



Air & Surface Transport Nurses Association

Position Statement

Critical Care Transport Nurse Safety in the Transport Environment

This Position Statement was developed as an educational tool based on the opinion of the authors. It is not a product of a systematic review. Readers are encouraged to consider the information presented and reach their own conclusions.

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President's Message

The Air & Surface Transport Nurses Association (ASTNA) is pleased to offer an update of this important position statement. As time passes, the tools, technology, and knowledge that create effective safety systems change, but the foundation remains the same. The need for all critical care transport professionals to maintain a solid commitment to safety remains paramount. Many programs emphasize safety, some are large and some are small, but all play a part in the safety systems and culture for which each of us are responsible. *Critical Care Transport Nurse Safety in the Transport Environment* is an important resource for administrators, managers, and line staff in transport programs of all types—those with ground, fixed-wing, or rotor-wing vehicles, operating in any area and any model. Operational safety and quality patient care are common goals of every transport program and provider. ASTNA is pleased to provide this important resource as part of its mission to advance the practice of transport nursing and enhance the quality of patient care through commitment to safety and education.

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2017-2018 ASTNA President

Statement of the Problem

The critical care transport environment has evolved to include air and ground transport, as well as other types of specialty transport. Team safety is a primary focus of the critical care transport community. Maximizing the safety of team members in the transport medical environment is a primary mission of the Air & Surface Transport Nurses Association (ASTNA). In 2017, ASTNA published the *Critical Care Transport Core Curriculum*, which emphasizes ASTNA's focus on safety.

A strong safety culture must be established, extending from the highest level of administration to the newest team member. All members of the medical transport community are responsible for ensuring safety and safe practices.¹

In 2015, ASTNA published the *Standards for Critical Care and Specialty Transport*, which also emphasizes the central role of safety.

Not only are individual team members responsible for their own safety, but organizational leadership is responsible for establishing and nurturing a culture of safety.²

Critical care transport nurses share the responsibility for ensuring the safety of aircraft and the team. Data from the 2007 ASTNA Safety Survey revealed that safety practices vary widely by program.³ A quantitative survey conducted in 2015 showed a positive trend toward many initiatives set forth by industry associations, air operators, the Federal Aviation Administration (FAA) and the National Transportation Safety Board (NTSB).⁴

Helicopter EMS (HEMS) transport began in the United States in 1972 and has grown precipitously over the past 45 years. In 1980, there were fewer than 50 HEMS providers. Twenty years later, there were 377 and by 2014, more than 1,500. Today there are approximately 1,048 HEMS providers operating in the United States.⁵ The number of patients transported by air, as well as the number of HEMS aircraft in operation, also has increased substantially. Air medical programs experienced an alarming number of fatal incidents between 1991 and 2008, exceeding that of any other type of aviation in the United States. The fatality rate in 2008 was the highest recorded in the history of the industry.⁶ In 2014, the FAA issued recommendations for helicopter operators, including air medical services, for “stricter rules and procedures, improved communications and training, and additional on-board safety equipment.”⁷ The air medical industry recognizes and addresses the importance of critical care transport nurses assuming an active role, along with other team members, in ensuring a safe aviation environment. The Commission on Accreditation of Medical Transport Systems (CAMTS) requires a safety management system (SMS) be in place and maintained to achieve accreditation.⁸

The number of fatalities involving critical care ground transport nurses is less clear. Ground transport fatalities are still underreported compared with fatalities in air transport. Ground transport nurses are at risk due to the larger size of transport vehicles required to accommodate critically ill patients and the increased amount of equipment. According to the National Highway Traffic Safety Administration (NHTSA), 4,500 motor vehicle traffic crashes involving an ambulance occurred between 1992 and 2011.⁹ Of the 662 fatalities in these crashes, 63% were occupants of another vehicle, 21% were ambulance passengers, 12% were not occupants of vehicles, and 4% were drivers. Of 10,400 reported injuries during that time, 17% affected the driver, 29% the passenger, and 54% the occupant of another vehicle involved

in the crash.⁹ Positive efforts to improve documentation, reporting, and analysis of ambulance crashes are ongoing. ASTNA continues to believe there is a great need to investigate, promote, and implement methods to decrease safety risks for each critical care transport nurse, regardless of practice area. Risks must be minimized and available knowledge and technology must be applied consistently within the transport community.

Data from the 2007 ASTNA Safety Survey showed widely variable safety practices across both programs and individuals.³ The transport community has made great strides since then to improve safety records and reputation. Through the implementation of SMS, the adoption of Just Culture principles, and the use of better communication processes, the industry strives to continue to improve. AAMS developed the Vision Zero program in 2005, which outlines the initial components of building a community culture of safety and offers tools to improve safety that can be easily implemented by any program.¹⁰

ASTNA believes every patient and transport team member is entitled to the highest level of protection and most effective transport safety systems available. Unity as a professional association for critical care transport nurses and openly sharing honest positions regarding issues of safety can be a powerful influence in positively affecting a future in which incidents in the transport medical community are significantly reduced.

Carelessness and complacency continue to be the single most inherent reasons for HEMS crashes. Most air medical crashes are not survivable. Prevention is the only way to mitigate the risk. This position paper includes all aspects of safety addressed in the earlier version, including helicopter design, ground transport, survival training, use of personal protective equipment, and relevant human factors.

Twelve topics are addressed, each providing background information and ASTNA's position. Each section contains adequate information to serve as a resource regarding a particular topic without necessitating review of the entire paper. This document reinforces ASTNA's commitment to ensuring that safe medical transport continues as an important and integral resource in the health care industry.

Improved Performance through Appropriate Scheduling and Provision for Adequate Rest

The provision of 24-hour availability of medical transport services may result in scheduling of nursing staff for extended or rotating shifts. Managers traditionally rotate day, evening, and night shifts on the exclusive basis of providing fair distribution of various shifts among employees. Long shifts and rotating schedules are known to lead to fatigue and sleep deprivation.¹¹ Shift work also has a known negative impact on quality of life and relationships with family and friends¹²; this often leads to decreased rest time between shifts as individuals try to make up for the disruption in work-life balance. Whether it is from shift work or sleep deprivation, the impact of fatigue is impaired decision making, decreased job performance, and an increase in the number of mistakes, all of which can lead to an unsafe environment for patients, critical care transport nurses, and fellow team members.

