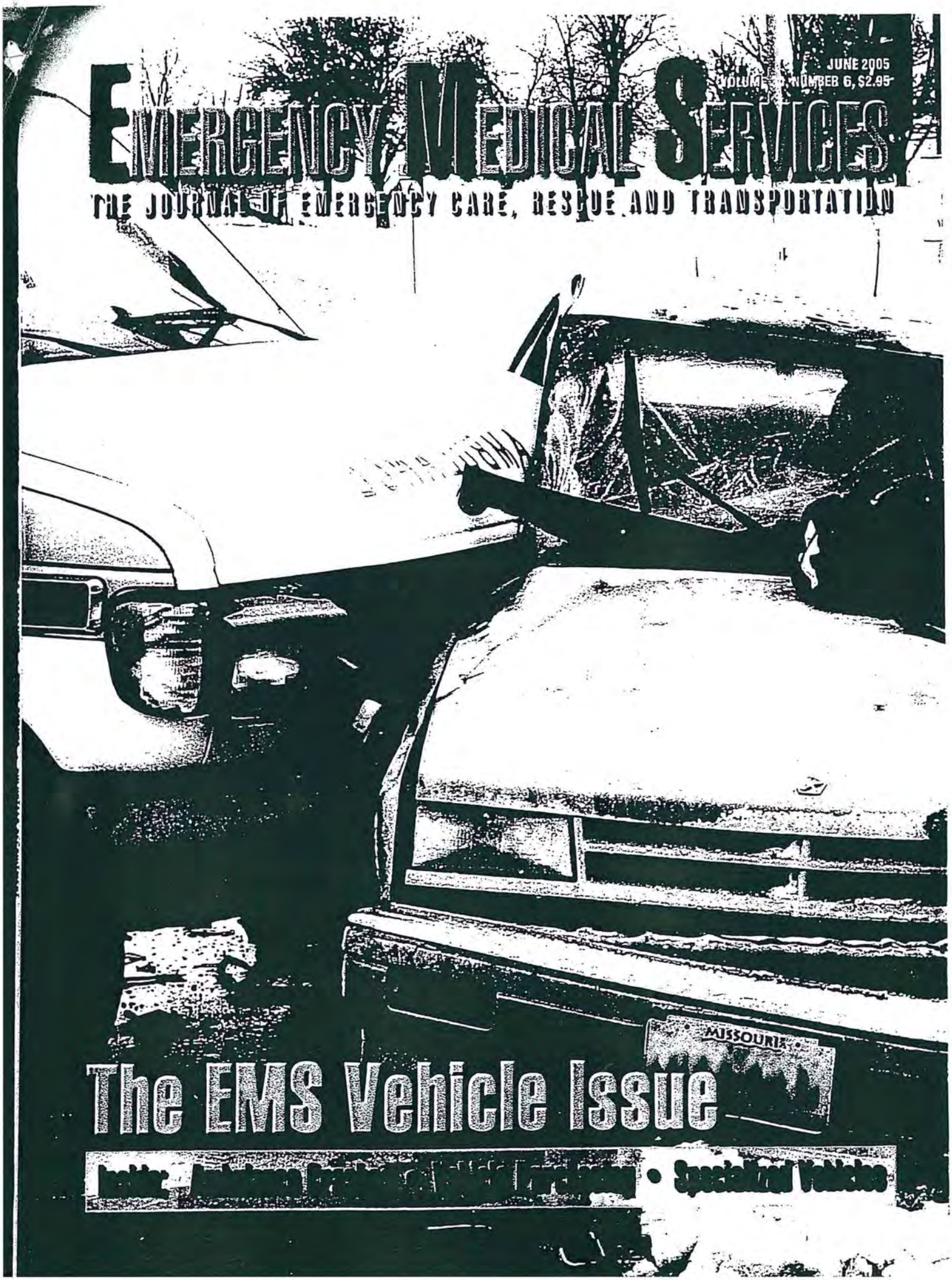
JUNE 2005
VOLUME NUMBER 6, $2.95

EMERGENCY MEDICAL SERVICES

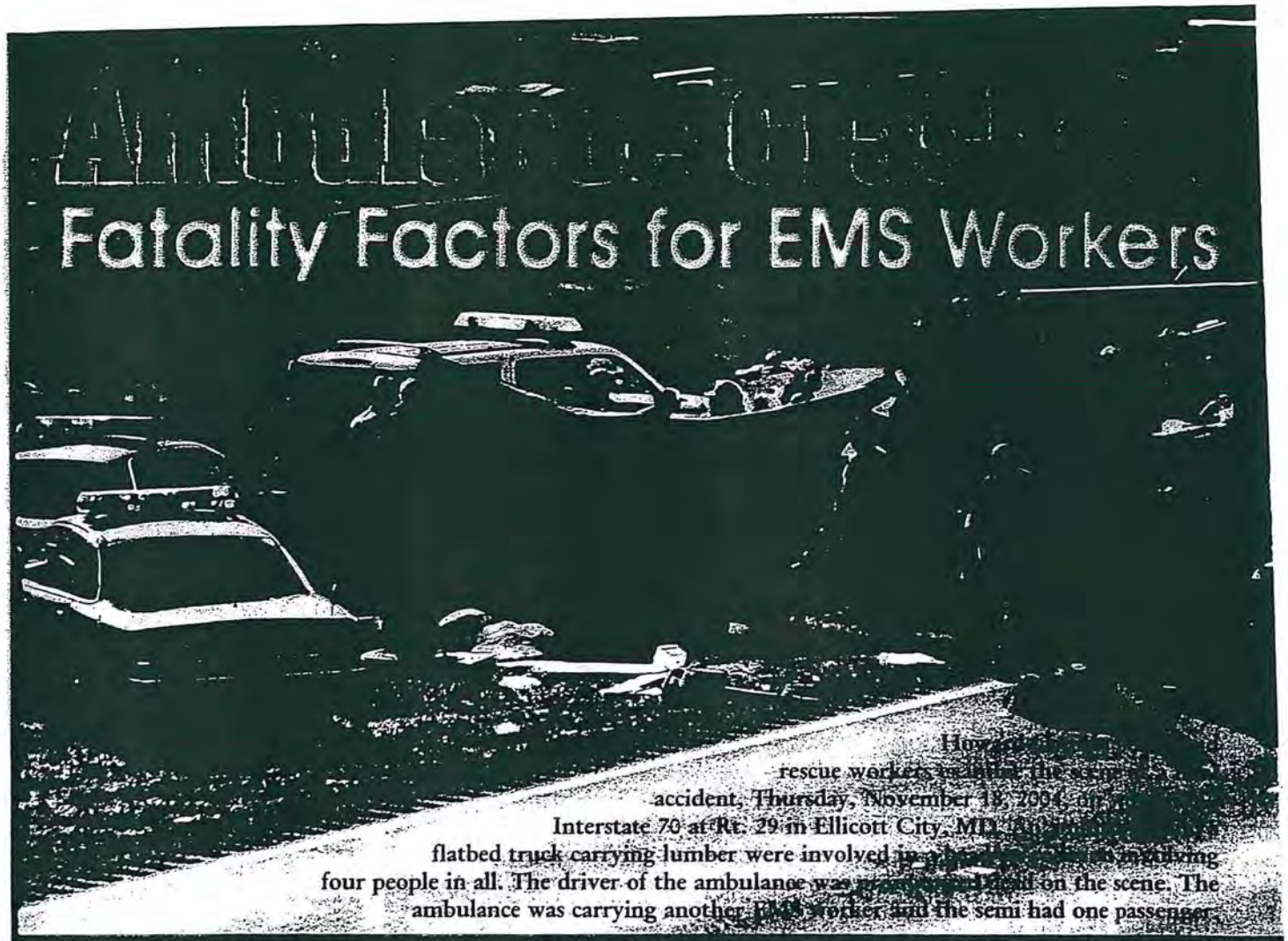
THE JOURNAL OF EMERGENCY CARE, RESCUE AND TRANSPORTATION



The EMS Vehicle Issue

• Specialized Vehicles

Ambulance-Related Fatality Factors for EMS Workers



How [illegible] rescue workers [illegible] accident, Thursday, November 18, 2004, on Interstate 70 at Rt. 29 in Ellicott City, MD [illegible] flatbed truck carrying lumber were involved in [illegible] involving four people in all. The driver of the ambulance was [illegible] on the scene. The ambulance was carrying another EMS worker, and the semi had one passenger.

AP/ Wide World Photos

By Steven L. Proudfoot

In a *Morbidity and Mortality Weekly Report* article published in February 2003,[1] the National Institute for Occupational Safety and Health (NIOSH) identified 27 EMS worker fatalities in ambulance crashes reported in the National Highway Traffic Safety Administration's Fatality Analysis Reporting System (FARS) for 1991–2000. This article presents a more in-depth look at the 25 crashes that resulted in these 27 fatalities, focusing primarily on ambulance configurations, roadway and environmental conditions, and driver-related factors.

