Safer Ambulance and Occupant Protections Being Designed, But EMS Workers Are Still Not Safe on the Road

Most emergency services managers would agree that the safety and well-being of their personnel is paramount. In fact, most will tell you that their personnel always wear protective gloves while caring for patients and safety belts while riding in the cab of the ambulance or fire truck.

Why, then, would one of the nation's leading EMS researchers say that, "It has been demonstrated through research and studies that ambulance safety is a significant problem across the country"?

Brian Maguire, PhD, of the Department of Emergency Health at the University of Maryland, is not alone in making this assertion. He and colleague Nadine Levick, MD, MPH, of Maimonides Medical Center in New York, are campaigning vigorously for improved working conditions on ambulances. Passionate about EMS workplace safety, Levick also maintains a Web site at www.objectivesafety.net to advocate for this cause.

According to Maguire and Levick, the dangers facing ambulance personnel are many, and all of them carry a high risk of injury, even death. Among their concerns are:

- Vehicles that are not crashworthy;
- Lack of occupant protection in the patient compartment;
- Operating ambulances with excessive speed;
- Insufficient and non-standardized driver training;
- Operator drowsiness associated with busy and long shifts; and
- Exposure to diesel fumes.

Although data on EMS occupational hazards is limited, the research that has been done seems to bear out the claim that ambulance work is, in fact, dangerous. The National Highway Traffic Safety Administration estimates that there are about 8,500 EMS-related vehicle crashes per year. The National Institute for Occupational Safety and Health reports that 300 fatal ambulance crashes occurred, resulting in the deaths of 82 ambulance occupants and 275 occupants of other vehicles and pedestrians, between 1991 and 2000 (the most recent year for which there was data).

In addition, 11-year retrospective statistics on ambulance crashes published in *Accident Analysis and Prevention* in 2003 show that:

- Unrestrained occupants in ambulances have 4-times greater fatality risk than restrained occupants;
- Unrestrained occupants have 6.5-times greater risk for an incapacitating injury compared with restrained occupants; and
- Rear compartment occupants carry more than 5-times greater risk for fatality vs. no injury compared with front seat occupants.

Making Ambulances Safer

Maguire and Levick have been successful in raising awareness about unsafe working conditions on ambulances, and as a result, some of the largest organizations in EMS now have begun to address the issue. For example, American Medical Response (AMR) is collaborating with American Emergency Vehicles (AEV) to jointly develop a safer ambulance.

The first incarnation of the new AMR/AEV safer ambulance was unveiled about 18 months ago and toured the country for nine months to allow hundreds of ambulance workers to inspect the vehicle and provide detailed feedback on its design.

"The ambulance was designed to make medical transportation safer for both medics and patients, enabling full access to the patient for uncompromised care and treatment," said Jim Love, AMR East Region Director of Safety and Risk. The original concept ambulance is now being used by AMR in its Evansville, Indiana, operation.

AMR/AEV's second generation safer ambulance came out last year and is currently on tour. It features many upgrades from the first vehicle. "This second prototype incorporates many ideas that came from frontline emergency medical professionals who saw the first version of the vehicle," said AMR Vice President of Safety and Risk Ron Thackery. "Thanks to them, this second design further increases safety and enhances patient care."

Among the features of the safer ambulance are:

- Improved seating and restraints that allow two medics to treat patients while wearing safety belts;
- External cameras and, inside the cab, a video monitor that help medics avoid colliding with another vehicle or other object;
- A traffic control device that changes red lights to green at appropriately equipped intersections;
- External lights alerting other motorists that medical treatment is underway onboard the vehicle;
- A Road Safety "black box" onboard computer system (similar to aircraft black boxes) that records vehicle speed, monitors the driver's safety behaviors (such as use of turn signals) and warns the driver about maneuvers that exceed pre-set safety parameters;
- Highly reflective paint that makes the vehicle more conspicuous;
- Cabinets designed to lower the risk of injury for anyone who falls against them;
- Onboard mobile network gateway and GPS tracking;
- Vehicle routing and mapping systems; and
- Wireless medical reporting that saves

time, ensures accuracy and protects confidentiality in identifying patients, documenting treatment and sharing data with hospital staff.

