramedic

Position Description

- Practices in accordance with philosophy, policies, procedures, and standards of the hospital; functions within the guidelines of the protocols for the transport program that are reviewed and agreed on by medical and nursing directors.
- As a team member during transport, functions to identify, plan, implement, and evaluate the stabilization and emergency care of the acutely ill neonates, infants, children, and/or adolescents in collaboration with the team leader and medical control physician. The transport paramedic is responsible for assisting the team leader in obtaining pertinent maternal, neonatal, and childhood histories, performing physical assessments (neonates through adolescents), and formulating and implementing care management plans. Responsible for performing necessary diagnostic and therapeutic procedures within the scope of practice of a paramedic.
- With expertise in the prehospital setting, the paramedic is responsible for ensuring that while in the out-of-hospital setting, the transport team is working in a safe and secure environment. Provides family-centered care to meet family needs, including psychosocial support, education, and transfer planning in conjunction with referral staff.
- Participates in educational and professional development of transport and other team members.
- Represents the hospital to health care professionals in referring hospitals.
- Maintains effective communication with referral staff, families, and the emergency medical services (EMS) system.
- Participates in the education of referral staff and prehospital care providers through informal teaching and planned educational conferences.
- Initiates and participates in educational, research, professional, and organizational activities that contribute to improving patient care, the transport program operation, and the individual's own professional development.

Reporting Relationship

Reports to:

- Medical director of the transport program for the supervision and guidance in expanded role function.

- MCP as designated for medical supervision concerning the management of individual neonatal and pediatric patients during transport.
- Transport program director or designee for clinical and administrative aspects of practice. If EMS services are outsourced, may report to EMS director of contracted service.

Requirements

1. Requires a minimum of 3 years of practice as a paramedic. Pediatric and critical care transport experience preferred.
2. Current in Basic Life Support for the Health Care Provider, Advanced Cardiac Life Support, and Pediatric Advanced Life Support. Certification in NRP and ATLS preferred. Critical care Emergency Medical Technician-Paramedic (EMT-P) certification preferred.
3. State licensure as a paramedic.
4. Computer literacy.
5. Holds current passport or is eligible to apply for one, if the program intends to perform international transports.
6. Demonstrates strong written and verbal communication skills at EMS, staff, patient, and family levels.

Major Responsibilities and Duties

I. Patient care activities
   A. Obtains pertinent maternal, neonatal, and pediatric histories with emphasis on risk factors and their implications for problems.
   B. Performs pertinent physical assessment.
   C. Assists in assessing patient weight for use in calibration of medication and fluid management.
   D. Formulates a plan for management of existing and potential problems in collaboration with the team leader and MCP.
   E. Performs (or assists with, as per team protocol) necessary diagnostic and therapeutic procedures as indicated for identification and management of problems, including (but not limited to):
      1. Airway management, including assessment, stabilization, bag-mask oxygenation and ventilation, endotracheal intubation, tracheostomy management, and rescue airways
      2. Needle aspiration of pleural space

3. Insertion of intraosseous needle for emergency vascular access
4. Spinal immobilization
5. Trauma triage care
6. Blood drawing and insertion of peripheral catheters

F. Provides clinical management for resuscitation of the newborn, pediatric, and adolescent patients, including necessary pharmacologic support.

G. Performs in accordance with standing orders, and accurately documents delivery of care.

H. Communicates information about the patient's diagnosis, plan of management, and prognosis to the referring physician, parents, and other members of the health care team.

I. Assesses parents' psychosocial needs, and initiates referral to appropriate consultants.

J. Obtains informed consent from parents or guardians.

K. Provides ongoing monitoring, assessment, and appropriate interventions in transit.

L. Ensures patient safety in the transport process.

M. Completes documentation in an accurate and timely manner, and transfers care of the patient to the receiving hospital staff.

II. Education

A. Contributes to community outreach and education.

B. Assists in the assessment of staff developmental needs, discusses the assessment with the transport team coordinator and medical director, and participates actively in plans to meet those needs.

C. Participates in teaching or coordination of in-service classes or workshops for the transport staff.

D. Serves as a preceptor in the training of future transport paramedics.

III. Operation of transport equipment

A. Demonstrates knowledge of operation of all transport equipment, and ensures proper functioning before transport.

B. Participates in the ongoing evaluation of transport equipment needs. Reports and documents transport equipment repairs as needed to biomedical engineering.

C. Demonstrates knowledge of aircraft and ambulance operating procedures and safety practices.

IV. Special assignments/project responsibilities
   A. Assists with medical procedures in the NICU/PICU and emergency department on request.
   B. Performs the following transport quality improvement activities:
      1. Maintains, supports, and documents evidence of a planned, systematic quality improvement program that includes effective mechanisms for monitoring and evaluating the patient care provided by the transport service.
      2. Ensures appropriate and adequate response to findings from quality improvement activities.
      3. Maximizes the efficient use of resources available to provide neonatal-pediatric transports.
      4. Identifies opportunities to improve care.

V. Leadership
   A. Initiates and participates in the implementation of change in transport paramedic policies, procedures, and/or practice to enhance the quality of patient care.
   B. Participates with transport staff in problem identification, goal setting, and transport care delivery evaluation.
   C. Uses previous clinical experience and knowledge to identify potential patient care problems related to transport.
   D. Serves as a resource or consultant to nursing and medical staff regarding prehospital and triage in neonatal and pediatric transport.

VI. Professional accountability
   A. Demonstrates continued professional growth through continuing education and review of current literature pertaining to neonatal-pediatric transport.
   B. Maintains licensure, certifications, and competency through required training and/or education.
   C. Maintains professional relationships with the EMS system, community physicians, nurses, and other health care professionals.
   D. Participates in peer review of the transport team members and case reviews with the medical director.

VII. Research
   A. Identifies researchable patient care problems related to transport.
   B. Uses evidence-based research findings in patient care.

C. Cooperates and/or collaborates with other health care team members in the conduct of research studies.

VIII. Physical capabilities

A. Frequently requires sitting, standing, and walking for long periods. Requires bending, crouching, and kneeling. Requires use of hands, keyboarding, fine motor skills, frequent lifting up to 50 lb, occasional moving up to 250 lb. Must be able to work in small confined spaces and be able to work in a mobile environment, either ground or air.

B. There is a potential for regular exposure to patients with infectious diseases requiring observance of appropriate precautions.

C. Flexible working hours required to provide 24 hour/day, 7 day/week coverage, including rotating shifts, weekends, holidays, and on call.

D. Dependability in regard to attendance at work, team meetings, paramedic meetings, committee meetings, etc.

IX. Environmental conditions

Indoor and outdoor environments with possible exposure to infectious, biological, and chemical agents. Occasionally requires working in proximity to sources of radiation. Work area includes riding in enclosed spaces such as ambulances, helicopters, and airplanes. Work environment commonly provides exposure to high noise levels.

4. Sample Position Description—Transport Emergency Medical Technician-Basic

Position Description

- Practices in accordance with philosophy, policies, procedures, and standards of the hospital; functions within the guidelines of the protocols for the transport program that are reviewed and agreed on by medical and nursing directors.
- Provides family-centered care to meet family needs including psychosocial support, education, and transfer planning in conjunction with referral staff.
- Participates in the educational and professional development of transport team members.
- Represents the hospital to health care professionals in referring hospitals.

- Maintains effective communication with community EMS system, referral staff, and families.
- Initiates and participates in educational, research, professional, and organizational activities that contribute to improving patient care, the transport program operation, and the individual's own professional development.

Reporting Relationship

Reports to:

- Medical director of the transport program for supervision and guidance in expanded role function.
- MCP as designated for medical supervision concerning the management of individual neonatal and pediatric patients during transport.
- Transport director, or designee, for clinical and administrative aspects of practice. In cases in which EMS services are outsourced, the emergency medical technician (EMT) may report to the EMS director of the contracted service.

Requirements

1. Requires knowledge of state and regional EMS codes and regulations.
2. Emergency vehicle operator certification.
3. State licensure as an EMT.
4. Computer literacy.
5. Demonstrates strong written and verbal communication skills at EMS, staff, patient, and family levels.

Responsibilities and Duties

I. Patient care activities
   - A. Assists in obtaining pertinent maternal, neonatal, and pediatric histories, if required.
   - B. Handles multiple tasks, and is self-directed.
   - C. Speaks clearly and concisely over the radio and telephone.
   - D. Performs in accordance with regional and program standing orders, and accurately documents delivery of care.
     1. Ensures patient and transport team safety in the transport process.
     2. Completes documentation in an accurate and timely manner, and transfers care of the patient to the receiving hospital staff.

3. Assists with patient care activities within scope of practice, such as spinal immobilization, oxygen therapy, and cardiopulmonary resuscitation (CPR).

II. Education
- A. Contributes to community outreach and education.
- B. Assists in the assessment of staff developmental needs, and participates actively in plans to meet those needs.
- C. Participates in teaching or coordination of in-service classes or workshops for the transport staff.
- D. Serves as a preceptor in the training of future transport team members.

III. Operation of transport equipment
- A. Demonstrates knowledge of operation of all ambulance equipment, and ensures proper functioning before transport.
- B. Participates in the ongoing evaluation of transport equipment needs. Reports and documents transport equipment repairs as needed to biomedical engineering.
- C. Demonstrates knowledge of ambulance operating procedures and safety practices.

IV. Special assignments/project responsibilities
- A. Assists in the emergency department or other clinical areas on request within scope of practice and employment.
- B. Performs the following transport quality improvement activities:
  1. Maintains, supports, and documents evidence of a planned, systematic quality improvement program that includes effective mechanisms for monitoring and evaluating patient care.
  2. Ensures appropriate and adequate response to findings from quality improvement activities.
  3. Maximizes the efficient use of resources available to provide neonatal-pediatric transports.
  4. Identifies opportunities to improve care.

V. Leadership
  1. Initiates and participates in the implementation of change in transport EMT policies, procedures, and/or practice to enhance the quality of patient care.
  2. Participates with transport staff in problem identification, goal setting, and transport care delivery evaluation.

3. Uses previous clinical experience and knowledge to identify potential patient care problems related to transport.
4. Serves as a resource or consultant to nursing and medical staff regarding prehospital and EMS aspects of neonatal and pediatric transport.

VI. Professional accountability

1. Demonstrates continued professional growth through continuing education and review of current literature pertaining to neonatal-pediatric transport.
2. Maintains licensure, certifications, and competency through required training and/or education.
3. Maintains professional relationships with other health care professionals and the EMS community.
4. Participates in peer review of the transport team members and case reviews with the medical director.

VII. Research

A. Cooperates and/or collaborates with other health care team members in the conduct of research studies.

VIII. Physical capabilities

1. Frequently requires sitting, standing, and walking for long periods. Requires bending, crouching, and kneeling. Requires use of hands, keyboarding, fine motor skills, frequent lifting up to 50 lb, occasional moving up to 250 lb. Must be able to work in small confined spaces and be able to work in a mobile environment.
2. There is a potential for regular exposure to patients with infectious diseases requiring observance of appropriate precautions.
3. Flexible working hours required to provide 24 hour/day, 7 day/week coverage, including rotating shifts, weekends, holidays, and on call.
4. Dependability in regard to attendance at work, team meetings, EMT meetings, committee meetings, etc.

IX. Environmental conditions

Indoor and outdoor environments with possible exposure to infectious, biological, and chemical agents. Occasionally requires working in proximity to sources of radiation. Work area includes enclosed spaces such as ambulances, helicopters, and airplanes. Work environment commonly provides exposure to high noise levels.