What We Examined

FARS is "a collection of files documenting all qualifying fatal crashes since 1975 that occurred within the 50 states, the District of Columbia and Puerto Rico. To be included in this census, a crash had to involve a motor vehicle traveling on a trafficway customarily open to the public, and must [have resulted] in the death of a person (occupant of a vehicle or a nonmotorist) within 30 days of the crash."[2] Data for FARS are collected primarily from police crash reports.

Cases for this study were selected by searching the "Special Use" variable for those vehicles coded as "Ambulance." EMS workers were identified by searching the "At Work" variable for occupants of ambulances; only those coded positively for at-work were defined as on-duty EMS workers to be included in this analysis. As stated above, the years examined included 1991–2000; however, while there were ambulances involved in crashes, no EMS worker fatalities (using our definition) were reported in FARS in 1999 or 2000.

Findings

Overall—During 1991–2000, 300 fatal crashes occurred involving occupied ambulances, resulting in the deaths of 82 ambulance occupants and 275 occupants of other vehicles and pedestrians.[1] Of the ambulance occupants killed, 27 (33%) were on-duty EMS workers.[1] Twenty-five ambulance crashes accounted for the 27 EMS worker fatalities: two incidents each in which two EMS workers were killed, and 23 with single EMS worker deaths.

Vehicles—Using the make, model and weight code for trucks and vehicle identification number data, one ambulance (4%) was identified as Type I (truck chassis with patient compartment attached), five (20%) as Type II (van with extended roof) and 11 (44%) as Type III (cutaway van chassis with patient compartment attached). Eight (32%) were not classifiable with the information available.

Roadway/Environmental Conditions—Eighteen of the 25 fatality incidents (72%) occurred at non-interchange (all roadways on the same level), non-junction locations—or, more simply put, did not occur at intersections. The remaining seven (28%) took place at intersections or were intersection- or crossover-related. Of the 300 total crashes, 132 (44%) occurred at non-interchange, non-junction locations; 134 (45%) occurred at non-interchange intersections.

Fifteen of the 25 fatal crashes (60%) took place in daylight; 18 (72%) in normal ("fair") weather; 17 (68%) on straight, level roadways; and 18 (72%) on rural roads.