Shift Work and Fatigue Management

The study of the effects of time on living organisms is an area of science known as chronobiology. Chronobiologists report that fatigue resulting from shift work is an insidious cause of decreases in every aspect of physical and mental performance.¹³ Lengthy duty time, such as that associated with 24-hour or longer shifts, may create an environment that promotes conditions of fatigue and compromised judgment

abilities unless periods of adequate rest can be ensured. Additionally, performance differs within the hours of a shift, with a measurable decrease in performance toward the end of a 24-hour shift.¹⁴ Scheduling shorter shifts, however, does not guarantee team members will receive sufficient rest or be free from fatigue and compromised performance. Although there are no perfect solutions to the problems inherent with shift work, chronobiologists have provided suggestions to minimize negative effects and maximize performance.¹⁵ Shifts should be changed infrequently, with as few combinations of different shifts in any given week as possible. Shift changes should occur in a forward rotational direction (ie, day to evening to night for 8-hour shift workers, or day to night for 12-hour shift workers), with days off scheduled in between allowing maximum shift transition.¹⁵

Burnout, staffing shortages, and adverse patient outcomes are linked to the psychological aspects of work and the associated recovery period or lack thereof. The average nurse working a 12-hour shift averages 5 hours of sleep between leaving the workplace and returning for the next shift. Variables include commute time, responsibilities involving children and elderly parents, and daily chores.¹¹ At 5 hours of sleep, performance is impaired. A week of 5-hour nights causes the brain to adapt to a stable but impaired state.¹⁶ Managers and leaders should take reasonable steps to create environments in which scheduling is conducive to sleep quality and sufficient time off work for restoration.¹¹

Rest Times

Alertness, fine motor skills, and judgment deteriorate significantly without adequate rest.¹⁶ In October 1999, Federal Aviation Regulation (FAR) requirements under Part 135 were changed to include a stringent limitation on the maximum time a pilot can be on duty before a mandated, uninterrupted rest period. Regulations dictate that a pilot must have a minimum of 10 hours of uninterrupted rest within every 24-hour period. “On-call” time, defined as when a pilot is required to carry and respond to a pager, currently is counted as “duty” time, as is repositioning time in an aircraft for long-range operations and cannot be included in the minimum 10 hours of required rest.¹⁷ Currently, critical care transport nurses and other air medical team members are not included in these requirements. Additional FARs relating specifically to air medical flight teams include a minimum of 8 consecutive hours of rest in a 24-hour period, no more than 8 hours of flight time in a 24-hour period, and other more long-term restrictions relating to flight hours and rest times.¹⁷

Imposing this same stricter limit of duty time on all team members may create difficulties for some programs. However, it has been well established that the pilot is not the only individual responsible for maintaining a safe aviation environment. Nurses who work 24-hour or longer shifts may encounter difficulties in obtaining adequate rest.⁸ The NTSB identifies factors that contribute to fatigue and potential safety lapses: acute sleeplessness, cumulative sleep debt, continuous wakefulness, and time of day; CAMTS requires crew rest policies, and the FARs have strict pilot duty time limitations.¹⁸

ASTNA Position

Based on the results of published research and the minimum rest requirements for pilots established by the FAA, ASTNA recommends and supports that improved performance, alertness, and decision making would be promoted if:

1. Structured scheduling ensures each critical care transport nurse receives a minimum of 10 hours uninterrupted rest between shifts. A written policy should be established acknowledging a transport nurse's responsibility to request relief from duty when feeling excessively fatigued or inadequately rested. The policy should include a process for identification and activation of backup personnel to relieve excessively fatigued team members, as well as language specifying that the transport nurse will not experience any punitive actions based on calling a "timeout" period. Use of timeout periods, rest times, and flight times should be tracked and used for quality improvement as applicable to the program.
2. Structured scheduling of critical care transport nurses provides for infrequent changes between night, evening, and day shifts, and with shift changes made in a forward rotation. Scheduling of days off should allow for maximum quality rest and transition between shifts.
3. Critical care transport nurses should not be prescheduled in excess of 24 hours in one shift.
4. A fatigue risk assessment tool is recommended for use in all shifts, especially for those in excess of 24 hours, and should include commute time between remote bases.
5. Increased training in fatigue management, warning signs, and mitigation strategies is recommended, including use of sleep aids, stimulants (including caffeine) and their effects on performance, the phenomenon of sleep inertia, and strategic napping.
6. Adequate quarters are provided for quiet rests and use of these quarters for strategic napping should be encouraged as needed along with required rest times.
7. Adequate fluids and nutrition are provided for critical care transport nurses, especially during the busiest service periods.

Improved Safety through Critical Care Transport Nurse Interaction with the Pilot- or Driver-In-Command to Ensure a Safe Transport Environment—Air Medical Resource Management (AMRM)

Background

ASTNA, along with many in the transport community, recognize and have addressed the absolute necessity of active participation of critical care transport nurses and other team members for ensuring a safe air and ground transport environment.¹ In response to an FAA-mandated, industry-wide effort to reduce the number of HEMS crashes, AAMS, in consultation with ASTNA, Helicopter Association International (HAI), the National EMS Pilots Association (NEMSPA), the National Flight Paramedics Association (NFPA), and principal air medical service operators and aircraft manufacturers, convened the Air Medical Safety Summit in Dallas, Texas, in April 2000 to discuss safety within the air medical service industry; the summit was repeated in July 2008. Since that time, countless safety-related meetings and conferences have been convened, including hearings before Congress. In 2010, the FAA issued recommendations regarding a possible path to safety for air medical transport agencies.⁷ One recommendation was the integration of air medical resource management (AMRM) because human error continues to be the major contributor to civilian transport incidents and crashes. This recommendation dovetailed with a September 2005 guideline issued by the FAA establishing minimum guidelines for

AMRM training to HEMS operators.¹⁹ Training focuses on pilots, maintenance technicians, flight nurses, flight paramedics, flight physicians, medical directors, specialty team members (eg, neonatal teams), communications specialists (eg, dispatchers), program managers, maintenance staff, operational managers, support staff, and any other potential air medical team members. AMRM is a system in which everyone is responsible for safety.

The fundamental basis of AMRM is open, interactive communication. Coupled with increasing situational awareness, AMRM emphasizes that team members should proactively speak up any time they have information that could potentially affect transport operations. They also should be encouraged to do so without fear of retribution or other negative consequence.⁷ These principles foster a collaborative environment in which team communication is used consistently during shift briefings, pre-mission briefings, post-mission debriefings, pre-mission inspections of an aircraft or vehicle, and pre-mission checklists involving every team member.¹ The degree of involvement by each team member may vary by program; however, all members of the team should play an active role.

Beginning-of-shift briefings provide an opportunity to disseminate information about particular concerns or circumstances expected during that shift such as weather conditions, scheduled maintenance, Notice to Airmen (NOTAM) alerts, and roadwork or road closures. Pre-mission briefings allow for pertinent information to be communicated to team members, including special needs of the patient, ground contacts, customs paperwork, potential safety hazards in the area, expected time of transport, anticipated weather conditions, anticipated landing zone, airport, and road concerns, and specific team task assignments.

Pre-mission checklists and aircraft or vehicle inspections are the responsibility of the pilot or driver.¹⁷ Nonetheless, all team members should perform walk around inspections prior to boarding on every leg of the transport, scrutinizing for unplugged cords, liquid spills beneath the aircraft or vehicle, unsecured objects in and around the aircraft or vehicle, loose objects in the vicinity, and unsecured latches. Any potential hazards should be brought to the attention of the pilot or driver as soon as identified.