5. Sample Position Description—Critical Care Transport Physician

Position Description

- Practices in accordance with philosophy, policies, procedures, and standards of the hospital; functions within the guidelines of the protocols for the transport program that are reviewed and agreed on by medical and nursing directors.
- As team leader/member during transport, functions to identify, plan, implement, and evaluate the stabilization and emergency care of acutely ill neonates, infants, children, and adolescents in collaboration with the MCP. The transport team physician is responsible for obtaining pertinent maternal, neonatal, and childhood histories, performing physical examinations (neonates through adolescents), and formulating differential diagnoses and care management plans. He or she is responsible for performing necessary diagnostic and therapeutic procedures as indicated for identification and management of problems, including but not limited to, umbilical catheter placement, airway management, needle aspiration of the chest, chest tube placement, and interpretation of laboratory and radiographic data.
- Provides family-centered care to meet such family needs as psychosocial support, education, and transfer planning in conjunction with referral staff.
- Participates in educational and professional development of transport and other team members.
- Represents the hospital to health care professionals in referring hospitals.
- Maintains effective communication with transport team members, referral staff, and families.
- Educates referral staff through informal teaching and planned educational conferences.
- Initiates and participates in educational, research, professional, and organizational activities that contribute to improving patient care, the transport program operation, and the individual's own professional development.

Reporting Relationship

Reports to:

- Medical director of the transport program for the supervision and guidance in expanded role function.
- MCP as designated for medical supervision concerning the management of individual neonatal and pediatric patients during transport.

Requirements

1. Must be board certified or eligible in pediatrics (and have additional formal training or certification in transport and acute care medicine).
2. Current in Basic Life Support for the Health Care Provider, Advanced Cardiac Life Support, and Pediatric Advanced Life Support. Certification in NRP and ATLS.
3. Computer literacy.
4. Holds current passport or is eligible to apply for one, if program intends to perform international transports.
5. Holds active, unrestricted state medical license and Drug Enforcement Agency (DEA) certificate.

Major Responsibilities and Duties

I. Patient care activities
  A. Obtains pertinent maternal, neonatal, and pediatric histories with emphasis on risk factors and their implications for problems.
  B. Performs pertinent physical examination using techniques of observation, inspection, auscultation, palpation, and percussion.
  C. Formulates differential diagnosis and a plan for management of existing and potential problems in collaboration with the MCP.
  D. Performs necessary diagnostic and therapeutic procedures as indicated for identification and management for problems, including (but not limited to):
    1. Peripheral percutaneous arterial sampling and catheter placement
    2. Umbilical venous and arterial catheterization
    3. Airway management, including assessment, stabilization, bag-mask oxygenation and ventilation, endotracheal intubation, tracheostomy management, and rescue airways

4. Needle aspiration of pleural space and chest tube placement
5. Interpretation of laboratory and radiographic data
6. Insertion of central venous line for central venous access
7. Insertion of intraosseous needle for emergency vascular access
8. Spinal immobilization
9. Trauma care
10. Blood drawing and insertion of peripheral catheters
11. Clinical management for resuscitation of neonatal, pediatric, and adolescent patients, including necessary pharmacologic support.

E. Performs in accordance with standards of care and accurately documents delivery of care.
F. Communicates information about the patient's diagnosis, plan of management, and prognosis to the referring and receiving physicians, parents, and other members of the health care team.
G. Assesses parents' psychosocial needs, and initiates referral to appropriate consultants.
H. Obtains informed consent from parents or guardians.
I. Provides ongoing monitoring, assessment, and appropriate interventions in transit.
J. Ensures patient safety in the transport process.
K. Completes documentation in an accurate and timely manner, and transfers care of the patient to the receiving hospital staff.

II. Education
A. Contributes to community outreach and education.
B. Assists in the assessment of staff developmental needs, and participates actively in plans to meet those needs.
C. Participates in teaching or coordination of in-service classes or workshops for the transport staff.
D. Serves as a preceptor in the training of future transport team members.

III. Operation of transport equipment
A. Participates in the ongoing evaluation of transport equipment needs. Reports and documents transport equipment repairs as needed to biomedical engineering.
B. Demonstrates knowledge of aircraft and ambulance operating procedures and safety practices.

IV. Special assignments/project responsibilities
   A. Assists with medical procedures in the NICU/PICU and emergency department on request.
   B. Performs the following transport quality improvement activities:
      1. Participates in, supports, and documents evidence of a systematic quality improvement program that includes effective mechanisms for monitoring and evaluating the patient care provided by the transport service.
      2. Helps to ensure appropriate and adequate response to findings from quality improvement activities.
      3. Maximizes the efficient use of resources available to provide neonatal-pediatric transports.
      4. Identifies opportunities to improve care.

V. Leadership
   A. Initiates and participates in the implementation of change in transport policies, procedures, and/or practice to enhance the quality of patient care.
   B. Participates with transport staff in problem identification, goal setting, and transport care delivery evaluation.
   C. Uses previous clinical experience and knowledge to identify potential patient care problems related to transport.
   D. Serves as a resource or consultant to nursing and medical staff regarding neonatal and pediatric transport.

VI. Professional accountability
   A. Demonstrates continued professional growth through continuing education and review of current literature pertaining to neonatal-pediatric transport.
   B. Maintains licensure, certifications, and competency through required training and/or education.
   C. Maintains professional relationships with community physicians, nurses, and other health care professionals.
   D. Participates in peer review of the transport team members and case reviews with the medical director.

VII. Research
   A. Identifies researchable patient care problems related to transport.
   B. Uses evidence-based research findings in patient care.
   C. Cooperates and/or collaborates with other health care team members in the conduct of research studies.

VIII. Physical capabilities
  A. Frequently requires sitting, standing, and walking for long periods. Requires bending, crouching, and kneeling. Requires use of hands, keyboarding, fine motor skills, frequent lifting up to 50 lb, occasional moving up to 250 lb. Must be able to work in small confined spaces and be able to work in a mobile environment, either ground or air.
  B. There is a potential for regular exposure to patients with infectious diseases requiring observance of appropriate precautions.
  C. Flexible working hours required to provide 24 hour/day, 7 day/week coverage, including rotating shifts, weekends, holidays, and on call.
  D. Dependability in regard to attendance at work, team meetings, transport meetings, committee meetings, etc.

IX. Environmental conditions
Indoor and outdoor environments with possible exposure to infectious, biological, and chemical agents. Occasionally requires working in proximity to sources of radiation. Work area includes riding in enclosed spaces such as ambulances, helicopters, and airplanes. Work environment commonly provides exposure to high noise levels.

6. Sample Position Description—Critical Care Transport Medical Control Physician (also known as Medical Control or Command Officer)

Position Description

- Practices in accordance with philosophy, policies, procedures, and standards of the hospital and transport service; functions within the guidelines of the protocols for the transport program that are reviewed and agreed on by medical and nursing directors. Adds online critical care expertise and direction to transport team members. Participates in knowledge and skill preparation of team members.
- As senior medical consultant for each transport, functions to identify, plan, implement, and evaluate the stabilization and emergency care of acutely ill neonates, infants, children, and adolescents in collaboration with the referring and transport teams.

- Represents the hospital to health care professionals in referring hospitals.
- Maintains effective communication with transport team members and referral staff.
- Educates referral staff through informal teaching and planned educational conferences.
- May initiate and participate in educational, research, professional, and organizational activities that contribute to improving patient care, the transport program operation, and the individual's own professional development.

Reporting Relationship

Reports to:
- Medical director of the transport program

Requirements

1. Board certified or eligible in pediatrics and specialty trained in a critical care specialty (intensive care medicine, emergency medicine, neonatology, cardiac intensive care medicine, or pediatric/trauma surgery) and additional formal training or certification in transport medicine
2. Current in Basic Life Support for the Health Care Provider, Advanced Cardiac Life Support, and Pediatric Advanced Life Support. Certification in NRP and ATLS as appropriate.
3. Holds active, unrestricted state medical license and Drug Enforcement Agency (DEA) certificate.
4. Is oriented to and knowledgeable regarding critical care transport.
5. Ideally has background that includes actual transport experience.

Responsibilities and Duties

I. Patient care activities
   A. Supervises and directs transport-related patient care activities Availability within scope of team guidelines (immediate for most teams). Ensures optimal, consistent, correct advice and seamless transition from referring team to transport team to definitive care location. Documents involvement, information, and advice.
   B. Formulates differential diagnosis and a plan for management of existing and potential problems in collaboration with the transport team.

C. Performs in accordance with standards of care, and accurately documents information, communication, and direction of care.

II. Education

A. Contributes to community outreach and education.

B. Assists in the assessment of staff developmental needs, and participates actively in plans to meet those needs.

C. Participates in teaching or coordination of in-service classes or workshops for the transport staff.

III. Transport capabilities

A. Understands and is literate with transport equipment and team and personnel capabilities.

B. Demonstrates knowledge of aircraft and ambulance limitations, standard operating procedures, and safety practices.

IV. Special assignments/project responsibilities

A. Participates in transport quality improvement activities:

1. Participates in, supports, and documents evidence of a systematic quality improvement program that includes effective mechanisms for monitoring and evaluating the patient care provided by the transport service.
2. Helps to ensure appropriate and adequate response to findings from quality improvement activities.
3. Maximizes the efficient use of resources available to provide neonatal-pediatric transports.
4. Identifies opportunities to improve care.

V. Leadership

A. Initiates and participates in the implementation of change in transport policies, procedures, and/or practice to enhance the quality of patient care.

B. Participates with transport staff in problem identification, goal setting, and transport care delivery evaluation.

C. Uses clinical experience and knowledge to identify potential patient care problems related to transport.

D. Serves as a resource or consultant to nursing and medical staff regarding neonatal and pediatric transport.

VI. Professional Accountability
   A. Demonstrates continued professional growth through continuing education and review of current literature pertaining to neonatal-pediatric transport and specific specialty.
   B. Maintains licensure, certifications, and competency through required training and/or education.
   C. Maintains professional relationships with community physicians, nurses, and other health care professionals.
   D. Participates in peer review of the transport team members and case reviews with the medical director.

VII. Research
   A. Identifies researchable patient care problems related to transport.
   B. Uses evidence-based research findings in patient care.
   C. Cooperates and/or collaborates with other health care team members in the conduct of research studies.

VIII. Specific Capabilities
   A. Requires rapid phone or in-person availability when in role as MCP.
   B. Requires knowledge and use of appropriate phone etiquette and terminology.
   C. Flexible working hours required to provide 24 hour/day, 7 day/week coverage, including rotating shifts, weekends, holidays, and on call.

APPENDIX B

Sample Transport Database Collection Fields

I. Demographic data

Unique transport identifier
Medical record number
Date of birth (and time of birth for neonates)
Age (gestational age for neonates)
Sex
Weight (kg)
Race/ethnicity
Patient address
Referring physician/medical professional with telephone/fax number
Date of transport
Name of parents (responsible for consent)
Name of guarantor (responsible for bill)
Primary physician (with contact information)
Religious preference if stated
Special family circumstances (e.g., sick mother from birth, deaf family member, need for translator)

II. System data

Community code (community, city, county, region, or state name)
Transport system type (public, private, hospital, volunteer)
Type of team (neonatal, pediatric, trauma, ECMO, burn)
Mode of vehicle (ground, fixed-wing, helicopter, combination, other)
Type of transport (acute vs return)
Team configuration (personnel dispatched with names, identifiers, eg, physician, RN, RRT, EMT, NNP, other
Time call received
Time vehicle called
Ambulance/aircraft No.