Ambulance Role (Striking vs. Struck)—Designating a vehicle as "striking" does not necessarily mean that vehicle was at fault. For example, in a head-on collision between two vehicles, both may be designated in FARS as having the role of "striking" for the incident. In 233 (78%) of all 300

Table 1: Roadway Properties Related to Fatal EMS Crashes

Alignment	Profile	Surface Conditions	Incidents	Percent
Straight	Level	Dry	13	52
Straight	Level	Snow or slush	1	4
Straight	Level	Wet	1	4
Straight	Level	Ice	2	8
Straight	Grade	Dry	2	8
Straight	Hillcrest	Snow or slush	1	4
Curve	Level	Dry	1	4
Curve	Grade	Dry	1	4
Curve	Grade	Snow or slush	1	4
Curve	Grade	Wet	2	8
Total			**25**	**100**

crashes involving fatalities, the ambulance was a striking vehicle; for those 25 in which an EMS worker was killed, the ambulance was a striking vehicle in 20 (80%). Three of the incidents in which an EMS worker was killed were defined as "non-collision" (12%), and two of the ambulances (8%) were struck by other vehicles.

Driver-Related Factors—Data pertaining to the driver of each vehicle involved in a fatal crash are included in FARS; therefore, it is possible to examine a number of driver-related factors that may have contributed. "Not in lane" (the ambulance not traveling in the proper lane) and "driving too fast" (for conditions or in excess of posted speed limits) were the most-cited driver-related factors. Since more than one of these factors may be entered in FARS for each incident, these two factors are cited a total of 19 times, either individually or in combination, in 15 (60%) of the 25 crashes.

Thirteen of the drivers (52%) had no prior crashes, moving violations, driving-while-intoxicated (DWI) convictions, license suspensions or other motor vehicle-related convictions within three years of their fatal crashes. Eleven (44%) had one or more crashes or convictions. There was one instance (4%) in which the driver of the ambulance was determined to have been drinking alcohol. Similarly, of the 300 total crashes, 167 ambulance drivers (56%) had clean driving records in the three years prior to their crashes.

What Does It Mean?

In most of these analyses, the percentages seen in EMS worker-fatality crashes compare closely to those seen in all fatal ambulance crashes. The exception appears to be the "intersection" analysis. While the numbers for all 300 crashes were nearly evenly split regarding intersection- (44%) versus non-intersection-related (45%), for those crashes in which EMS workers died, 72% did *not* occur at intersections. While it is intuitively acknowledged that traveling through intersections is inherently dangerous for an ambulance, it may be that the higher speeds traveled away from intersections are a significant crash factor as well. The ambulance's travel speed was unavailable for 18 of the 25 fatality crashes (72%); however, the posted speed limit was 45 mph or higher in 20 of the crashes (80%), with 55-mph zones in 14 incidents (56%). The relatively small size of the EMS worker fatality universe in FARS makes a trend analysis unfeasible. The lack of a unified *nonfatal* ambulance crash database—which might provide sufficient numbers to perform more-detailed analyses—hinders further research into the dangers of intersections, and the rest of the spectrum of ambulance crash-related factors, on a national level.

Restraints are considered a hindrance by EMTs and paramedics providing care in the patient compartment. Working under the premise that occupants coded "other enclosed" were, in fact, in the patient compartment, six EMS workers killed there (22%) were definitely not wearing restraints, and one (4%) was coded "unknown" for restraint use. Even more distressing is the fact that an equal number of EMS workers killed (seven, 26%) were drivers who were not wearing safety belts.[1] Drivers are provided with restraints and protective systems specifically designed for that position in the ambulance. Ambulance service providers should have standard operating procedures (SOPs) in place requiring safety belt use for drivers[3] and enforcement mechanisms for the SOPs.