Love said that making a safer ambulance is an ongoing project, and that AMR and AEV plan to design a third concept vehicle. "The input we gather from the second vehicle will help us in the design for the third," he explained. "The purpose of these tours is to get people thinking and let us know what they want."

Both Maguire and Levick expressed admiration for the safer ambulance effort. "Large ambulance companies like AMR are supporting safety initiatives, while the American Ambulance Association is sponsoring more safety seminars," Levick said. "It's been a positive change, and it's good to see that the industry is now embracing safety enhancements."

On the other hand, Levick pointed out that the safer ambulance currently under development does not have collaborative input from the automotive safety industry. "There should be a panel with automotive safety engineers, ergonomic and occupational health and safety people, academic people, EMS providers and systems managers – a proper structured panel," Levick said.

Levick also questioned the use of Type III ambulances altogether. "I feel very strongly that the rest of the world is using smaller vehicles largely for safety reasons," she said. She favors including safety features in Type II rather than box-type ambulances, since the box is not an automotive structure, and her research shows that boxes are at risk of detachment during ambulance crashes.

Better Occupant Protection

Research conducted by Levick and others shows that medics are at the greatest risk while riding in the patient compartment of the ambulance. Typically, they do not wear safety belts during transport, particularly if patient care demands that they are standing or leaning over the patient.

Levick calls this practice "completely at-risk behavior." She suggests the North American EMS industry learn from safety measures used in European and Australian ambulances, which have 90-degree rotating rear compartment bucket seats and over-the-shoulder harnessing for both patients and providers. The air medical industry also is a good place to look for best safety practices, Levick said.

"Many EMS helicopters use a harness that allows you to lean forward in your seat while still being attached to the seat," she said, adding "a seat is a safety device within itself." However, Levick admitted that these harnesses do not allow standing or moving away from the seat since "the minute you stand up you've extracted yourself from the major part of your restraint system: the seat."

Levick said that medics riding in ground ambulances also would benefit by wearing appropriate headgear; however, she pointed out that no helmet standard currently exists for ground EMS personnel, despite National Institute for Occupational Safety and Health statistics showing more than 65 percent of EMS fatalities in ambulance crashes involve a serious head injury.

Levick is collaborating with members of the International Safety Equipment

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Poor EMS Safety Data Compounds the Problem

Research on EMS vehicle safety has lagged behind general automotive safety research, Levick said. Likewise, research and data collection on EMS worker injury lags behind that of other occupations. This may result in an inaccurate safety portrait of the EMS workplace.

For example, the US Bureau of Labor Statistics does not have a specific occupation code for EMS. EMS workers are often coded as firefighters in national databases, while volunteer EMS workers are coded under their paid and often non-EMS related occupations. Finally, the US government does not maintain a reporting system or database that specifically identifies ambulance crash-related injury.

The inconsistency in identifying and reporting overall EMS worker fatalities was illustrated by Rebecca J. Heick, MS, EMT-P, of the College of Public Health at the University of Iowa and colleagues during the December 2005 American Public Health Association meeting in Philadelphia.

Using information from two national fatality databases, the Census of Fatal Occupational Injuries (CFOI) and the National EMS Memorial Service (NEMSMS) for the calendar years 1997 to 2003, Heick and colleagues assessed occupational hazards faced by EMS workers. These databases include dramatically different figures, including:

- Fatalities during motor vehicle emergency responses between 19% and 31% among paid and 47% or 60% among volunteer providers.
- Fatalities during air emergency response between 38% and 55% among paid and at 0% among volunteer providers.

Combined statistics from these databases showed:

- Most deaths are among paid, male, 25- to 34-year-old EMS workers in southern regions of the US, and
- Paid EMS workers have a significantly higher annual fatality rate than volunteer workers – 10.5 vs. 2.2 per 100,000, respectively.

The lack of accurate assessment/surveillance data limits the development of regional or national injury prevention programs for EMS workers, Heick noted. "As a result," she said, "there is wide variability in the type and extent of occupational injury prevention work being done from one workplace to the next." Development of methodologically sound designs to produce useful, generalized results that will effectively guide prevention efforts will take time and resources, she added.

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Association to draft a helmet standard for medics working on ground ambulances. She said that such a standard is necessary to ensure manufacturers' willingness to market such a helmet. Research currently focuses on an extreme ski-type helmet – one that is lightweight, protects from high-speed and hard-surface impacts, includes a biohazard protection visor and an integrated communications feature.