Time and location of dispatch
- If air: Outbound
  - Departure to aircraft location (if off site)
  - Take-off (airport/helipad and time)
  - Landing (airport/helipad and time)
- Inbound
  - Departure to aircraft location (if off site)
  - Take-off (airport/helipad and time)
  - Landing (airport/helipad and time)

Time of arrival at referring hospital
Referring facility
Referring physician
Time of departure from referring hospital
Time of arrival at destination facility
Destination facility (name, code, level of care)
Admitting physician at destination facility
Time of departure from destination facility
Time of arrival at home base facility/office
Special equipment needed (eg, nitric oxide)

III. Clinical data

Reason for transport
Type of case
- Medical
- Surgical
- Trauma (use pediatric trauma registry format)
- Neonate
- Cardiac

Intake diagnosis (for neonate multiples: twin A, triplet B)
Vital signs
Respiratory status (room air, FiO_2, NC, CPAP, intubated, ventilation)
Respiratory support (ventilator settings, FiO_2, nitric oxide)
Transport team recommendations to referring team before transport team arrival
Transport team interventions/procedures
- Use *CPT* codes

Medications administered by transport team

Grouped according to degree of medical control required (group 1, highest)

Group 1: Resuscitation (eg, epinephrine, atropine, bicarbonate, airway control adjuncts, vasoactive infusions)

Group 2: Drugs to treat neurologic emergencies and for gastrointestinal tract decontamination, antidotes, analgesics, drugs to treat acute metabolic disturbances (eg, insulin, glucagon, hypertonic dextrose, polystyrene sulfonate [Kayexalate]), intravenous fluid administration for shock, surfactant

Group 3: Routine therapy for acute but not life-threatening conditions, such as bronchodilator treatment, antibiotics, intravenous fluid therapy (except for shock)

Contact to transport team base/MCP

No Yes

Time/name of MCP contacted

IV. Adverse events before or during transport

1. Death
2. Cardiac arrest
3. Respiratory arrest (as defined by team)
4. Hypotension (as defined by team)
5. Unplanned extubation
6. Obstructed, dysfunctional, or replaced endotracheal tube
7. Air leak or pneumothorax
8. Equipment failure
    a. Loss of oxygen
    b. Loss of suction
    c. Battery or power failure
    d. Ventilator malfunction
    e. Monitor malfunction
    f. Medication/catheter infiltration
    g. Vehicle mishap
    h. Other

9. Delayed transport
    a. Ambulance, aircraft (reason)
    b. Personnel
    c. Multiple calls
    d. Elective/nonemergency
    e. Bed/staff availability
    f. Communications
    g. Weather
    h. Equipment
10. Aspiration
11. Dislodged catheter/line
12. Bradycardia/arrhythmia during transport
13. Worsening respiratory status
14. Medication error
15. Hypoxemia (eg, SpO_2 decreases by >10%)
16. Hypothermia (as defined by team)
17. Airway not cleared at time of admission (head positioning, mucus, poor mask control)
18. Patient's condition unstable on arrival at referring or receiving hospital
19. Referring physician
    a. Present on team arrival
    b. Present at any time but not on arrival
    c. Not present
20. Training of referring physician
    a. Pediatrics
    b. Pediatric emergency medicine
    c. Pediatric critical care
    d. Pediatric subspecialist
    e. Emergency medicine
    f. Neonatologist
    g. Family practice
    h. Other
21. Referring team (staff, nurses, respiratory therapists)
    a. Interactions
    b. Conflicts

22. Adverse events reporting
    a. Staff meeting
    b. Mortality/morbidity conference
    c. Legal affairs
    d. Debriefing/crisis management
    e. Human resources

V. Diagnosis at transfer from ward, emergency department, PICU, NICU, step-down unit

1. Medical
2. Surgical
3. Trauma
4. Still hospitalized

VI. Severity scoring

Systolic blood pressure: highest, lowest
Diastolic blood pressure: highest, lowest
Heart rate: highest, lowest
PaO_2/FIO_2: lowest/highest
PCO_2: highest
pH: highest/lowest
Pupillary reaction: normal, unequal or dilated, fixed and dilated
Prothrombin time and control
PTT/control ratio <1.5 ☐Yes ☐No
Bilirubin: highest
Potassium: highest, lowest
Calcium: highest, lowest
Glucose: highest, lowest
Bicarbonate: highest, lowest
PRISM score from referring hospital
PRISM score values within 24 hours after transport
Pediatric trauma score
Glasgow Coma Scale score
Neonatal severity score (eg, SNAP)
Apgar Score

Disposition

Admitting unit at receiving hospital

a. NICU
b. PICU
c. Ward
d. Step-down unit
e. Burn unit
f. Emergency department
g. Operating room
h. Morgue/medical examiner
i. Date and time of disposition

VII. Financial data

Third-party insurer preauthorization n Yes n No
Preauthorization contact
Reason for lack of preauthorization (if needed)
Team charge (date billed)
Reimbursement (date received)
Reason for denial
Code
If denied, appeal of denial ☐Yes ☐No
Appeal successful ☐Yes ☐No

ECMO indicates extracorporeal membrane oxygenation; RN, registered nurse; RRT, registered respiratory therapist; EMT, emergency medical technician; NNP, neonatal nurse practitioner; FIO_2, fraction of inspired oxygen; NC, nasal cannula; CPAP, continuous positive airway pressure; *CPT, Current Procedural Terminology;* MCP, medical control physician; SpO_2, oxygen saturation; NICU, neonatal intensive care unit; PICU, pediatric intensive care unit; PaO_2, partial pressure of oxygen in arterial blood; PCO_2, partial pressure of carbon dioxide; PTT, partial thromboplastin time; PRISM, Pediatric Risk of Mortality Score; SNAP, Score for Neonatal Acute Physiology.

APPENDIX C

Sample Transport Medicine Transfer Agreement

Parties: XYZ Transport Service (referred to as XYZ)
Address
ABC Hospital (referred to as ABC)
Address

Date: xx/xx/xx

This is an agreement between ABC and XYZ for the purposes of establishing terms, conditions, and limitations on the request for services by ABC and the provision of services by XYZ for air transport of patients to be transported to or received at ABC.

ABC represents that it is a licensed hospital operating under the laws of the State of [insert state] with locations at [insert location] and with designated helicopter landing sites at [insert location]. It is further understood that ABC from time to time requires the services of helicopter medical transport for patients being transferred to ABC or by ABC to other facilities on both scheduled and emergency bases.

XYZ represents that it operates a duly licensed transport service, including helicopters, for scheduled and emergency response for transfers between hospitals and from emergency scenes. XYZ further represents that all personnel responding with its service are duly licensed [paramedics] [flight nurses] [physicians] trained, qualified, and licensed/authorized to provide care within the State of [insert state].

XYZ agrees to respond to accepted requests for service from ABC with a helicopter equipped consistent with Federal Aviation Administration (FAA) and State requirements for transport vehicles and with an appropriately trained, qualified, and licensed/authorized medical crew and pilot on the following basis:

1. Response will be made to emergency requests by the nearest available aircraft with capabilities and crew appropriate to the nature of the request.
2. Nonemergency requests will be made at the time agreed between ABC and XYZ, subject to priority for emergency transports.
3. Responses are subject to availability of aircraft owing to prior use commitment, maintenance/repairs, flight-time restrictions, fuel, weather, or other safety or regulatory issues, as determined by XYZ at its sole discretion.
4. Aircraft may be diverted for emergency or cases of greater need at the sole discretion of XYZ personnel. Rescue scene responses will be given greater priority than responses for patients currently in a hospital environment.
5. If a request is accepted, XYZ will provide an estimated time of arrival. XYZ will update ABC on estimated time of arrival in case any factor or change of circumstances occurs that appears will delay the estimated response time for a period of greater than 30 minutes. XYZ personnel will use their sole discretion in determining the reasonable possibility of delay.
6. If XYZ accepts a request, but the estimated response time or subsequent delays do not meet the reasonable needs of ABC, ABC may cancel the request at any time before arrival for transport from ABC or the sending hospital (in the case of transports to ABC).
7. XYZ may decline to transport any patient after accepting a request in which in its sole discretion such patient is not medically appropriate for transport; the transport would violate any XYZ, state, or federal rule or regulation; or aircraft safety or weather requires grounding or delay of flight.
8. XYZ agrees that all services for transport will be billed to the patient or the patient's third-party payer and not to ABC hospital, unless as agreed in writing in individual cases *or* if ABC fails to notify XYZ of a transport cancellation before arrival. A change in patient condition that prevents transport after arrival (whether determined by ABC or XYZ) will not result in a charge to ABC.
9. XYZ rates and charges are attached as Addendum 1.
10. XYZ agrees that it will accept custody of and transport patient medical records along with any patient being transported.

ABC understands and agrees that this is a nonexclusive agreement and that it is subject to availability, acceptance, diversion, and cancellation terms and conditions as stated above.

ABC further understands that all regulatory compliance requirements of state and federal law, including but not limited to the Emergency Medical Treatment and Active Labor Act (EMTALA) and the Health Insurance Portability and Accountability Act (HIPAA), are the responsibility of ABC and that XYZ does not assume or agree to provide any compliance on behalf of ABC.

ABC, its employees, and its medical staff are responsible for providing any and all informed consents, explanations, and medical decisions to transport by transport vehicle consistent with EMTALA, including certification for transport. XYZ will be responsible for obtaining compliance documentation for its own purposes only.

Each party shall be responsible for maintaining professional liability insurance for its respective entity, employees, agents, and medical staff.

This agreement will remain in full force and effect until written notification by either party, with or without cause, with 7 days' advance notice. This agreement is nonexclusive and does not limit either party from transacting similar services with other providers.

The parties agree to enter into reciprocal Business Associates Agreements for the purposes of HIPAA compliance, which agreements are separate and distinct from this agreement.

Approved: [date]

ABC

By ____

XYZ

By ____

APPENDIX D

Policies and Procedures

Outline

- General policies, guidelines, and information
- Safety and travel policies
- Communication policies
- Documentation policies
- Human resources policies
- Medical protocols and policies
- Policy examples
  - —Management of congenital abdominal wall defects
  - —Guidelines for primary medical provider participating in neonatal transport
  - —Management of neural tube defect
  - —Roles and responsibilities for transport
  - —Infant ground transport provider/nurse/respiratory therapist skills competency
  - —Emergency lights and siren use during transport

Policies and protocols are recommended for neonatal-pediatric transport teams. The following list is not exclusive or all inclusive of policies needed for any particular neonatal or pediatric transport team. Neonatal-pediatric transport teams should consider federal, state, and local regulations and current hospital policies when determining the additional policies needed.

General Policies, Guidelines, and Information

- Organizational chart
- Mission, vision, and value statements
- Scope of care
- Definition of line of authority for transport team members and contracted ground and air teams
- Press-release policy

- Confidentiality and security of patient care records, meeting minutes, and policies and procedures

Safety and Travel Policies

- Age parameters of patients to be transported
- Dress code
- Hearing protection, when appropriate for patient and/or team
- Seat belts and shoulder harnesses for patient and team
- Transport of twins and/or dual patient transport
- Helmet use by ground and/or air transport team personnel
- Interior modification of transport vehicles
- When to use alternative (backup) vehicles
- How to choose mode of transport (eg, ground, air, type of aircraft)
- Weight restrictions, density altitude (aircraft-related)
- Physical examinations and performance standards for weight, height, and lifting appropriate for service
- Annual tuberculosis testing
- Policy requiring immunization history (eg, tetanus, hepatitis B, measles, mumps, rubella)
- International transport policy, when appropriate
- International immunization history, when appropriate
- Passport requirements, when appropriate
- Use of medications (prescription and over-the-counter)
- Use indications and allowances for nonstandard personnel
- Minimum personnel configurations
- Medical control identification and backup
- Appropriate loading and unloading of patients
- Weight limit for each incubator and transport stretcher
- Refusal to transport patients (combative patient or family member)
- Screening family belongings for potential weapons or hazardous materials before flight
- Sharps disposal and disposal containers
- Securing equipment in transport vehicle
- Restraints, physical and chemical
- Cleaning and disinfecting transport vehicles, equipment, instruments, and uniforms
- Standard precautions and special precautions for identified or suspected

infectious patients
- Infection control
- Process for identifying people at risk for exposure to infectious disease and communicating exposure to all affected personnel
- Occupational Safety and Health Administration (OSHA) exposure control plan for bloodborne pathogens and tuberculosis
- Hazardous materials
- Risk management
- Refueling (eg, with no patient on board, no crew members on board)
- Emergency procedures, method of exiting transport vehicle in a catastrophic event
- Emergency plan including the following:
  - —List of personnel to be notified and order of notification
  - —Communication with aircraft or ambulance
  - —Process to initiate search and rescue
  - —Plan to transport patient in case of an incident
  - —Timeframe to activate emergency plan
  - —Method of information dissemination and press release to ensure accuracy of information
  - —Annual drill of emergency preparedness
- Policy stating the program will follow all Federal Aviation Regulations and Federal Communications Commission regulations
- Policy stating compliance with the Consolidated Omnibus Budget Reconciliation Act of 1986 (COBRA) and Emergency Medical Treatment and Active Labor Act (EMTALA) regulations
- Criteria and procedure for using lights and sirens
- Criteria for speed limitations
- Policy addressing security of aircraft and ambulance transport vehicles when unattended
- When nitric oxide or other inhaled gases are used, policies addressing: cylinder safety, monitoring, transportation regulations, weight, mounting, delivery of drug, emergency procedures, and occupational exposure
- Process for conditions causing delay of transport team (eg, weather, traffic, mechanical breakdown, deterioration in patient's condition)