Perhaps the most alarming issue in this study pertains to driver-related factors. Weather and road conditions did not appear to play significant roles in most crashes, but driving the ambulance too fast and/or in the wrong lane were notable factors. Nearly half of the ambulance drivers in all of the fatal crashes (both overall and among those involving EMS worker fatalities) had some kind of collision or moving violation in the three years before the fatal event. Several drivers had more than one offense listed in FARS; one in particular had been cited for speeding five times, had

Table 2: Driver-Related Factors Associated With EMS Worker Fatality Crashes

Cited Factor #1	Cited Factor #2	Cited Factor #3	Incidents	Percent
Driving too fast	None	None	1	4
Driving too fast	Not in lane	None	1	4
Driving too fast	Not in lane	Water, snow, oil	1	4
Driving too fast	Inattentive	None	1	4
Driving too fast	Driving shoulder	Curve, hill, etc.	1	4
Driving too fast	Operator inexperience	Not in lane	1	4
Not in lane	None	None	2	8
Not in lane	Driving too fast	None	1	4
Not in lane	Failure to yield	None	1	4
Not in lane	Overcorrecting	None	1	4
None	None	None	4	16
Failure to obey	None	None	2	8
Drowsy, asleep	Not in lane	None	1	4
Erratic/reckless	Driving too fast	None	1	4
Hit and run	Inattentive	None	1	4
Inattentive	Vehicle in road	None	1	4
Other improper turn	Inattentive	Not in lane	1	4
Vehicle in road	Not in lane	None	1	4
Weather	None	None	1	4
Wrong side of road	None	None	1	4
Total			**25**	**100**

Table 3: Restraint Use of EMS Workers Killed in Ambulance Crashes

Seating Position	Restraint Use	Victims	Percent
Front seat-left	None used or N/A	7	26
Front seat-left	Lap and shoulder	3	11
Front seat-left	Unknown	1	4
Front seat-right	None used or N/A	2	7
Front seat-right	Lap and shoulder	2	7
Front seat-right	Used, type unknown	1	4
2nd seat-right	None used or N/A	1	4
2nd seat-right	Unknown	1	4
3rd seat-right	None used or N/A	1	4
Other enclosed	None used or N/A	6	22
Other enclosed	Unknown	1	4
Unknown	Unknown	1	4
Total		**27**	**101***

** Total equals 101% due to rounding*

had his license suspended or revoked five times, and had been convicted of one other moving violation—all within three years prior to his fatal ambulance crash. The authors of a study examining 11 years of fatal ambulance crashes were similarly taken aback at the high numbers of previous citations among drivers of ambulances involved in fatal crashes.[4]

While it is not possible in FARS to determine the types of ambulance services (private, volunteer, fire department, etc.) involved in the fatal crashes, there are steps all EMS providers can take to improve vehicle safety. It seems imperative that all ambulance services carefully screen their drivers' histories. Emergency vehicle operator courses should be required for all individuals authorized to drive ambulances,[5] and refresher training should be provided frequently. As previously discussed, SOPs mandating safety belt use for drivers should be in place and enforced.

Drivers of ambulances must be exceptionally vigilant, as they are responsible not only for the health of their patients, but for the safety of their coworkers and those people they encounter on the road. ■

References

☐ 1. Centers for Disease Control and Prevention. Ambulance crash-related injuries among emergency medical services workers—United States, 1991–2002. *MMWR* 52(8), Feb. 28, 2003.

☐ 2. Tessmer JM. *FARS Analytic Reference Guide, 1975–2002.* National Center for Statistics and Analysis, National Highway Traffic Safety Administration, 2002.

☐ 3. National Institute for Occupational Safety and Health. Emergency medical technician dies in ambulance crash—New York. DHHS (NIOSH) publication no. FACE-2001-12, 2004.

☐ 4. Kahn CA, Pirrallo RG, Kuhn EM. Characteristics of fatal ambulance crashes in the United States: An 11-year retrospective analysis. *Prehosp Emerg Care* 5:261–9, 2001.

☐ 5. National Institute for Occupational Safety and Health. Career fire fighter/emergency medical technician dies in ambulance crash—Texas. DHHS (NIOSH) publication no. F2003-05, 2003.

Steven L. Proudfoot is a statistician with the National Institute for Occupational Safety and Health. He currently serves as an emergency response specialist for the EMS Vehicle Occupant Safety Project, the Ambulance Crash Survivability Improvement Project and the Fire Fighter Fatality Investigation and Prevention Program.