Post-mission debriefings involve a formalized process documented in writing. These debriefings allow for the identification and trending of safety issues and/or concerns (including safety near-misses) so the information can be brought to the attention of appropriate safety personnel. Information gathered from post-mission debriefings, such as tracking potential problems and monitoring trends, is invaluable for quality improvement purposes. Safety issues identified should be forwarded in a timely manner to the attention of appropriate safety and/or administrative personnel. The acceptable timeframe and method of communication depends on the severity of the incident. Information regarding safety issues also should be formally communicated to other team members as soon as identified to improve awareness and prevent future incidents. Corrective action(s) taken should be documented with a timely, follow-up evaluation of the effectiveness of the action(s). Data resulting from this process should be integrated into a transport program's comprehensive ongoing SMS. Critical care transport nurses also have an obligation to assist the pilot and/or driver in maintaining a safe environment inside the aircraft or vehicle cabin. These responsibilities include but are not limited to the following:

- Ensuring all equipment is fully secured
- Ensuring all team members and/or passengers (ie, patients) remain secured in seat belts and/or safety restraint devices during all phases of transport

- Notifying the pilot or driver in the event that seat belts and/or safety restraint devices need to be released to provide patient care and when resecuring these safety devices
- Properly securing patients within an aircraft or ground transport vehicle
- Verifying that pilot or driver controls are isolated from potential patient movement
- Ensuring night lighting is used judiciously
- Ensuring appropriate use of night vision goggles during flight
- Maintaining a sterile cockpit during critical phases of flight
- Providing a proper safety briefing to patients and passengers²

ASTNA Position

Although referred to as air medical resource management, ASTNA believes the principles of AMRM are applicable within both air and ground transport and should be practiced in the transport environment, regardless of the type of transport vehicle. ASTNA believes safety through interaction between critical care transport nurses and pilots- or drivers-in-command will be enhanced if:

1. Critical care transport nurses actively participate in ensuring a safe environment inside the aircraft or ground transport vehicle at all times.
2. Critical care transport nurses work closely with pilot(s) and/or driver(s) in developing procedures for beginning-of-shift briefings, pre-mission briefings, pre-mission checklists, pre-mission inspections, and post-mission debriefings as appropriate for a program's specific circumstances.
3. Critical care transport nurses receive training and routinely practice safety procedures during daily operations (eg, sterile cockpit, watching for other aircraft/vehicles, identifying potential hazards, avoiding obstacles, assessing anticipated landing zones).

Loading/Unloading an Aircraft While the Rotors Are Turning (“Hot” Loading/Unloading)

Background

“Hot” loading/unloading refers to loading or unloading of patients and team members without taking the necessary time to shut down aircraft engines and/or rotors. Most HEMS programs conduct “hot” loading/unloading of patients in a variety of circumstances. Individuals who participate in loading and/or unloading procedures while the rotors are turning are at increased risk for injury. The significantly increased noise levels associated with turning rotor blades also may prevent essential communication between team members and others who are assisting, as well as result in hearing loss in the patient and transport personnel. Patients may experience additional adverse effects as a result of the cold air associated with rotor wash.²⁰ No evidence is available to support a cause-and-effect relationship between the delay required for the aircraft shutdown and a negative impact on the patient’s condition or progress. In most circumstances, the time associated with shutdown is minimal—30 seconds to over 2 minutes—depending on the type of aircraft. However, the inherent risks of loading and/or unloading an aircraft with the rotor blades turning are well known. Any contact between personnel and either the main rotor system or the tail rotor may result in fatal injuries.²¹ Therefore, it is prudent for team members to consider the risks and benefits of this practice in determining when “hot” loading and/or unloading is deemed appropriate.

ASTNA Position

ASTNA believes safety during rotor-wing transport would be enhanced if:

1. HEMS programs consider the benefits versus the risks of “hot” loading/unloading of an aircraft. Programs that elect use of “hot” loading/unloading procedures should establish written policies and procedures detailing these operations.
2. “Hot” loading/unloading procedures are not used routinely, but only in situations when the benefits outweigh the additional risks.
3. All personnel, including fire and EMS, involved in “hot” loading/unloading procedures receive initial and recurring training to ensure safe performance of these procedures.

Personal Protective Equipment

In 1986, the NTSB began investigating the growing number of HEMS incidents and crashes. By 1988, a comprehensive study that included safety improvement recommendations had been completed and its results presented to the FAA and the American Society for Hospital-based Emergency Air Medical Systems (ASHBEAMS), now known as AAMS.¹² The NTSB recommendations included the following priority action:

Encourage members who operate emergency medical services (EMS) programs to provide medical personnel, who routinely fly EMS helicopter missions, with mission-appropriate protective clothing and equipment to reduce the chance of injury and death in survivable incidents. This clothing and equipment should include protective helmets, flame- and heat-resistant suits, and protective footwear.¹²

In 1992, the AAMS Safety Congress recommended that “hospital programs doing scene work should have helmets, Nomex uniforms, and boots with steel toes and shanks” and that “all EMS hospital personnel should wear helmets for head protection.”²² Both the NTSB and AAMS Safety Congress define personal protective equipment to include helmets, fire-resistant (Nomex) uniforms, and high-top leather boots.

Helmets

The US Army Aeromedical Research Laboratory at Fort Rucker, Alabama, has performed extensive testing, research, and analysis of helicopters accident kinematics and the efficacy of personal protective equipment. Shanahan and Shanahan²³ reviewed crash analysis data of 297 military helicopters and concluded the following:

The most common cause of injury was secondary impact caused by collapse of the helicopter structure into occupied areas, by inadequate restraint of the occupants that allowed them to flail into structures, or by a combination of both mechanisms. Injury solely related to acceleration occurred infrequently.

The authors also reported that head injuries were the most commonly reported injury in both survivable and nonsurvivable crashes. A total of 56% of occupants died as a result of head injuries in fatal crashes

classified as “survivable”; a total of 24% of all injuries were to the head and face and of those, nearly 25% were fatal.²³

Impact tolerances to the face and temporal area of the skull are relatively low. Lateral impact injury to the temporoparietal area requires a relatively small amount of force to produce a potentially lethal injury. Given sufficient energy, blunt trauma to most areas of the skull can result in linear skull fractures that extend to the base of the skull. Helmets provide adequate spreading or attenuation of the impact load, which results in a decreased incidence of skull fractures.²³ Crowley²⁴ compared helmeted and non-helmeted occupants of 595 military helicopter crashes classified as “survivable.” The risk of fatal head injuries was six times greater in occupants who did not wear helmets than in those who did. The risk was even higher for occupants positioned behind the cockpit. In studies of the original SPH-4 helmet used by the military, the average abbreviated injury scale (AIS) score for team members who lost their helmets during impact was 4.3 compared with 2.7 for those who retained their helmets in survivable or potentially survivable incidents.²⁵ This represents a 37% reduction in average AIS scores for individuals wearing helmets. An analysis from 2003 determined that the second leading cause of fatalities in helicopter crashes is brain and skull injuries, precipitating the need for and use of helmets while in flight.²⁶

Helmets with attached facial visors provide additional eye and vision protection, not only in the event of a crash, but also in situations when birds or other objects come through the windshield/windscreen or windows of a helicopter and into the cockpit or cabin. In multiple documented civilian HEMS incidents, feathers, blood, and bird parts caused significant potential for eye and facial injuries. The loss of vision, even for a short time, can be catastrophic, especially when a pilot cannot navigate the aircraft to a safe landing. In one report of 459 US Army incidents, use of a visor decreased injury severity by 25%.²⁷ Coupled with the use of helmets, proper use of facial visors substantially decreases the percentage of fatalities and increases survivability of all incidents, regardless of the incidence of facial injuries.²⁵

Helmet use is mandated for all personnel employed at CAMTS-accredited rotor-wing programs.⁸ CAMTS also requires that helmets are inspected at least once annually.⁸ Helmets specially designed for use in HEMS operations provide protection specific to the air medical environment, including greater sound and crash attenuation, increased ease of movement within the limited space of the cabin and cockpit, broader fields of vision, and increased comfort features. Although more commonly associated with HEMS operations, helmet use also is believed to be beneficial to individuals working in ground and fixed-wing transport operations. More investigation of the possible benefits of helmet use in these environments is warranted.