Communication Policies

- Request for transport
- Identify authorized requestors, including "without discrimination" clause
- Process for admitting the patient, if applicable
- Process for monitoring transport (eg, time of departure, arrival, locations, and any necessary changes)
- Diversion criteria
- Weather and launch protocols
- Outline of location, distance, preferred transport arrangements, capabilities, and resources of receiving facility or facilities
- Cellular phone use
- Guidelines for timely notification of team for request for transport

Documentation Policies

- Record of patient care
  —Minimally including purpose of transport, treatments, medications, and patient's response to treatments and medications; transport facilities (referring and receiving hospitals); and who is receiving report

Human Resources Policies

- Disciplinary policies
- Written code of conduct
- Scheduling policies (addresses duty time to ensure adequate rest)
- Wellness programs (eg, smoking cessation, weight control)
- Preemployment and annual physical examinations or medical screening that includes history of chronic or acute illnesses and illnesses requiring use of medications that may cause drowsiness or affect judgment and coordination
- Duty status during pregnancy
- Duty status during acute illness
- Duty status while taking medication that may cause drowsiness
- Job requirements (education, training, licensing, experience level)
- Continuing education requirements
- Background checks of personnel and personnel carrying photo identification at all times
- Hours worked by transport personnel with minimum rest and duty times

Medical Protocols and Policies

- Diseases and injuries transported as dictated by scope of team mission (eg, neonatal diseases for neonatal teams, common injuries encountered when transporting to pediatric trauma center)
- Diseases affected by altitude as appropriate for flight teams
- Specification of certain specialty patients requiring prompt consultation
- Preparation for transport (eg, staff, equipment, supplies)
- Stating transfer of care is to higher level of care

Policy Examples

Examples of policies are provided and serve as examples of ways to write a policy. These are examples of policies used by established transport services and are not meant to be used as verbatim templates or specific standards of care. Individual hospital policies and procedures and team composition must be considered when drafting policies for each individual neonatal-pediatric transport team.

Management of Congenital Abdominal Wall Defects

Definition:

Omphalocele: a central abdominal wall defect of variable size involving herniation of abdominal contents into the base of the umbilical cord. The malpositioned abdominal contents are covered by a protective membrane/translucent sac (unless rupture has occurred). The umbilical cord and vessels radiate onto the sac.

Gastroschisis: a central abdominal wall defect involving herniation of abdominal contents lateral (most commonly to the right) of the umbilical attachment. There is no protective membranous covering.

Associated Factors:

Omphalocele	Gastroschisis
• Structural or genetic defects in 50% to 75% of affected infants • Associated with cardiac, genitourinary defects • VACTERL • Beckwith-Wiedemann syndrome • Trisomies 13, 18, and 21	• Generally not associated with other congenital anomalies • Associated with prematurity • Intestinal atresias (secondary to in utero volvulus, malrotation, or incarceration)

Clinical Findings:

Omphalocele:

- Defect may be central, hypogastric, or epigastric
- Smaller omphaloceles usually contain only intestine compared with larger or giant omphaloceles that contain liver and/or spleen as well
- Respiratory compromise secondary to pulmonary hypoplasia may occur
- Ruptured omphalocele may be confused with gastroschisis (omphaloceles do not have an intact umbilical cord at level of abdominal wall)

Gastroschisis:

- Edematous, matted intestine, often with an inflammatory rind or "peel"

Laboratory Findings:

No laboratory data necessary

- Hypoglycemia can be seen in association with Beckwith-Wiedemann syndrome

Radiography:

Radiographic examination is not necessary unless other clinical indications dictate (respiratory distress, dysmorphology)

Differential Diagnosis:

- Umbilical cord hernia
- Umbilical polyp
- Omphalomesenteric fistula with intestinal prolapse

Assessment and Initial Management:

Management goals include: diagnose omphalocele or gastroschisis, cover bowel defect, minimize heat loss, decompress stomach, and avoid dehydration and hypothermia.

- Physical examination should assess the ABCs including respiratory (SpO_2; tachypnea) and cardiovascular compromise (blood pressure; heart rate; peripheral pulses; capillary refill), and the abdominal defect
- Limit excessive handling of defect
  - Examine defect for discoloration, infarction, or torsion; ***if present, call Fellow/Attending immediately to notify Pediatric Surgery***
- Cover bowel/defect with a sterile, warmed-saline-soaked dressing
  - Infants are at increased risk for hypothermia secondary to exposure of intestinal surface (Gastroschisis and Ruptured Omphalocele)

- Place infant in a sterile bowel bag secured at the level of the axilla to help minimize heat loss
  - —If bowel has been wrapped prior to arrival of transport team, unwrap defect, examine for discoloration/infarction/torsion, and rewrap as described above
- Place an oro/nasogastric tube and aspirate gastric contents with syringe or Replogle tube on low continuous suctioning
- Place infant NPO
- Place peripheral IV; start IV fluids with $D_{10}W$ at 140 mL/kg/d maintenance for gestational age (Gastroschisis)
- Obtain or review laboratory studies including
  - —CBC with differential and peripheral blood culture (if needed)
  - —Serum glucose/Dextrostix
- Start ampicillin and gentamicin (see Sepsis and Meningitis section for gentamicin dosing)
- Correct metabolic abnormalities: hypo/hyperglycemia; metabolic acidosis
  - —Metabolic acidosis
    - Check peripheral perfusion; capillary refill; color of bowel
    - Correct with volume expansion with normal saline bolus ***FIRST***
    - If requires sodium bicarbonate, ensure adequate ventilation prior to administration as administration during inadequate ventilation may worsen respiratory acidosis and infant's condition
  - —See Correcting Metabolic Abnormalities section
- Maintain thermal neutral environment/correct hypothermia
- If infant is in respiratory distress, review or obtain arterial (preferably) blood gas, but do ***not*** spend a prolonged period of time establishing arterial assess
  - —Obtain or review chest radiograph
  - —Deliver O_2 via nasal cannula or facemask or oxygen hood at community hospital to maintain SpO_2 90% to 98% (≥34 weeks gestation) and 88% to 95% (<34 weeks gestation)
  - —Transport infant in facemask or nasal cannula; use nasal cannula if FiO_2 is less than 40% to 50%

- —If infant has ineffective ventilation PCO_2 ≥50 to 55 mmHg, is showing evidence of respiratory exhaustion, ***or*** requires >60% oxygen, perform elective intubation and commence mechanical ventilation
    - ***AVOID NCPAP and Prolonged Mask Positive Pressure Ventilation!***
    - See Intubation section and Assisted Mechanical Ventilation for Transport section for initiating mechanical ventilation
- Closely monitor mean systemic blood pressure as it should be greater than infant's gestational age
- Provide aggressive cardiovascular support if hypotensive or poor perfusion
  - —Normal saline or lactated ringers bolus 10 to 20 mL/kg over 10 to 20 minutes (normal saline is the most readily available fluid at community hospitals)
  - —Repeat boluses as required while monitoring response/changes (heart rate; blood pressure; perfusion; bowel color)
  - —If infant requires greater than 20 mL/kg of volume expansion, ***call Medical Control immediately***
- ***Call Medical Control immediately if infant has respiratory or cardiovascular compromise***
- Re-evaluate infant prior to leaving community hospital
  - —Bowel defect/dressing
  - —SpO_2; heart rate; blood pressure; capillary refill time; temperature
  - —Serum glucose/Dextrostix
- Elevate head of transport bed and attempt to position infant on right side to avoid mass pressure on inferior vena cava that could impede venous return to the heart
- Prior to departure, call Medical Control and alert Pediatric Surgery (and other subspecialties if suspect anomalies) of pending patient
- On return to hospital call Pediatric Surgery fellow and provide update/clinical status

Potential Complications:
- Respiratory failure
- Hypothermia
- Metabolic abnormalities and dehydration
- Torsion of bowel with vascular compromise

Guidelines for Primary Medical Provider Participating in Neonatal Transport[1,2]

Neonatal Attending:
- All infants to be discussed with on call staff (medical control)

Neonatal Fellow:
- Any potential life threatening situation or congenital anomaly and/or infants not responding adequately to initial medical or airway management or for whom intubation was unsuccessful
- Multiples <30 weeks[3]

Neonatal Nurse Practitioner (unaccompanied):
- For infants likely to require intubation, competency demonstrated during DR/NICU rotation
- Non life threatening congenital anomaly

***Senior Resident (PL-2, unaccompanied)*[4]:**
- For infants likely to require intubation, competency demonstrated during DR/NICU rotation
- Non life threatening congenital anomaly

***NICU Nurse/Respiratory Therapy*:**
- All transports

Management of Neural Tube Defect

Definition:
Neural tube defects (NTD) result from a failure of primary neural tube closure during the third to fourth week of gestation. Most of these defects are related to some degree of failure of anterior (anencephaly, encephalocele) or posterior (myelomeningocele) neuropore closure. These defects can be

[1] These are guidelines. All transports and accompanying personnel discussed by Attending Physician, Fellow, and Charge Nurse.

[2] An RN and an RT staff member accompany all incoming transports. Deviation from this expectation is at the discretion of the Attending.

[3] *Multiples*: Goal is to have 1 complete qualified team per baby, and ensure adequate coverage in the NICU. May need to call in on-call Attending and back-up on-call Attending.

[4] PL1s and NNPs interested in transport are encouraged to accompany.

open or closed, and dorsal or ventral midline. See below for specific defects frequently managed.

Associated Factors:
The etiology of NTD is multifactorial, including genetic and environmental factors. Numerous genetic syndromes are associated with NTD. Many pregnancies affected by NTD result in termination.

- Previous pregnancy/sibling affected with NTD
- Prenatal folate deficiency
- Maternal medications: carbamazepine; valproate; additional antimetabolites of folic acid
- Infant of a diabetic mother (non-gestational diabetes)
- Chromosomal syndromes (trisomy 13 and 18; triploidy)
- Infant of consanguineous parents
- Maternal hyperthermia

Clinical Findings:

- Open lesions are usually clinically apparent at birth, whereas closed defects have a variable presentation. Prenatal history may reveal elevated (≥2.5 multiples of the mean) maternal serum alpha-fetoprotein (open neural tube defects) and polyhydramnios. Genetic counseling and detailed fetal ultrasonography may have been performed.

Anencephaly

- The most severe (incompatible with life) and most common anterior tube closure defect
- Is readily apparent at birth due to incompletely developed or absent calvarium and portions of the cerebrum and cerebellum
- Majority are stillborn. Spontaneous abortion frequently occurs. Delivery is often post-dates.

Encephalocele

- Cranial defect through which brain tissue protrudes
- 75% to 80% occur in the occipital region with remainder in the frontal (nasal cavity protrusion), temporal, and parietal regions
- Associated with Meckel-Gruber syndrome; microcephaly; cleft lip/palate; Chiari III malformation; partial or complete corpus callosum agenesis

Myelomeningocele
- Characterized by herniation of meninges, spinal cord, CSF, and nerve roots through deficient axial skeleton with variable dermal covering
- Approximately ¾ are lumbar, of which 90% are associated with hydrocephalus
- May present with varying degree of paresis of legs and sphincter dysfunction
- Associated with cardiac, intestinal, genitourinary, orthopedic, and esophageal anomalies
- 75% to 90% association with Chiari II malformation/hydrocephalus as well as several other CNS anomalies

Meningocele
- Restricted herniation of the meninges (without associated neural tissue) through a bony defect site, which usually has a dermal covering

Occult Spinal Dysraphisms
- Disorders of the caudal neural tube with dermal covering
- Includes intraspinal lipomas, epidermoid cysts, subcutaneous lipomas, and tethered cords
- Variable clinical symptoms (absent; minimal; moderate; severe) depending on degree of neural tissue involvement
- May present with a cutaneous marker (hypo/hyperpigmentation; hemangioma; hypertrichosis; skin appendage)

Laboratory Findings:
Necessary laboratory studies (chromosomes) will be obtained after transport

Radiography:
Radiographic examination is not necessary unless other clinical indications dictate (respiratory distress).