A survey of EMS providers initially showed that about 84 percent would not consider wearing a helmet. But after watching a graphic one-hour slide presentation showing the risks of head injury to rear compartment occupants during ambulance crashes, Levick found that about 82 percent of these same individuals said they would consider helmet use.

Straighten Up and Drive Right

Vehicle design and occupant protection are meant to protect medics in the event of an accident, but greater safety comes from avoiding accidents altogether. One way to reduce the risk of accidents is to ensure that all ambulance operators are trained to drive safely. And one way to do that is to continuously monitor driver performance with onboard computers, Levick said. [See "Savvy Managers Can Reduce Driver Resistance to On-Board Vehicle Monitoring," September 2005, *Best Practices in Emergency Services*].

According to Levick, installation of onboard monitors in Little Rock, Arkansas, resulted in the an 878-fold improvement in safety: a 3,375-fold reduction in seatbelt violations; and fewer and less severe crashes in more than 18 months of use by more than 250 EMS drivers operating 36 ambulances. Over more than 1.9 million miles, there was no increase in response times, despite a substantial increase in call volume.

In a study conducted from March to June 2003, Levick set out to determine if emergency vehicle driver behavior could be modified and improved with the installation of an onboard, computer-based monitoring device, with real-time driver auditory feedback. The onboard computer system monitored a number of parameters every second and provided real-time auditory feedback to the driver. The parameters monitored included: vehicle speed, hard acceleration/braking, cornering velocity and g-forces, use of emergency lights and sirens, use of front seat belts, turn signals, parking brake and back-up spotters. The computer system provided an audible real-time feedback to the driver, by a system of warning growls and then penalty tones for when the preset parameters are approached and exceeded.

The onboard computer recorded penalty counts when drivers exceeded certain set parameters. The penalty count data were stored by the onboard computer and downloaded automatically to a base station on a daily basis for analysis. Detailed electronic reports were generated for management who tracked trends and individual drivers.

Levick concluded that the implementation of this system demonstrated to be highly effective to enhancing safety in-ambulance transport, requiring minimal in service training time and optimal safety outcome. She now recommends the use of an onboard computer system with real-time feedback and monitoring for widespread implementation throughout the EMS system to optimize safety.

Joene Hendry and Daniel Casciato reported on this article.

Next month: NTSB Addresses Air Ambulance Safety

Firefighters Also Face Dangers

While unsafe working conditions on ambulances pose unnecessary hazards for medics, firefighters also are dying because they are taking unnecessary risks. The most lethal of these risks are lifestyle habits that lead to poor heart health. In 2005, heart attacks again proved to the leading cause of on-duty death for firefighters, according to the US Fire Administration's preliminary count.

All told, 106 firefighters died in the line of duty in 2005, with 48 of those deaths attributed to heart attacks. Seven additional firefighters died from cardiovascular disease.

Vehicle accidents also accounted for a significant number of firefighter fatalities last year, taking 26 lives. Of these deaths, five resulted from crashes involving passenger vehicles, five in tanker crashes, four in pumper crashes and the others in ATVs, aircraft and a boat.

Firefighters also are putting themselves at unnecessary risk by entering burning structures that are known to be clear of victims. Seventy-four firefighters lost their lives fighting structure fires that occurred between October 1997 and December 2003, according to data from the Centers for Disease Control and Prevention National Institute for Occupational Safety and Health (NIOSH) Firefighter Fatality Investigation and Prevention Program.

At a December 2005 American Public Health Association meeting in Philadelphia, Ann E. Farmer, MS, and Dawn N. Castillo, MPH, both of NIOSH, reported that 66 percent of these deaths occurred in structures known to be clear of civilian victims. Firefighter fatality rates in unoccupied structures were higher among volunteer firefighters — 84 percent — compared with 57 percent among career firefighters.

The fact that 76 percent of the fire departments responding to the identified fires used incident command standard operating procedures suggests the need to concentrate on defensive firefighting procedures for unoccupied structures, the researchers advised.

"Incident commanders and firefighters should consider using defensive tactics when the risk to firefighters far outweighs the benefits to saving property," the researchers concluded.