For use in HEMS operations, lighter weight Kevlar helmets or Kevlar and carbon fiber helmets are available. For maximum comfort and safety, helmets must fit properly and facial visors must be used at all times. Chinstraps also must be fastened whenever a helicopter is airborne and must be properly tightened to ensure the helmet cannot become dislodged from the force of impact in hard landings and/or crashes. Because a helmet alters vision, movement, and hearing, each air medical team member must become accustomed to differences by simulating normal activities in and around the aircraft prior to wearing a helmet on an actual mission.¹²

Flame-Resistant Uniforms and Gloves

An aircraft crash creates the potential for spilled fuel from ruptured fuel tanks and lines, with additional risk of a major fire if an electrical spark ignites the fuel or a heated surface. If the pilot and/or air medical team members involved in a crash are not immobilized or incapacitated, the only escape route may be through flames. Although no protective clothing completely prevents burn injuries, the goal is to minimize the skin's exposure to the intense thermal environment during an aviation fire. Flight suits made of fire-resistant fibers, coupled with undergarments made of natural fibers, offer a high level of protection from fire.²⁸ Fabrics of synthetic undergarments such as polyester, polypropylene, and nylon should be avoided as they melt and become embedded in the skin when they are exposed to intense heat. In post-incident aviation fires, fabric weight is only one factor that determines the amount of heat transfer that will occur. Of greater importance is uniform fit and type of undergarments worn. Uniforms should be fitted with a minimum of $\frac{1}{4}$ " between the undergarment(s) and flight suit.²⁹ The gap between garments is to account for absorption of heat and energy from flash fires, causing the fire-resistant fibers to swell; this prevents the suit from constricting too tightly around the wearer.

Nomex is a flame- and heat-resistant material made from aramid fiber, which is similar to nylon, but does not melt or drip when exposed to higher temperatures. Nomex aramid fiber is designed to withstand a brief intense heat environment by remaining intact and forming a char, which provides a barrier between an individual and the heat source. Nomex will not prevent thermal injury to the skin but may reduce the risk or severity of tissue damage.²⁸

Results of burn testing on different fabrics to assess the percent of total body surface area (TBSA) burned while wearing different layers of clothing showed that when a Nomex flight suit was worn directly against the body, burns of approximately 52% of TBSA occurred.²⁸ When the flight suit was paired with short cotton underwear, the percent of TBSA burned decreased to 34% and when paired with Nomex long underwear, the percent of TBSA burned decreased to 9%.²⁸ The combination of a Nomex flight suit and Nomex undergarments resulted in a very survivable burn. If the testing had included protection for the head, hands, and feet, the percent of TBSA burned would have been close to zero.

Documents such as the Air Force Instruction 36-2903, Army Regulation 670-1, and Army Regulation 95-1 also offer direction pertaining to proper wear of a flight suit, garments to wear under a flight suit, and appropriate accessories.²⁹ Base layers must be 100% cotton or fire-resistant fibers. During the course of in-flight operations, flight suits must be zipped up to no lower than the middle of a team member's nametag and the sleeves must be to be completely pulled down. In addition to the undergarments and flight suit, direction also is given regarding the use of fire-resistant gloves and cotton or wool socks.

Nomex gloves are considered part of a flame- and heat-resistant uniform because severe, debilitating injuries to the hands can result from brief exposure to flame or intense heat.²⁸ Nomex gloves are not likely be worn during patient care; however, they may be worn on outbound flights, as well as other situations where patient care is not being performed.

Although data show the incidence of post-crash fires in survivable air medical accidents is <25%, the effects of burn injuries are devastating—physically, emotionally, and financially.³⁰ The mean total health care cost for burn patients in high-income countries is \$88,218.³¹ After initial treatment, extensive rehabilitation, occupational therapy, and plastic surgery are common, adding significantly to the total

cost. Although use of Nomex uniforms does not provide complete protection from a post-crash fire, when worn appropriately, it decreases the severity of thermal injury by providing a barrier between the heat source and the skin. If burn depth is subsequently decreased by as little as several hundred microns, patient outcome and prognosis greatly improve.

Protective Footwear

According to National Safety Council statistics, foot-related injuries (eg, contusions, cuts, lacerations) represent approximately 20% of the total workplace injuries reported.³² The frequent incidence of these injuries is likely due to the fact that feet often are highly exposed and largely unprotected. Air medical team members are at even greater risk for foot injuries because of their increased exposure to environments where multiple hazards exist, including sharp metal objects, moving equipment, falling debris, wet and/or slippery surfaces, and obstacles to climb over. Injuries can be extremely disabling if the foot's supporting and balancing functions are comprised or lost.

The use of protective footwear may substantially reduce the risk of foot injuries when footwear is constructed of all-natural leather material and extends several inches above the uniform pant legs. Leather protects underlying tissue from punctures, lacerations, and thermal injuries, and high-top boots reduce the potential for ankle sprains and fractures, as well as provide additional ankle support and stabilization when working in a harsh environment. Boot soles should be constructed of slip-resistant, lightweight material. Zippers provide convenience in donning and doffing boots quickly; however, when exposed to fire or significant heat, underlying skin must be insulated from direct contact with metal zippers to reduce the potential for rapid heat transfer. Socks and/or stockings also should be made of all-natural fibers, such as cotton, wool, or silk, and should be heavy enough to keep the feet insulated and protected from friction injuries.

Worker Visibility Apparel

In November 2006, the Federal Highway Administration (FHWA) issued the Worker Visibility Rule 23 CFR Part 634, which states:

All workers within the right-of-way of a Federal-aid highway who are exposed either to traffic (vehicles using the highway for purposes of travel or to construction equipment within the work area) shall wear high visibility safety apparel.³³

US Department of Transportation (DOT)-approved clothing is required whenever in close proximity to the highway and should be in accordance with the ANSI-ISEA 107-2004 publication.³⁴ CAMTS requires all medical teams and operators responding to night scene requests wear both reflective material or striping on uniforms and approved high-visibility apparel.⁸ These garments most commonly are added over a uniform and outerwear during scene requests, as lightweight-style vests will not interfere with normal patient care operations. A Performance Class 2 or higher style vest is the required for all highway right-of-way exposures, as it covers the torso and is more visible to motorists than Performance Class 1 vests.³⁴

ASTNA Position

ASTNA believes the potential for injury in survivable incidents would be reduced if:

1. Critical care transport nurses in HEMS operations wear helmets specifically designed for helicopter operations. These helmets should meet or exceed US military specifications for aviation head protection gear and should have full facial visors. Helmets should be properly fitted and a facial visor should be used at all times.
2. Critical care transport nurses wear loose-fitting, long-sleeved uniforms constructed of flame- and/or heat-resistant materials. Uniforms should be fitted to provide for at least $\frac{1}{4}$ " between undergarments and the uniform and undergarments should be made of all-natural fibers. Nomex gloves provide additional protection and should be worn whenever possible.
3. Critical care transport nurses in operations that conduct scene flights or missions wear high-top, all-natural leather boots, with cotton or cotton-wool blend socks. If zippers are used in the boot design, a leather shield should be placed between the zipper and the inside of the boot.
4. Critical care transport nurses working in any type of transport environment are aware of the decibel level in their environment and the potential damage to hearing. Appropriate hearing protection should be worn. Annual hearing tests are recommended.