Differential Diagnosis:
- Iniencephaly
  - —Rare neural tube defect involving rachischisis of cervical and thoracic spine and with extreme retroflexion of the head
- Lipoma
- Teratoma
- Caudal regression syndrome

Assessment and Initial Management

Management goals include covering the defect securely and maintaining an adequate airway.

- Physical examination should assess respiratory status (the ABCs) and neurologic abnormalities. Evaluate:
  - —Lesion (level; size; surrounding tissue; ruptured)
  - —Head circumference (hydrocephalus)
  - —Motor function (muscle tone; muscle power and bulk; spontaneous active movements; tendon and neonatal reflexes)
  - —Sensory function (cutaneous sensation/pinprick)
  - —Orthopedic deformities (foot; knee; hip; spine)
  - —Anal sphincter tone; urinary stream; bladder
  - —Presence of associated malformations

Anencephaly

- Given the 100% lethality of this condition, ***only*** supportive care is provided (warmth; comfort; enteral nutrition)

Encephalocele, Myelomeningocele, Meningocele

- Limit excessive handling of defect
- Cover defect with sterile, warmed-saline soaked non-adherent dressing
  - —***Do not use betadine***
  - —Infants are at increased risk for increased insensible loss and hypothermia.
- Place infant in a sterile body bag secured around defect to minimize heat loss
- Preferably place infant in prone or side position if respiratory status allows
  - —Avoid placing infant on back
- Obtain if necessary or review chest radiograph
- Obtain or review laboratory studies including
  - —CBC with differential
  - —Serum glucose/Dextrostix
- Place infant NPO
- Place peripheral IV; start IV fluids with $D_{10}W$ at appropriate rate for gestation
  - —Secondary to increased insensible loss, may need to increase fluids to 1.5 maintenance
    - ▪ Lesions not adequately covered and open lesions are at highest risk for increased insensible loss

- Place an oro/nasogastric tube and aspirate gastric contents with a syringe
- Catheterize bladder if full/paralyzed
  - —May perform intermittently depending on response
- Maintain thermal neutral environment/correct hypothermia
- Ensure adequate airway; have oxygen, suction, bag and mask, laryngoscope, and ET tube readily available
  - —Monitor SpO_2, heart rate, blood pressure
- If infant exhibits respiratory distress, review or obtain arterial (preferably) blood gas
  - —Deliver O_2 to maintain SpO_2 90 to 98% (≥34 weeks gestation) and 88 to 95% (<34 weeks gestation) via facemask or nasal cannula
  - —If infant requires >60% FIO_2, perform elective intubation and commence mechanical ventilation
    - ▪ See Intubation section and Assisted Ventilation for Transport section for initiating mechanical ventilation
- Provide aggressive cardiovascular support if hypotensive and/or poor perfusion
  - —Normal saline bolus 10 to 20 mL/kg (normal saline is the most readily available fluid at community hospitals)
  - —Repeat boluses as required while monitoring response/changes (heart rate; blood pressure; perfusion; liver edge)
- Correct metabolic abnormalities: hypo/hyperglycemia; metabolic acidosis
  - —See Correcting Metabolic Abnormalities section
- If suspect sepsis, if defect is open, or *if defect's sac ruptures*, obtain blood culture (or recheck if obtained) and start Ampicillin and Gentamicin (see Sepsis and Meningitis section for dosing)
- ***Call Medical Control immediately if infant has respiratory or cardiovascular compromise, or if the defect appears concerning***
- Re-evaluate infant prior to leaving community hospital
  - —Dressing over defect
  - —SpO_2; heart rate; blood pressure; capillary refill time; temperature
  - —Serum glucose/Dextrostix
- En route to receiving facility, call team to alert Pediatric Neurosurgery of pending patient

Potential Complications
- Sepsis/meningitis
- Urinary retention
- Hydrocephalus

Roles and Responsibilities for Transport

MD Responsibilities:
1. Take call from referring physician and document history with pertinent information
2. Discuss case with the charge nurse verifying bed availability and ability to accept case
3. Make recommendations regarding stabilization of infant and plan for transport with referring physician once a bed is secured
4. Discuss case with the accepting attending physician/medical control
5. If unable to accept case, assist the community facility in locating a bed at another facility
6. Order appropriate medication and fluids from pharmacy that may be needed
7. En route: provide details of the case to the entire team, plan approach and make recommendations as appropriate
8. On site: request a sample of the mother's blood and the placenta if possible
9. At referral facility, identify self and staff and obtain report, up to date vital signs and any interventions performed prior to team's arrival.
10. Assess patient and formulate plan for safe transport
11. Call receiving hospital and have secretary arrange conference call with Fellow and Medical Control to discuss plan and management of patient
12. Obtain copies of patient's medical records (ie, radiology reports/images, labs, placenta, consultation reports)
13. En route, call unit with brief
14. On arrival, sign out to accepting team
15. Call family at referral facility that infant has arrived safely and provide brief update
16. Complete NICU Transport Evaluation

Unit Secretary:

1. Triage phone call to the Fellow or Attending
2. Once transport accepted book an ambulance
3. Provide transport checklists and charged transport phones to (Medical Provider, RN, and Respiratory)
4. Notify Security of transport and ask for call with ambulance arrival
5. Record information in the transport Log
6. When Ambulance arrives, call Transport Phones to notify Team
7. Call transferring hospital for demographics and birth information
8. Assemble charts
9. Charge for NICU transport in the computer including *ICD-9* code for medical control
10. Fill out and enter newborn screen if not completed at referring hospital
11. Assist with initiation of conference call for the medical provider in the field to Medical Control, Fellow and Charge Nurse
12. Notify Charge Nurse when team calls with the “ETA” back to hospital
13. If placenta and maternal blood is brought back, label with baby label and notify laboratory
14. Complete NICU Transport Evaluation

Charge Nurse:

1. Consult with fellow or attending regarding composition of transport team
2. Notify secretary to initiate the transport process
3. Notify admission nurse of transport
4. Notify respiratory of transport
5. Assist transport nurse preparing for transport (eg, call referring hospital for update before team departs)

Transport Nurse:

1. Prepare transport bed by double checking temperature, supplies, IV pumps, supply boxes, etc
2. Place the refrigerator medication bag on the bed and obtain Fentanyl and Versed from Pyxis
3. Call pharmacy regarding the status of any additional medications ordered through CPOE by the NICU fellow for transport
4. Call referring hospital for updated report utilizing the Transport Record
5. Take the transport telephone, confirming it is properly charged
6. Complete NICU Transport Evaluation

Respiratory Therapist:

1. Check O_2 and air levels of cylinders for transport bed
2. Check to ensure the ventilator circuit is attached and ventilator is functioning properly
3. Check to ensure the respiratory transport bag is secure and stocked appropriately
4. Obtain appropriate dose of Surfactant, place in cooling pack
5. Obtain appropriate spare O_2 and air cylinders
6. Obtain the I-STAT device (newly charged) and 4 cartridges (check expiration dates)
7. Check transport ambulance to ensure the electrical inverter is working properly
8. Check transport ambulance to ensure an adequate O_2 supply is available
9. Complete NICU Transport Evaluation

Infant Ground Transport Provider/Nurse/Respiratory Therapist Skills Competency

I. Purpose
   A. To establish guidelines for objective evaluation of each team member's competency to perform expected responsibilities/procedures/interventions for critically ill newborns on transport.

II. Procedure
   A. The transport team member will complete an orientation program including didactic, simulation in the field training
      a. Appropriate for team member's specific job description and set of responsibilities
      b. Completed before independent performance of transport activities
      c. Complete no fewer than three supervised transports
   B. The yearly evaluation will include the following information:
      a. Required ICU and Respiratory Care Department annual competency records completed in home department personnel file
      b. Biannual CPR, NRP certification
      c. Transport Skills lab attendance date (when available)
      d. Transport i-STAT competency
      e. Transport equipment checklist
   C. Regular transport case reviews and quality assessments

Emergency Lights and Siren Use During Transport

Policy Statement:

Emergency lights and sirens will be used only in critical situations and only when endorsed by the medical control physician. During emergency operation, the vehicle shall not exceed the posted speed limit. On Interstate highways, the maximum speed limit is 75 mph. All school zone speed limits must be adhered to at all times. Vehicle operators are required to drive at a speed that is safest for existing road and weather conditions, regardless of the posted speed limit. If possible, the family will be informed of emergency lights and sirens use. Use of lights and sirens will be documented in the physician's note.

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APPENDIX E

Transport Resources

This appendix is divided into several sections on transport resources: The first section contains a listing of various organizations and Web sites offering information and educational opportunities on critical care and transport; the second contains information on journals that have published transport-related articles; the third section lists various training courses available that have served as training opportunities, documentation of skill level, or review opportunities for transport team members; the fourth section is a listing of programs offering ground, rotor-, and/or fixed-wing transport on a national and international level. Each of these sections has been reviewed extensively but will not be inclusive as new programs become available and existing programs merge or change their focus. Listing in these sections should not be interpreted as a recommendation or endorsement by the authors or the American Academy of Pediatrics.

1. Transport Organizations and Web Sites

Aerospace Medical Association: This organization represents the fields of aviation, space, and environmental medicine. Its membership includes aerospace medicine specialists, scientists, flight nurses, physiologists, and researchers in the field. Most are with industry, the Federal Aviation Administration, National Aeronautics and Space Administration, Department of Defense, and universities. Approximately 25% of the membership is international. The organization publishes a monthly peer-reviewed journal entitled *Aviation, Space and Environmental Medicine.* It offers a yearly meeting to review information and latest research in the field of aviation medicine.

ASMA
320 S Henry St
Alexandria, VA 22314-3579

Phone: (703) 739-2240
Fax: (703) 739-9652
http://www.asma.org

Air and Surface Transport Nurses Association: This nursing organization is composed of hospital-based, public service, military, and private providers of emergency and nonemergency patient air and ground transport. The majority of its members are employed by transport programs. Affiliate members, such as respiratory therapists, paramedics, pilots, aircraft vendors and operators, may also belong to the association. Its Web site offers specific information on air and ground transport. The organization publishes transport manuals and offers specific educational courses.

ASTNA
ASTNA National Office
9101 E Kenyon Ave
Suite 3000
Denver, CO 80237

Phone: (800) 897-6362
Fax: (303) 770-1812
http://www.astna.org

Air Medical Physician Association: This association seeks to attract physicians with an interest in air medical transport. Its mission is to offer opportunities to collectively study the impact of air transport on patients and to share expertise so that patients may receive the best care possible in the safest operating environment. Its Web site offers specific information on air transport and has links to the organization's published manual and membership list. Continuing medical education conferences are held yearly.

AMPA
383 F St
Salt Lake City, UT 84103

Phone: (801) 534-0829
Fax: (801) 534-0434
http://www.ampa.org

Air Medical Safety Advisory Council: Internet-based access to a variety of helicopter safety and accident information is provided.

http://www.amsac.org
http://www.safecopter.arc.nasa.gov

American Academy of Pediatrics, Section on Transport Medicine: The section facilitates interactions between members involved in pediatric interfacility transport for the purpose of improving care of infants, children, and adolescents who require transport. Membership is open to physician members of the American Academy of Pediatrics (AAP) and approved nonphysician section affiliates who are actively involved in the study or practice of pediatric or neonatal transport. The section offers a biannual conference on transport medicine, and its Web site offers helpful links to other transport resources. It also publishes a transport newsletter and *Guidelines for Air and Ground Transport of Neonatal and Pediatric Patients*. A transport listserv is available through the section's Web site.