Reporting of Hazardous Situations and Safety Issues

Background

A safety survey of ASTNA's membership conducted in 1988 revealed the absence of formal mechanisms for reporting safety concerns and resources to assist in resolution of those concerns.³⁵ These results led the ASTNA Safety Committee to recommend that the ASTNA Board explore a mechanism for members to report and resolve safety issues. Despite the recognized importance of reporting/resolution processes, more than a decade passed without development of any system. As a result, ASTNA added a page to its website for reporting safety concerns; this worked well initially but ultimately was removed from the website with the advent of new mechanisms for reporting.

In 1984, the National Flight Nurses Association (now ASTNA) established the Concern Network (CoOperation Network Call for Emergency Regional Notification) as a telephone tree designed to share information related to mishaps during ground or air transports. Information is provided by individuals and/or individual transport programs and distributed via email in the form of Concern Bulletins to subscribers to the Concern Network. Participation is voluntary and has become increasingly more widely used to disseminate information ranging from mechanical failures to actual incidents and crashes. Preliminary information typically is distributed initially, followed by a more in-depth description of the events surrounding the incident, mishap, or event as details are gathered and confirmed. The Concern Network has become one widely used option for reporting.

The Center for Leadership, Innovation, and Research in EMS also offers a reporting tool for transport-related incidents through the EMS Voluntary Event Notification Tool (E.V.E.N.T). This tool allows

anonymous reporting of safety concerns to encourage EMS providers to report events without fear of retribution.

In addition to these two reporting systems, SMS have been developed within the HEMS industry to mitigate the risks of transport. These systems are intended to help manage potential hazards by identifying and reducing risks associated with critical care transport industry. The SMS concept empowers and charges every member of the team to be safety conscious, encouraging individuals to speak up when a problem or potential problem exists in an effort to prevent accidents or mishaps from happening.

ASTNA Position

ASTNA believes consistent, widespread reporting of safety-related incidents and near-misses enhances critical care transport nurse safety. Safety reporting systems must include the following components:

1. An anonymous process of reporting or notifying others that the hazard exists;
2. A forum allowing for questions, feedback, and discussion;
3. Clearly visible, written notification that information obtained through this reporting mechanism is not to be used for criticism, negative feedback, or punitive measures; and
4. An SMS that allows personnel at all levels of an organization to identify, report, and take action regarding unsafe or potentially unsafe situations.

Vehicle Configuration and Design to Maximize Safety and Reduce the Potential of Serious Injury to Transport Teams in the Event of a Crash

Background

Much has been learned from the studies of helicopter crashes and their results during the past several decades. Researchers in the 1970s identified several areas of significant risk, some of which referred to problems with helicopter design and/or configuration.¹² In a 1985 report prepared for the FAA, an analysis of rotor-wing aircraft crash dynamics resulted in recommendations made for improved crashworthiness, including energy-attenuating seats, single-point release shoulder harnesses, and crash-resistant fuel cells.³⁶ The authors reported that with implementation of these safety enhancements, fatalities and injuries in otherwise survivable crashes could be reduced as much as 85%. FARs now require all aircraft manufactured after 1992 be equipped with safety belts that have single-point release shoulder harnesses and energy-attenuating seats, and crash-resistant helicopter fuel system standards have been in place since 1994.^{37,38} Certification requirements for fixed-wing operations also require proper restraints and energy attenuating seats.³⁹

Although the recommendations made in the 1970s and 1980s resulted in subsequent amendments to the FARs,³⁶ only a small percentage of the helicopters used in the EMS transport industry today are required to have these safety modifications. Aircraft originally certified prior to the date the above amendments were added to the FARs are not required to make these modifications. These aircraft need only meet the standards established as requirements at the time of the original aircraft certification process. Research from Johns Hopkins 20 years later continued to demonstrate that improved crashworthiness can reduce

the number of fatalities in EMS helicopter crashes.⁴⁰ The NTSB recently recommended that the FAA require all newly manufactured rotor-wing aircraft be equipped with crash-resistant fuel systems, regardless of the airframe's original certification date.⁴¹ At present, the FAA has agreed with this recommendation, but it is not yet codified in the FARs.

The first dynamic crash testing of an ambulance was not performed until 2000.⁴² Many major ambulance manufacturers have since begun voluntary crash testing to enhance the safety of occupants in the event of a crash.⁴³ Current standards for ambulance construction, including the General Services Administration Standard KKK-A-1822F,⁴⁴ the National Fire Protection Association (NFPA) Standard 1917,⁴⁵ and the Commission on Accreditation of Ambulance Services (CAAS) Ground Vehicle Standard⁴⁶ require basic safety features be incorporated into ambulance construction following Society of Automotive Engineers (SAE) standards.

Recent estimates by NHTSA and the National Institutes for Occupational Safety and Health (NIOSH) suggest an average of 4,500 ambulance-involved incidents annually, with 34% resulting in injuries and 1% in fatalities.⁴⁷ The data also reveal that EMS providers were unrestrained in 80% of crashes, and unrestrained occupants were at much greater risk of sustaining serious or fatal injuries.⁴⁷ In 2015, the Department of Homeland Security (DHS) issued recommendations for ambulance design to maximize the ability for medical team to reach essential equipment and tend to a patient while remaining seated and restrained.⁴⁸ NFPA Standard 1917,⁴⁵ the CAAS Ground Vehicle Standard,⁴⁶ and the DHS guidebook⁴⁸ specify that any equipment weighing >3 lb be mounted or secured per SAE standards. Ongoing research continues to address design safety in ground ambulance vehicles, prompting innovations in design, layout, and safety features.⁴⁹ Most of this work, however, addresses BLS or ALS operations, so additional research may be needed to identify design considerations unique to critical care transport that may need to be incorporated into critical care transport-specific vehicles.

Real-time driver performance feedback and monitoring systems dramatically improve safe vehicle operations. Use of these devices result in significant and sustainable improvements and provide excellent return on investment when considering the reduction in maintenance, crashes, lost productivity, and litigation.⁵⁰ Other available technology and devices that enhance safety include backing cameras, power lift stretchers, event video cameras that record accidents, global positioning systems with weather reporting capability, and speed governors.

ASTNA Position

ASTNA believes protection of the transport team in survivable crashes would be maximized if:

1. Air medical programs or operators install or configure all aircraft that have this type of seating available with crash-attenuating seats and single-point release shoulder harnesses that meet current FAR standards. As transport programs reconfigure and refurbish interiors of existing aircraft, available data should be reviewed and requests made of either vendors or manufacturers to install this equipment to meet FAR standards.
2. When possible, crash-resistant fuel systems are installed in all helicopters used in the air medical transport industry.

3. Programs require vehicle interiors be designed with a clear head-strike envelope for each occupant.
4. Ground programs choose the smallest ground critical care ambulance to accommodate the program mission, locate team member seating and equipment mounting positions in such a layout as to permit rendering of care from a seat-belted position, use automobile-grade padding on corners and edges, and ensure lap belts are positioned at the pelvic level.
5. All programs make use of technology as much as possible, including monitoring, performance, feedback, and crash analysis technology, as well as other devices or systems that enhance team and occupant safety.
6. Transport vehicles are configured using the recommendations of all available resources, including but not limited to the FAA, NEMSPA, DOT, NFPA, CAAS, SAE, DHS, and other organizations that can offer input to improved vehicle safety and crashworthiness.

Maximizing Transport Critical Care Transport Nurse Familiarity with Vehicle/Aircraft Specific Emergency Procedures and Equipment

Background

Safety training pertaining to emergency procedures and equipment provided to transport medical team members is often specific to a particular vehicle or aircraft. However, due to vehicle and aircraft availability, contractual agreements with vendors, and costs associated with maintaining backup vehicles and/or aircraft, the backup vehicles and/or aircraft may not be the same type and/or model used by the organization as their main mode of transport.

The introduction of an unfamiliar vehicle or aircraft, even if used only for a short time, may substantially diminish the performance of team members in the event of an emergency. Team members with exceptional performance of emergency procedures in the program's primary vehicle(s) or aircraft are likely to have more difficulty accomplishing those same procedures in an unfamiliar vehicle or aircraft. The FAA introduced legislation in 2014 that requires, at least for HEMS operations, a preflight safety briefing of all medical personnel in "safety in and around the helicopter, in-flight emergency procedures, emergency landing procedures, emergency evacuation procedures, efficient and safe communications with the pilot, and operational differences between day and night operations."⁵¹ This training may be accomplished before each mission or during an approved 8-hour training session held every 24 months.⁵¹ Importantly, there is no provision for other modes of transportation, and backup aircraft are not specifically addressed. CAMTS' 2015 *Accreditation Standards* require initial and annual education about safety measures and emergency procedures for each aircraft and ambulance used by a program, including "... specific training for backup or occasionally used aircraft and ambulances."⁵²

The ability to function appropriately in an emergency is often dependent on repetitive training and complete familiarity with equipment and procedures. Daily safety practices are often a function of habit—continually doing certain things in a certain way until the response is automatic, rather than requiring analysis in the midst of an emergency. During periods when an unfamiliar backup vehicle or aircraft is used, consideration should be given to providing team members with adequate time to orient to the

unfamiliar vehicle or aircraft. Differences in emergency equipment and procedures regarding either the backup vehicle or aircraft should be identified and practiced.

ASTNA Position

ASTNA believes critical care transport nurse safety would be enhanced if:

1. Transport programs attempt to develop contractual provisions that ensure the availability of backup vehicles and/or aircraft of the same type and model as the primary vehicles and/or aircraft. When this is not possible, reasonable measures should be taken to obtain a vehicle and/or aircraft as similar as possible to the primary vehicle and/or aircraft.
2. Emphasis is placed on providing time for adequate familiarization with backup vehicles and/or aircraft. Training in safety and emergency procedures should be provided, and allowances made for practicing those procedures and working with the unfamiliar equipment. Written policies and procedures should be established to address provisions for ensuring the safety of transport team members in emergency situations when backup vehicles and/or aircraft is a different type or model than the primary vehicles and/or aircraft.

The Use of Patient Restraints in the Transport Environment

Background

Combative and potentially combative patients can pose a significant threat to the safety of the transport team, bystanders, other medical personnel, and themselves.⁵² Combative and potentially combative patients include, but are not limited to, those with head injuries, intoxication from alcohol and/or drugs, psychiatric disturbances, postictal psychosis and/or delirium states, and the potential for cerebral hypoxia. The use of physical or pharmacologic restraint may be required to ensure safety. Restraints are initiated only after an appropriate history of present illness, physical exam, and necessary diagnostic tests are performed.

Physical restraints such as “hard” and “soft” limb restraints and stretcher belts/straps cannot always guarantee adequate immobilization in extremely combative patients. Appropriately dosed pharmacologic restraint such as sedatives, dissociative agents, hypnotics, and neuromuscular blocking drugs can help ensure immobilization.^{53,54} Use of these agents may require adequately oxygenating, monitoring, and/or placing a definitive airway in a patient.

The transport of prisoners or patients who are under arrest may require accompaniment by a correctional officer or some other law enforcement personnel. Accompanying personnel often carry a firearm or other weapon, including but not limited to conducted electrical weapons and irritant sprays. These present an additional risk to the team and passengers should the patient or prisoner break free from restraints or should an aviation-related hard landing or vehicle crash occur.

Restraint protocols should address the type of physical restraints that are permissible for use by EMS providers. Any physical restraint device used should allow for rapid removal if emergent care (eg, vomiting, respiratory distress) is needed. Hard restraints, such as handcuffs, are generally not acceptable for EMS application or use. If patients are restrained in devices that require a key, the key must

accompany the patient during treatment and transportation.⁵² Metal handcuffs should be placed only by law enforcement personnel, and programs should discuss use of restraints in the transport of prisoners with local law enforcement and reach agreement when developing policies or protocols to avoid issues during transport.

ASTNA Position

ASTNA believes safe transport of combative or potentially combative patients would be improved if:

1. Critical care transport nurses assume the responsibility to carefully assess the potential that a patient may be or become combative. This evaluation is ongoing and begins with the initial encounter.
2. Each program, under the direction of the medical director(s), should develop a written protocol(s) for transport of patients deemed combative or potentially combative. Such protocols should include the following:
 - Consideration of state laws, local protocols, and regulatory requirements about restraint use;
 - A stepwise approach to the application of restraints, including but not limited to verbal de-escalation, physical restraint, and pharmacologic restraint;
 - Indications for use of both physical and pharmacologic restraints;
 - A procedure should it be determined the patient cannot be transported safely either by ground or air;
 - Careful consideration to maintain the patient's dignity if the use of restraints is indicated, although never to sacrifice the safety of the transport team; and
 - Options for monitoring and patient care procedures while maintaining adequate patient restraint.
3. Each program should have a formal policy regarding the transport of prisoners. Such policies should include the following:
 - Patient restraint techniques;
 - Provisions for weapon searches by law enforcement personnel;
 - The accompaniment of correctional officers or law enforcement personnel; and
 - Securing weapons and/or firearms including but not limited to conducted electrical weapons and chemical irritant spray.
4. Physical restraints, including but not limited to hard wrist restraints or handcuffs, must be secured in a manner so they can be quickly removed by the transport team in that event of an aviation-related hard landing or vehicle crash. This includes the transport team having access to the restraint/handcuff release key.