AAP—Section on Transport Medicine
141 Northwest Point Blvd
Elk Grove Village, IL 60007-1098

Phone: (847) 434-4000
Fax: (847) 434-8000
http://www.aap.org/sections/transmed/

American Ambulance Association: This organization promotes health care policies that ensure excellence in the ambulance services industry and provides research, education, and communications programs to enable its members to effectively address the needs of the communities they serve. The Web site offers membership information, specifics on political legislation involved in ground transportation, and educational opportunities.

AAA
8201 Greensboro Dr
Suite 300
McLean, VA 22102

Phone: (703) 610-9018
(800) 523-4447
Fax: (703) 610-9005
http://www.the-aaa.org

American Association of Critical-Care Nurses: A specialty nursing organization serving the needs of critical care nurses, AACN defines critical care nursing as that specialty within nursing that deals with human responses to life-threatening health problems. Its Web site offers specific information on educational opportunities, and its organization helps to publish 2 journals, the *American Journal of Critical Care* and *Critical Care Nurse.*

AACN
101 Columbia
Aliso Viejo, CA 92656-4109
Phone: (800) 899-2226
(949) 362-2000
Fax: (949) 362-2020
http://www.aacn.org

American Association for Respiratory Care: This is an association for respiratory therapists with subspecialty interests including air and ground transport. Its Web site offers a variety of critical care links and educational and employment opportunities.

AARC
9425 N MacArthur Blvd
Suite 100
Irving, TX 75063-4706
Phone: (972) 243-2272
Fax: (972) 484-2720
(972) 484-6010
http://www.aarc.org

American College of Emergency Physicians: This national organization represents emergency physicians with a number of subspecialty interests, including pediatrics and transport. Its Web site offers specific topics of interest to emergency physicians in addition to educational and employment opportunities.

ACEP
National Headquarters
1125 Executive Circle
Irving, TX 75038-2522
Mailing Address
PO Box 619911
Dallas, TX 75261-9911
Phone: (800) 798-1822 or
(972) 550-0911
Fax: (972) 580-2816
http://www.acep.org

Washington, DC Office
2121 K St, NW
Suite 325
Washington, DC 20037
Phone: (800) 320-0610 or
(202) 728-0610
Fax: (202) 728-0617

Association of Air Medical Services: This international association is a voluntary nonprofit organization that serves air and surface medical transport providers. It encourages and supports its members in maintaining a standard of performance reflecting safe operations and efficient, high-quality patient care. Its Web site provides specific information about the organization, a list of individual members, and an annual resource guide.

AAMS
AAMS National Office
526 King St, Suite 415
Alexandria, VA 22314-3143
Phone: (703) 836-8732
Fax: (703) 836-8920
http://www.aams.org

Atlas and Database of Air Medical Services (ADAMS): This compilation of information on air medical service providers who respond to emergency medical and trauma scenes, implemented in a geographic information system, can be accessed via its Web site.

http://www.ADAMSairmed.org

Board of Certification for Emergency Nursing: This organization certifies nurses who provide emergency services across the health care continuum, including flight nurses. Its Web site contains information on the various certifications offered and how and where they can be obtained.

BCEN
915 Lee St
Des Plaines, IL 60016

Phone: (800) 900-9659, extension 2630
(847) 460-2630
Fax: (847) 460-2631
http://www.ena.org/bcen/
e-mail: bcen@ena.org

The Comcare Alliance: The Alliance is a coalition of organizations that includes nurses, physicians, emergency medical technicians, 911 directors, wireless companies, public safety and health officials, law enforcement groups, automobile companies, consumer organizations, telematics suppliers, safety groups, and others working to encourage the deployment of lifesaving wireless communications networks and technologies. Its Web site offers a newsletter and a list and status of its projects.

The Comcare Alliance
888 17th St, NW 12th Floor
Washington, DC 20006

Phone: (202) 429-0574
http://www.comcare.org

Commission on Accreditation of Medical Transport Systems: This organization supports a program of voluntary evaluation of compliance with accreditation standards for air-medical or ground interfacility transport. The Web site offers a list of accredited programs and publishes a set of accreditation standards.

CAMTS
PO Box 1305
Anderson, SC 29622

Phone: (864) 287-4177
Fax: (864) 287-4251
http://www.camts.org

Emergency Medical Services for Children: This program supports 2 resource centers—the EMSC National Resource Center (NRC), located in Washington, DC, and the National EMSC Data Analysis Resource Center (NEDARC), located in Salt Lake City, UT. NRC provides support and assistance to states on a variety of topics, operates a clearinghouse, and provides information to professionals and the public. NEDARC specializes in providing assistance on data collection and analysis. The Web site provides links to various EMS programs and offers updates on research and legislation before congress.

EMSC

EMSC National Resource Center
111 Michigan Ave, NW
Washington, DC 20010

Phone: (202) 884-4927
Fax: (202) 884-6845
http://www.ems-c.org

National EMSC Data Analysis
Resource Center (NEDARC)
University of Utah
615 Arapeen Dr, Suite 202
Salt Lake City, UT 84108

Phone: (801) 581-6410
Fax: (801) 581-8686
http://www.ems-c.org

Emergency Nurses Association: The ENA is a national association for nurses dedicated to the advancement of emergency nursing practice. Its Web site offers information on annual meetings and educational and employment opportunities. Transport interests are represented via subspecialty interest groups.

ENA
915 Lee St
Des Plaines, IL 60016-6569

Phone: (800) 900-9659
http://www.ena.org

EMS Web Site: This Web site focuses on individuals with an interest in rescue and EMS services. It offers various links to other EMS services and offers educational and employment opportunities.

http://http://www.fireemsrescue.com

Flight Nursing: This Internet resource focuses on educational opportunities specifically for flight-based nursing.

http://http://flightnursing.com

Flight Web: The primary goal of the site is to provide timely news, information, and resources. In addition, communications between the various specialties (air medical professionals around the world, including EMS pilots, flight nurses, medics, respiratory therapists, physicians, communication specialists, maintenance, administration, and others) are facilitated by hosting forums such as the Flight Med mailing list (http://www.flightweb.com/staticpages/index.php?page=flightmed).

http://www.flightweb.com

Helicopter Association International (HAI): HAI is a not-for-profit, professional trade association of 1350-plus member organizations in more than 70 nations. It is dedicated to promoting the helicopter as a safe and efficient method of transportation and to the advancement of the civil helicopter industry.

HAI
1635 Prince St
Alexandria, VA 22314

Phone: (703) 638-4646
Fax: (703) 683-4754
http://www.rotor.com

International Association of Emergency Managers (IAEM): This is an international organization whose goals are to promote the saving of lives and protection of property during emergencies and disasters. Its Web site offers lists of educational opportunities, job resources, and a list server.

IAEM
201 Park Washington Ct
Falls Church, VA 22046-4527

Phone: (703) 538-1795
Fax: (703) 241-5603
e-mail: info@iaem.com

The International Trauma Anesthesia and Critical Care Society: Also operating under the name Trauma Care International, this nonprofit, international multidisciplinary society is dedicated to improving the care of trauma patients. Its Web site offers information on meetings, course listings, and various clinical and basic research awards. It publishes a quarterly peer-reviewed journal, and pediatric trauma is represented through a subcommittee.

ITACCS
ITACCS World Headquarters
PO Box 4826
Baltimore, MD 21211

Fax: (410) 235-8084
e-mail: info@nwas.org

National Air Transportation Association: An association of aviation business service providers, its mission is to be the leading national trade association representing the business interests of general aviation service companies on legislative and regulatory matters at the federal level. The association sponsors an annual trade show, and its Web site offers information and links to various aviation interests.

NATA
4226 King St
Alexandria, VA 22302

Phone: (800) 808-6282
(703) 845-9000
Fax: (730) 845-8176
http://www.nata.aero

National Association of Air Medical Communication Specialists: This organization's mission is to represent the air medical communication specialist on a national level through education, standardization, and recognition. The membership consists of active communications specialists and administrative managers. Air-medical flight programs and others associated with or interested in communications can join as associate members. Its Web site offers information on continuing education and job opportunities. The organization publishes a manual for training air-medical communications specialists.

NAACS
PO Box 28
Otis Orchards, WA 99027-0028

Phone: (877) 396-2227
http://www.naacs.org

National Association of EMS Physicians: The National Association of EMS Physicians is an organization of physicians and other professionals partnering to provide leadership and foster excellence in out-of-hospital emergency medical services. The Web site contains general and specific educational opportunities and offers annual continuing education activities.

NAEMSP
PO Box 15945-281
Lenexa, KS 66285-5945

Phone: (913) 492-5858
(800) 228-3677
Fax: (913) 599-5340
http://www.naemsp.org/
e-mail: info-naemsp@goAMP.com

National Association of Neonatal Nurses: This organization represents the community of neonatal nurses that provides evidence-based care to high-risk neonatal patients. Within the organization are special interest groups that include critical care transport. The Web site contains general and specific education opportunities and offers annual continuing education activities.

NANN
4700 W Lake Ave
Glenview, IL 60025-1485

Phone: (800) 451-3795
(847) 375-3660
Fax: (888) 477-6266
International Fax: (732) 380-3640
http://www.nann.org

National Association of State EMS Directors: This organization supports its members by providing leadership in the development and improvement of EMS systems and national EMS policy. The organization participates in all the states and territories and acts as a resource for EMS information and policy. Its Web site offers information about itself, EMS news, educational opportunities and Web links.

NASEMSD
201 Park Washington Ct
Falls Church, VA 22046-4527

Phone: (703) 538-1799
Fax: (703) 241-5603
http://www.nasemsd.org

National EMS Pilots Association: The association serves pilots involved in emergency medical services, including helicopter and fixed-wing pilots in EMS. Its Web site offers information on job and educational opportunities. Pilot and vendor data-bases are available.

NEMSPA
526 King St
Suite 415
Alexandria, VA 22314-3143

Phone: (703) 836-8930
Fax: (703) 836-8920
http://www.nemspa.org

National Flight Nurses Association
Now the Air and Surface Transport Nurses Association

http://http://www.nfna.org

National Flight Paramedic Association: Members are involved in transporting critical care patients by airplane, helicopter, and ground ambulance. Most members are flight paramedics, but this is not a requirement. There are also associate memberships for anybody with an interest in the paramedical profession. The Web site offers specific information on job and educational opportunities within the industry.

NFPA
951 E Montana Vista
Salt Lake City, UT 84124

Phone: (801) 266-6372
Fax: (801) 534-0434
http://www.flightparamedic.org

Pediatric Critical Care Medicine: This is a multidisciplinary resource on the Internet for pediatric critical care. The Web site provides specific reviews of current literature, research, funding, and professional opportunities in pediatric critical care.

http://www.pedsccm.org

Pem-Database.Org: This Web-based database platform for professionals practicing pediatric emergency medicine (PEM) is sponsored by a not-for-profit organization dedicated to the advancement of PEM through the application of information technology.

http://www.pemdatabase.org

Pediatric Transport Listserv: PEDTPT-L is an international forum for professionals interested in interhospital transport of children. PEDTPT-L is a listserv offering access to people regarding pediatric interfacility transport. It is available to people with an interest in transport medicine and can be accessed by free subscription by using the following information:

LISTSERV@LISTSERV.BROWN.EDU
With the message: Subscribe PEDTPT-L

Outside the United States

Australian Nursing Council: ANC sets and regulates nursing national standards with a state or territory nurse regulatory authority. This includes the flight nurses. Its Web site lists several publications and educational opportunities.

ANC
PO Box 873
20 Challis St
Dickson ACT 2602

Phone: +612 6257 7960
Fax: +612 6257 7955
http://www.anc.org.au
e-mail: anc@anc.org.au

Flight Nurses of Australia: This organization for Australian flight nurses promotes their subspecialty. Its Web site lists contact numbers for various committee members and publishes a standard for flight nursing practice.
PO Box 346
Rockdale, NSW 2216

Phone: +08 8383 6196

In-Flight Nurses Association: This is a representative forum of flight nurses within the Royal College of Nursing. Its Web site offers some clinical and educational information and links to other members.

IFNA
http://www.ntlworld.com/gerpaul/ifna/RCN aaaIFNA/rcn ifna.html
e-mail: ifna.uk@ntlworld.com

International Society of Air Medical Services (Australasia)

ISAS (Australasia)
PO Box 843
Niddire Victoria 3042
Australia
http://www.isas.org.au

New Zealand Nurses Organization: The organization represents nursing and nurse midwifery throughout New Zealand. The New Zealand Flight Association is a subspecialty group that promotes excellence in flight nursing. The organization publishes a monthly journal, and its Web site offers information on educational and job opportunities.

National Office
Level 3, Willbank Ct
57 Willis St PO Box 2128
Wellington

Phone: 0800028 38 48
Fax: 04 382 9993
http://www.nzno.org.nz

NurseScribe: This Web site lists various links to nursing organizations, national and international, including several transport organizations.

http://www.enursescribe.com
NSW Newborn and Paediatric Emergency Transport Service (NETS)

Phone: +61 1300 36 2500
Fax: +61 1300 36 2498
http://www.nets.org.au
e-mail: consultATnets.org.au

Royal Flying Doctor Service of Australia: This is an organization of medical transport and service providers serving a large proportion of Australia. Its Web site describes the range of services offered.

RFGS Central Operations
8-10 Stuart Terr
Alice Springs NT 0870
Australia

Phone: +61 8 8238 3333
Fax: +61 8 8234 5640
http://www.rfds.org.au/central/default.htm
e-mail: enquiries@flyingdoctor.net

2. **Journals With a Previous Published Interest in Neonatal and Pediatric Transport**

Air Medical Journal: The official journal of the Air and Surface Transport Nurses Association, Air Medical Physician Association, Association of Air Medical Services, National EMS Pilots Association, and National Flight Paramedics Association. The journal is published monthly and contains original research, collective reviews, case studies, editorials, and letters to the editor concerning clinical practice, laboratory and clinical research, education, planning, and administration of medical care by air-medical professionals. It also contains selected academic articles examining the management, flight operations, and safety aspects of the aviation component of air medical services.

Manuscripts are submitted, in the appropriate format to: *Air Medical Journal,* 10801 Executive Center Dr, Suite 509, Little Rock, AR 72211; phone: (501) 223-0183; e-mail: d.drennan@elsevier.com.

Emergency Medicine Journal: (formerly *Journal of Accident and Emergency Medicine*) is published bimonthly by the BMJ publishing group. It is the journal of the British Association for Accident & Emergency Medicine and the official journal of the British Association for Immediate Care and the Faculty of Prehospital Care of the Royal College of Surgeons of Edinburgh. It focuses on developments and advances in emergency medicine and critical care and represents all specialties involved in emergency and prehospital care. Articles included consist of editorials, reviews, original articles, short reports, research series, and best evidence topic reports. Articles are submitted online using submission protocols.

Critical Care Medicine: A monthly publication focusing on all aspects of acute and emergency care for the critically ill or injured patient. It is the official journal for the Society of Critical Care Medicine. Submitted manuscripts are peer reviewed and submitted to the editor: Critical Care Medicine, 701 Lee St, Suite 200, Des Plaines, IL 60016; phone: (847) 827-6869; e-mail: journals@sccm.org. The publisher is Lippincott Williams & Wilkins.

Pediatrics: The official journal of the American Academy of Pediatrics. It publishes articles on original research or observations and special feature articles in the field of pediatrics as broadly defined. Articles pertinent to pediatrics are also included from related fields such as nutrition, surgery, dentistry, public health, child health services, human genetics, animal studies, psychology, psychiatry, education, sociology, and nursing. Committee statements and guidelines also are published regularly. It is owned and controlled by the American Academy of Pediatrics and is published monthly by the American Academy of Pediatrics, PO Box 927, Elk Grove Village, IL 60009-0927.

Journal of Pediatrics: Publishes original research articles, clinical and laboratory observations, reviews of medical progress in pediatrics and related fields, grand rounds and clinicopathologic conferences, and special articles. The journal is published by Elsevier, Inc, and articles can be submitted to the editor: The Journal of Pediatrics, Children's Hospital Medical Center 3333 Burnet Ave, MLC 3021 Cincinnati, OH 45229-3039; Alice Landwehr, managing editor; phone: (513) 636-7140; fax: (513) 636-7141; e-mail: journal.pediatrics@cchmc.org. The journal also accepts electronically submitted articles at http://jpeds.edmgr.com.

Pediatric Critical Care: The official journal of the Society of Critical Care Medicine, the World Federation of Pediatric Intensive and Critical Care Societies, the Paediatric Intensive Care Society UK, and the Latin American Society of Pediatric Intensive Care. It is written for pediatricians, neonatologists, respiratory therapists, nurses, and others who deal with pediatric patients who are critically ill. The journal includes a full range of scientific content, including clinical articles, scientific investigations, solicited reviews, and abstracts from pediatric critical care meetings. It also includes abstracts of selected articles published in Chinese, French, Italian, Japanese, Portuguese, and Spanish. The journal is published by Lippincott Williams & Wilkins. Articles for submission are forwarded to the editor at: Society of Critical Care Medicine, 701 Lee St, Suite 200, Des Plaines, IL 60016; phone: (847) 827-6869, e-mail: journals@sccm.org.

Pediatric Emergency Care: A monthly publication that presents information for emergency physicians, pediatricians, and allied health professionals who provide care for acutely ill or injured children and adolescents. The journal addresses most immediate acute care management problems, with articles on topics such as transport, pediatric airway management, acute trauma, sharp object ingestion, and toxicology. The journal is published by Lippincott Williams & Wilkins, and articles are submitted to the editor with a cover letter to Room 2011, The Children's Hospital of Philadelphia, 34th St & Civic Center Blvd, Philadelphia, PA 19104; fax: (215) 590-2768; e-mail: ludwig@email.chop.edu.

Prehospital Emergency Care: The official journal of the National Association of EMS Physicians, National Association of State EMS Directors, and the National Association of EMS Educators. It is published quarterly with clinical and research information on advances in medical care in the out-of-hospital setting. The journal is published by Elsevier, and articles are submitted to the editor: James J. Menegazzi, PhD, Editor-in-Chief, Prehospital Emergency Care, 230 McKee Pl, Suite 500, Pittsburgh, PA 15213; phone: (412) 647-7992; fax: (412) 647-4670; e-mail: menegazz+@pitt.edu

Trauma Care Journal: The official journal of the International Trauma Anesthesia and Critical Care Society, which also operates under the name Trauma Care International. It is a quarterly journal on prehospital trauma care and anesthesia issues. Articles are submitted to the managing editor, Linda J. Kesseling, MS, ELS, Trauma Care, ITACCS, PO Box 4826, Baltimore, MD 21211.

3. **Pediatric and Neonatal Transport-related Certification Courses (see also chapters 2, 3, 8, 14, and 23)**

Basic Life Support (BLS): Noninvasive assessments and interventions used to treat victims of respiratory and/or cardiovascular emergencies and stroke. This term has become synonymous with cardiopulmonary resuscitation (CPR) and includes automated external defibrillation.

http://www.americanheart.org

Neonatal Resuscitation Program (NRP): Designed to teach an evidence-based approach to resuscitation of neonates using teaching modules. The causes, prevention, and management of mild to severe neonatal asphyxia are explained so that health care professionals develop optimal knowledge and skill in resuscitation. Specific skills and special situations are addressed. Program information can be accessed at: American Academy of Pediatrics Division of Life Support Programs, 141 Northwest Point Blvd, Elk Grove Village, IL 60007; phone: (847) 434-4798; fax: (847) 228-1350; http://www.aap.org/nrp/nrpmain.html.

S.T.A.B.L.E.: An educational program designed to address the pretransport stabilization and postresuscitation care of sick neonates in the community hospital setting. It has been developed for maternal-child health care providers (including nurses, physicians, respiratory therapists, and other prehospital care providers) and consists of several modules, including a learner, instructor, and cardiac module. Program information can be found at http://www.stableprogram.org.

Advanced Cardiac Life Support (ACLS) Course: Medical interventions used to treat victims of respiratory and/or cardiac emergencies and stroke, including invasive techniques such as intubation and administration of drugs. Developed by the American Heart Association for the resuscitation of patients in cardiac arrest or prearrest states. The ACLS course provides a basic level of information combined with skill development, providing participants with the skills and knowledge to manage an adult cardiac arrest situation.

http://www.americanheart.org

Advanced Pediatric Life Support (APLS): The fourth edition of *APLS: The Pediatric Emergency Medicine Resource* represents quantum leaps in the content and scope of the course. Originally conceived as a course in the basic elements of pediatric emergency medicine for physicians who did not regularly care for ill or injured children, the course now attempts to be the definitive resource in pediatric emergency medicine education for physicians and physician extenders in training and in practice. The expanded horizon of the fourth edition is neatly captured in the mission statement adopted by the APLS Steering Committee.

http://www.aap.org/profed/nrp/aplsmain.htm

Advanced Trauma Care for Nurses (ATCN): ATCN is an advanced course designed for registered nurses interested in increasing knowledge in the management of multiple trauma patients. The course is taught in concert with the ATLS (Advanced Trauma Life Support) course for physicians. The nurse participants audit the ATLS course. During the ATLS skill and testing stations, the nurses are separated from the physician group and directed through interactive, hands-on, scenario-based ATCN skill stations.

http://www.traumanursesoc.org/edu_atcn.html

Course in Advanced Trauma Nursing (CATN II): The course is designed to expand trauma nursing knowledge and enhance complex decision-making skills. Advanced trauma nursing is based on the physiologic principles and human responses to injury and illness. The nurse applies critical decision making to optimally affect the outcome of critically injured or ill patients. CATN II concepts correlate broad psychophysiologic and pathophysiologic processes to specific clinical problems.

http://www.ena.org/catn_enpc_tncc/catn/

Emergency Nursing Pediatric Course (ENPC): A 16-hour course designed to provide core-level pediatric knowledge and psychomotor skills needed to care for pediatric patients in the emergency setting. The course presents a systematic assessment model; integrates the associated anatomy, physiology, and pathophysiology; and identifies appropriate interventions. Triage categorization and prevention strategies are included in the course content. ENPC is taught using a variety of formats, including lectures, videotapes, and skill stations that encourage participants to integrate their psychomotor abilities into a patient situation in a risk-free setting.

http://www.ena.org/catn_enpc_tncc/enpc/

Pediatric Advanced Life Support (PALS): A joint project of the American Academy of Pediatrics and the American Heart Association, the PALS course provides knowledge and skill sessions to improve participant performance during a pediatric resuscitation. The goal of PALS is to provide the learner with advanced assessment skills to recognize infants and children at risk for cardiopulmonary arrest. Information and strategies needed to prevent cardiopulmonary arrest in infants and children are addressed, as are the cognitive and psychomotor skills needed to resuscitate infants and children and stabilize their conditions, including advanced airway management and administration of medication.

http://www.americanheart.org

Pediatric Education for Prehospital Professionals (PEPP): PEPP is a curriculum developed by the American Academy of Pediatrics to provide core pediatric education for prehospital providers. Pediatric assessment skills are stressed throughout the course that has separate ALS and BLS curricula or can be taught to mixed audiences. http://www.peppsite.com/

The Transport Nurse Advanced Trauma Course (TNATC): Formally known as the Flight Nurse Advanced Trauma Course, is a 3-day educational experience focused on care of trauma patients during initial resuscitation and transport. Information concerning locations and course offerings can be obtained by calling The Air and Surface Transport Nurses Association at (800) 897-NFNA (6362); fax: (303) 770-1812; e-mail: astna@gwami.com.

Trauma Nursing Core Curriculum (TNCC): This course is sponsored by the Emergency Nursing Association. Currently in the fifth edition (2000) (6th edition scheduled for 2006), this course is designed to provide nurses (emergency department and inpatient and critical care areas) with core trauma knowledge through lectures and integration of skills stations. The goal of the course is to decrease the overall morbidity and mortality of trauma patients by increasing the level of nursing care provided in a variety of settings.

http://www.ena.org/catn_enpc_tncc/tncc/

4. **Programs and Service Organizations Performing International Transport**

Following is a brief listing of programs and organizations that report or advertise experience or availability in the transport of patients internationally and in other parts of the world. It is by no means complete. Listing in this section does not imply endorsement by the authors or the American Academy of Pediatrics. Other similar programs can be accessed through a variety of Web sites, such as http://www.combose.com/Health/Public_Health_and_Safety/Emergency_Services/Medical/Air_Ambulance/.