Refusal to Transport

Background

An assessment of all potential risks involved with completing a mission should be performed prior to any decision and should include but is not limited to weather conditions, time of day considerations, team well-being, team duty time, equipment, patient weight, and familiarity with route or landing zone.²⁰ An operational risk assessment tool may assist with this decision.

Accepting or declining a mission is the shared responsibility of the transport team,^{1,2,55} in accordance with “Three to say go, one to say no” philosophy.²⁰ If one member of the team that has a reasonable, legitimate concern about accepting a mission then the mission should be declined.

Each transport team member has a responsibility to ensure his or her safety. Specifically, critical care transport nurses have the added responsibility to ensure a patient’s safety because the patient has an altered ability to meet that need. Without exception, a critical care transport nurse has a legitimate concern for his or her safety or that of the patient and/or other team members; the critical care transport nurse has the responsibility to voice those concerns and to refuse participation in the transport before it is initiated or to refuse continued participation in a transport in progress. In addition, critical care transport nurses have a responsibility to promote an environment that other team members can voice concerns regarding the safety of the team and the patient.

Fatal HEMS incidents have been associated with a practice known as “helicopter shopping.”²⁰ This practice occurs when an air medical provider accepts a mission that was previously declined by another agency(s) for reasons of weather, landing zone availability, or other safety factors. This is a result of a requesting agency “shopping” around for a helicopter to perform the mission. Air medical providers, dispatchers, and requesting agencies should be educated about the potential hazards associated with this practice.²⁰ Dispatchers and HEMS teams should inquire whether another program declined the mission before the request, especially if the nature of the request suggests another program has previously declined the request.²⁰ Prior to the acceptance of any previously declined requests, direct communication between the two air medical programs shall occur, specifically involving direct communication between the two flight teams.

ASTNA Position

ASTNA believes personal safety of critical care transport nurses would be enhanced if:

1. Programs use a risk assessment tool to aid in the assessment of the potential risks and planning of each mission.
2. Programs establish a written policy that acknowledges the responsibility of each team member to refuse participation in, or continued participation in any transport as a result of concern for personal, patient, and/or team safety.
3. Written policies include a mechanism for appropriate documentation of the concern and/or event and timely review of such by program administration and/or safety personnel. The outcome of this

review should include an action plan for continued quality improvement monitoring and/or tracking.

4. Programs establish a policy that addresses the practice of helicopter shopping. In addition, air medical providers, dispatchers, and requesting agencies receive education regarding potential hazards of this practice.
5. Programs refuse to participate in or condone practices of competing in any manner for missions turned down by other local teams for reasons of weather, landing zone availability, or other safety factors unless direct communication between the two flight teams occurs. All pertinent safety-related information related to why a mission was declined (eg, weather, potential hazards) should be identified and shared between programs in the same locale.

Safety Considerations Specific to Critical Care Ground Transport

Background

Critical care nursing via ground transport is a unique practice, distinct from EMS in its knowledge base, staffing, medical equipment, and typically functioning in larger ambulances. Accordingly, it brings with it the risks known to EMS as well as additional threats to safety by nature of critical care transport nursing.

Ongoing ambulance crash study data from NHTSA show that in a sample of 45 providers in the patient compartment at the time of a crash, 84% were unrestrained.⁵⁶ Critical care transport nurses must be belted and stay belted, not only to protect themselves, but because unsecured occupants in the patient compartment can injure other occupants and/or the patient. CAMTS accreditation standards for surface vehicles strongly encourage forward and aft facing seats.⁸ Side-facing bench seats are discouraged, as are shoulder harnesses on side-facing bench seats. If side-facing bench seats are used, they should have seat belt mountings situated at the pelvic level.⁸ Unsecured equipment also has been shown to be a major cause of death in EMS fatalities.⁵⁷ By virtue of having more and often heavier equipment, critical care ground transport nurses are at higher risk for injury.

Another well-documented source of increased risk of crashes is the use of lights and sirens, with 60% of crashes and 58% of fatalities occurring during emergency use.⁵⁸ Critical care transport nurses must consider carefully if minutes make a difference in patient outcome and weigh the risk of putting the patient, driver and team's lives at greater risk.

Sled tests of patients on stretchers positioned the length of the ambulance with the head pointed toward the cab demonstrate that use of shoulder straps and, when clinically appropriate, elevation of the head, help prevent ejection from the stretcher as well as provide back support.⁵⁹

Drivers are the first line of defense against crashes. With few national standards, programs must establish policies that promote optimal practices in hiring, education, and management of the drivers. Attributes to consider include the following:

- Minimum age;
- Pre-employment and annual drivers' history;
- Orientation to the critical care environment and equipment;

- Driver duty time (including a maximum of 10 hours driving within a 24-hour period);
- Mandatory rest time for drivers prior to reporting to work;
- Completion of an Emergency Vehicle Operations-type course and non-emergent driving course; and
- Application of Occupational Safety and Health Administration (OSHA), NHTSA, and Network of Employees for Traffic Safety (NETS) *Guidelines for Employers to Reduce Motor Vehicle Crashes*.^{2,60}

Programs may also take advantage of the American National Standards Institute/American Society of Safety Engineers ANSI/ASSE Z15.1-2012 motor vehicle operations standard, which provides an effective risk management program for motor vehicle operations. Its key components include management, leadership and administration, operational environment, driver and vehicle considerations, and incident reporting and analysis.⁶¹

Critical care ground transport often is sought for acutely ill bariatric patients because their weight precludes rotor- or fixed-wing transport. Ground transport teams may be pressured to transport these patients, with comments such as “You’re the only ones who can move this patient.” However, without proper equipment to accommodate these patients, an incident can compromise both patient and team safety if the patient is not adequately secured to the stretcher, compounding injuries to the patient and/or the team.

ASTNA Position

ASTNA believes safety would be enhanced if each ground transport medical transport program has:

1. Operational policies that address the following issues:
 - Wearing seat belts at all times;
 - Reporting crashes to the CONCERN Network and NHTSA’s Fatality Analysis Reporting System;
 - Avoiding use of lights and sirens (when possible);
 - Developing accident and incident plans and drills; and
 - Developing loading training drills with specified roles.
2. A thorough orientation for drivers of ground transport vehicles operated by the program, including policies that limit driving time to no more than 10 hours every 24 hours and restrictions regarding work performed before reporting to duty as a driver for the program.
3. Mechanisms to ensure all medical equipment, gas tanks, supply packs, needle boxes, computers, and personal items, including bags and water bottles, are secured within the patient compartment.
4. Policies, training, and management of drivers and vehicles that promote safety.
5. Appropriate equipment for transport of bariatric patients, specifically adequate stretcher bases to support both the patient and medical equipment, with hydraulic assists and loading ramps encouraged. Transport of bariatric patients will be undertaken with stretchers designed and tested

to accommodate them (eg, bariatric stretchers) and loading mechanisms or loading systems are available that can support their weight.

6. Policies that address ambulance safety for ground transport of flight teams. Critical care transport nurses must reserve the right to address any safety issues encountered when being transported by a contracted ground team, including requesting another ambulance.
7. Policies that address weather-based risk assessment to determine appropriateness of acceptance of ground transports in the event of inclement weather.

Training in Survival Techniques and Emergency Equipment and Procedures

Background

Sudden introduction into a new and threatening environment can be a traumatic experience. The ability to handle this change depends heavily on an individual's mental state.⁶² Knowing what to do during an emergency situation could mean the difference in survival. Quality training and practice on a regular basis have proved to significantly affect a team's response to emergency situations. Survival training needs to be interactive, hands-on, and not solely video-based. Attitude, more than any other skill, determines success in a survival situation. It is important to know the Rule of 3: 3 hours without shelter, 3 days without water, 3 weeks without food.¹

The transport environment is composed of many different risk and dangers. Knowing how to mitigate the risk and avoid the dangers are key to the survival of the transport team. The chain of survival starts with a good SMS used in conjunction with a Just Culture work environment, which helps optimize the chain of survival. Air medical operations often require critical care transport nurses not only to be medical personnel but also active members of the flight team. Therefore, critical care transport nurses must be proficient in aircraft safety, radio operations, emergency procedures, knowledge of weather patterns, and the use of visual techniques to identify potential hazards. Intercom communications during all portions of flight and good communication with the other members of the team are vital.

Critical care ground transport programs should be held to the same or similar standards as air medical transport programs in providing optimal safety for the entire team. Critical care transport nurses should be aware of hazards or potential hazards unique to their transport environment, such as road and weather conditions, traffic, knowledge of the geographic area, and alternate routes of travel. Preparation and protection against hazards in the transport environment are critical for survival.

In the event of an unscheduled landing or aircraft/vehicle crash, critical care transport nurses or other members of the team may have to carry out emergency shutdown procedures, facilitate emergency egress, locate and activate the emergency locator transmitter (ELT), and operate radios. Critical care transport nurses should be familiar with their program's aircraft/vehicle emergency shutdown and egress procedures.

Personal survival kits and aircraft/vehicle survival kits have proved beneficial in the event of an incident.¹ A basic personal survival kit is small and can be easily carried at all times and should include items for self-extraction, signaling, and fire starting, along with a good multipurpose tool, flashlight, whistle, Mylar space blanket, and anything else that could enhance chances of survival in the team's specific geographic

location. When preparing for a potential survival situation, critical care transport nurses must first admit that these situations can happen. After that, preparations can begin for an event that, hopefully, will never occur.⁶²

ASTNA Position

ASTNA believes critical care transport nurse safety and/or positive outcomes in the event of an incident or survivable crash will be enhanced if:

1. Training in emergency shutdown procedures, emergency egress, the location and use of the ELT, and the use of aircraft/vehicle radios is provided initially and with repeated training annually.
2. Hands-on survival training focusing on shelter building, fire starting, signaling, and the use of survival equipment/supplies carried by the program is provided initially and annually.
3. Critical care transport nurses carry individual survival equipment and do not rely solely on the aircraft/vehicle survival kit in the event of an incident.
4. Continued review of safety policies for deficits and drills to test the safety policies is conducted regularly.

Creating Healthy Work Environments Designed to Promote and Sustain Personnel Well-Being

Background

A healthy work environment is defined as one that supports and fosters excellence in transport safety and patient care wherever transport nurses practice.⁶³ Within a healthy work environment exists a multi-professional empowered team committed to continuous improvement of the team itself. A healthy work environment promotes a culture of safety, open communication, and the Just Culture concept among all team members.¹

An unhealthy work environment has been shown to lead to an increase in stress and ultimately to an increase in errors. Human factors such as health, fatigue, emotional state, increased workload, and interpersonal conflicts also contribute to an increased risk for errors.¹⁸ Such errors in judgment and critical thinking can place patients, the transport team, and others at risk for harm.⁶³

Health care environments should promote a Just Culture workplace, an environment where errors are investigated to uncover the source of the error rather than assign blame resulting in automatic punishment.⁶⁴ Just Culture recognizes that individuals should not be accountable for system failings over which they have no control.⁶⁵ Many individual errors may represent predictable interactions between human operators and the systems they work within. Although Just Culture is representative of a “no blame environment,” there is no tolerance for gross misconduct or conscious disregard of risks.⁶⁵

As echoed by the American Association of Critical Care Nurses,⁶³ there are six essential standards for establishing and sustaining a healthy work environment, including skilled communication, true collaboration, effective decision making, appropriate staffing, authentic leadership and meaningful recognition. Work environments should be supportive of effective interpersonal relationships and

education to develop and acquire the skills needed to prevent harm and perpetuate these unacceptable conditions.

Physical and mental well-being is also essential for the promotion of a healthy work environment in transport nursing.⁶⁶ Stress is pervasive in this profession. Unmanaged stress can have direct consequences to the transport team, patients, and the overall safety of the team dynamic. Exposure to critical incidents commonly occurs among critical care transport nurses and other EMS personnel. Although it is quite normal for individuals to experience emotional aftershocks when they have been involved with and witnessed a particularly difficult event, left unaddressed, the resulting signs and symptoms of stress can affect an individual's physical health and overall well-being.¹⁹ Guidance and resources such as critical incident stress management (CISM), the Survivors Network, and employee assistance programs are available for all staff.^{67,68} Emerging data have revealed that CISM may or may not be as effective at stress management as previously thought.^{67,68}

Teamwork Strategies to Enhance Performance and Patient Safety (TeamSTEPPS) is a system designed to improve patient safety, improve communication, and teamwork skills.⁶⁹ Developed by the Department of Defense's Patient Safety Program in conjunction with the Agency for Healthcare Research and Quality, it is a program rich in evidence-based processes:

TeamSTEPPS produces highly effective teams that optimize the use of information, people, and resources to achieve the best outcomes. It clarifies team roles and responsibilities, as well as increases team awareness. It helps to resolve conflict and eliminates roadblocks to quality and safety.⁶⁹

CAMTS references TeamSTEPPS as a means to exceed compliance requirements, as it provides the tools to support team dynamics; it also supports the root cause analysis and gives team members a way to work through problem solving.⁸

The Survivors Network was established as a resource to the air medical community and other emergency medical responders as a means to share experiences of survivorship and survival after a critical incident. The Network also offers multiple links regarding stress and stress management strategies. These tools and strategies are not only useful post-critical incident but they also can be used as a means to mitigate the daily stressors experienced in the air medical environment.

ASTNA Position

ASTNA believes safety would be enhanced through improved critical care transport nurse performance and job satisfaction if each program develops and/or has access to the following:

1. A healthy work environment that incorporates principles of Just Culture and TeamSTEPPS.
2. A stress management program that includes access to an employee assistance program, an appropriate leave of absence policy, and a formalized physical fitness program that allows for personalized adjustments and consideration of specific individual needs, such as age and sex.
3. Critical incident stress management (CISM) programs, which may be beneficial in either a formal or informal setting, including peer support and debriefings on an informal basis for use when a small number of team members are affected and a more formal CISM process consisting of an

outside group of individuals who could be called in cases when multiple team members and/or the surrounding community, other EMS providers, and/or co-workers are impacted by a major event.

4. Access to the Survivors Network, which offers resources on stress, stress recognition and management and post-traumatic stress disorder, as well as a means for those who have been involved in incidents to communicate with other survivors who are empathetic to their situation.

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