The AAP Section on Transport Medicine also maintains a database that includes many of the transport programs in the United States. Although not currently specifically designed to identify programs with international experience, contact names and numbers for the individual systems are included (http://www.aap.org/sections/transmed/database.pdf).

US- and Canada-Based Companies

National Air Ambulance
Fort Lauderdale, FL
Phone: (800) 327-3710; (954) 359-9900
e-mail: inquiry@nationaljets.com

Air Ambulance Professionals
1535 Perimeter Rd, Hangar 36B
Fort Lauderdale, FL 33909
Phone: (800) 752-4195; (954) 481-0555
e-mail: info@airambulanceprof.com

Care Flight International
Clearwater, FL
Phone: (800) 282-6878; (813) 530-7972

AAA Air Ambulance America
PO Box 4051
Austin, TX 78765-4051
Phone: (800) 222-3564; (512) 479-8000
e-mail: admin@airambulance.com

Skyservice Lifeguard
Montreal, Quebec, Canada
Phone: (800) 463-3482 (North America); (514) 497-7000 (worldwide)
Fax: (514) 636-0096
e-mail: lifeguard@skyservice.com

Aeromedical Services International
Las Vegas, NV
Phone: (800) 222-9993; (702) 798-4600

Air Ambulance Incorporated
San Carlos, CA
Phone: (800) 982-5806; (702) 798-4600

Critical Air Medicine
San Diego, CA
Phone: (800) 247-8326; (619) 571-0482

Schaefer's Air Service
Van Nuys, CA
Phone: (800) 247-3355; (818) 786-8713

AEA International/SOS
Seattle, WA and Singapore
Phone: (800) 468-5232; (206) 340-6000

AEA International/SOS
Philadelphia, PA 31685
Phone: (800) 523-8930
Note: AEA International acquired SOS International in 1998.

Travel Care International, Inc
Phone: (800) 524-7633 (United States); (715) 479-8881 (outside the United States)

Air MD
4707 140th Ave
Suite 204
Clearwater, FL 33762
Phone: (800) 282-6878
e-mail: info@airmed.net

US Air Ambulance
5919 Approach Rd
PO Box 18718
Sarasota, FL 34270

Caribbean, Mexico, and Latin America

Bohlke Aviation International
Alexander Hamilton Airport
St Croix, US Virgin Islands
Phone: (809) 778-9177

Emergencia Aera Nacional
Mexico City
Phone: [52] (5)-655-3644 or [52] (5)-573-2100

Vuelo de Vida (Life Flight)
Caracas, Venezuela
Phone: [58] (2) 919-054 or (2) 351-143

United Kingdom and Europe

Aeromed 365 Ltd
Suite 66
Worth Business Centre
Worth Corner
Phone: +44 (0) 8709-596999
Fax: +44 (0) 8707 559 599

Air Ambulance International
Box 1044
Magnolia, TX 77355
Phone: (800) 513-5192 (in the United States); (832) 934-2390
Fax: (832) 934-2395

Austrian Air Ambulance
Vienna, Austria
Phone: [43] (1)-401-44
Compagnie Generale de Secours
Paris, France
Phone: [33] (0) 1-4747-6666

Euro-Flite Ltd
Helsinki International Airport
Vantaa, Finland
Phone: [358] (0) 1-174-655

German Air Rescue
Stuttgart, West Germany
Phone: [49] (711)-701-070
Jet Flite

Helsinki International Airport
Vantaa, Finland
Phone: [358] (0)-822-766
MEDIC'AIR International
35, rue Jules Ferry
93170 Bagnolea
Paris, France
Phone: [33] (0) 1-4172-1414

Swiss Air Ambulance
Zurich, Switzerland
Phone: [41] (1)-383-1111
Transport operations in Europe, Russia, Africa, and the Middle East

Trans Care International
London, England
Phone: [44] (181)-993-6151

The Wings Medical Group of Companies
WINGS
238 Broomhill Rd
Brislington, Bristol BS4 5RG
Phone: +44 (0) 117 9719333
Fax: +44 (0) 117 3007000
http://www.wings-medical-group.co.uk
e-mail: admin@wings-medical-group.co.uk

UK London Heathrow
PO Box 279, Iver Bucks
SLO 0BQ10X
Phone: +44 (0) 208-897-6185; +44 (0) 1753 651 511

Middle East

Herzliya Medical Center
Tel Aviv
Phone: [972] (9)-592-555
Air transport for the Middle East and Eastern Mediterranean

M.A.R.M.
Izmir (Smyrna)
Phone: [90] (51)-633-322 or (51)-219-556

Africa

Flying Doctors Society
Nairobi, Kenya
Transport service through East Africa
Phone: [254] (2)-501-280 or (2)-336-886

Medical Air Rescue Service, Ltd
Belgravia, Harare, Zimbabwe
Phone: [263] (0)-73-45-13/14/15

Medical Rescue International
Johannesburg, SA
Phone: [27] (11)-403-7080
Transport network covering sub-Saharan Africa

EuroAssistance
Johannesburg, South Africa
Phone: [27] (11)-315-3999

Medical Rescue International
Aukland Park, South Africa
Phone: [27] (11)-403-7080

India

East West Rescue
New Delhi, India
Phone: [91]-11-2469 8865; [91]-11-2462 3738; [91]-11-2469 9229; [91]-11-2469 0429
Transports throughout Indian subcontinent and adjacent islands

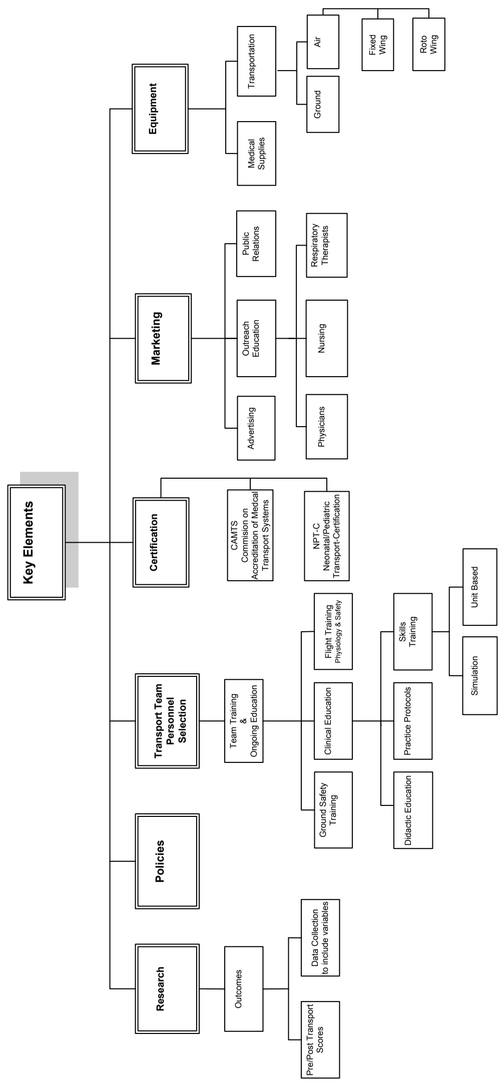
Southeast Asia

AEA International
(Asia Emergency Assistance)
Singapore
Phone: [65] 338-2311 or 338-7800
Transport from Hong Kong, China, Far East Asia, Pacific Rim, and westernmost Pacific islands

Heng-Gref Medical Services
Singapore
Phone: [65] 272-6028
Transport from South East Asia and Indonesia

APPENDIX F

Key Elements of a Neonatal/Pediatric Transport Team



APPENDIX G

Emergency Medical Conditions Form

PHYSICIAN

Emergency Medical Condition (EMC) Identified: *(Mark appropriate box(es), then go to Section II)*

I. MEDICAL CONDITION: Diagnosis ____________________

☐ **No Emergency Medical Condition Identified:** This patient has been examined and an EMC has not been identified.

☐ **Patient Stable** - The patient has been examined and any medical condition stabilized such that, within reasonable clinical confidence, no material deterioration of this patient's condition is likely to result from or occur during transfer.

☐ **Patient Unstable** - The patient has been examined, an EMC has been identified and patient is not stable, but the transfer is medically indicated and in the best interest of the patient.

I have examined this patient and based upon the reasonable risks and benefits described below and upon the information available to me, I certify that the medical benefits reasonably expected from the provision of appropriate medical treatment at another facility outweigh the increased risk to this patient's medical condition that may result from effecting this transfer.

II. REASON FOR TRANSFER: ☐ Medically Indicated ☐ Patient Requested ____________________

☐ On-call physician refused or failed to respond within a reasonable period of time.

Physician Name ____________________ Address ____________________

III. RISK AND BENEFIT FOR TRANSFER:

Medical Benefits:	**Medical Risks:**
☐ Obtain level of care / service NA at this facility. Service ____________________ ☐ Benefits outweigh risks of transfer	☐ Deterioration of condition en route ____________________ ☐ Worsening of condition or death if you stay here. There is always risk of traffic delay/accident resulting in condition deterioration.

IV. Mode/Support/Treatment During Transfer as Determined by Physician – (Complete Applicable Items):

Mode of transportation for transfer: ☐ BLS ☐ ALS ☐ Helicopter ☐ Neonatal Unit ☐ Private Car ☐ Other__________

Agency ____________________ Name/Title accompany hospital employee____________________

Support/Treatment during transfer: ☐ Cardiac Monitor ☐ Oxygen – (Liters) __________ ☐ Pulse Oximeter ☐ IV Pump

☐ IV Fluid __________ Rate __________ ☐ Restraints – Type __________ ☐ Other __________ ☐ None

Radio on-line medical oversight ***(If necessary)*****:** ☐ Transfer Hospital ☐ Destination Hospital ☐ Other

V. Receiving Facility and Individual: The receiving facility has the capability for the treatment of this patient (including adequate equipment and medical personnel) and has agreed to accept the transfer and provide appropriate medical treatment.

Receiving Facility / Person accepting transfer ____________________ Time __________

Receiving MD ____________________

Transferring Physician Signature____________________ Date/Time __________

Per Dr. ____________________ by ____________________RN/ Qualified Medical Personnel Date/Time__________

NURSING

VI. ACCOMPANYING DOCUMENTATION – sent via: ☐ Patient/Responsible Party ☐ Fax ☐ Transporter

☐ Copy of Pertinent Medical Record ☐ Lab/ EKG/ X-Ray ☐ Copy of Transfer Form ☐ Court Order

☐ Advance Directive ☐ Other____________________

Report given (Person / title) ____________________

Time of Transfer__________ Date __________ Nurse Signature ____________________ Unit __________

Vital Signs Just Prior to Transfer T __________ Pulse__________ R __________ BP __________ Time__________

PATIENT

VII.PATIENT CONSENT TO "MEDICALLY INDICATED" OR "PATIENT REQUESTED" TRANSFER:

☐ I hereby **CONSENT TO TRANSFER** to another facility. I understand that it is the opinion of the physician responsible for my care that the benefits of transfer outweigh the risks of transfer. I have been informed of the risks and benefits upon which this transfer is being made.

☐ I hereby **REQUEST TRANSFER** to ____________________. I understand and have considered the hospital's responsibilities, the risks and benefits of transfer, and the physician's recommendation. I make this request upon my own suggestion and not that of the hospital, physician, or anyone associated with the hospital.

The reason I request transfer is ____________________

Signature of ☐ Patient ☐ Responsible Person ____________________ Relationship____________________

Witness ____________________ Witness ____________________

TRANSFER FORM **White:** Receiving Facility; **Yellow:** Medical Record; **Pink:** QA	Patient Name: Date of Birth: Medical Record Number:

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Guidelines for Air and Ground Transport of Neonatal and Pediatric Patients, 4th Edition

American Academy of Pediatrics Section on Transport Medicine

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