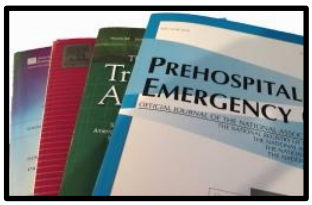
International Prehospital Medicine Institute



IPHMI Literature Review

Keeping You Up To Date with Current EMS Literature and Studies

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1. **Physician-Staffed Ambulance and Increased In-Hospital Mortality of Hypotensive Trauma Patients Following Prolonged Prehospital Stay: A Nationwide Study.** Yamamoto R, Suzuki M, Yoshiawa J, et al. *J Trauma Acute Care Surg. ePub online ahead of print. 2021. DOI:10.1097/ta.0000000000003239*
2. **Early Predictors of Near-Shore Spinal Injuries among Emergency Department Patients.** Lurie T, Berman E, Hassan S, et al. *J Emerg Med*. 2021;60:17-24.
3. **Characteristics of Survivors of Civilian Public Mass Shootings: An Eastern Association for the Surgery of Trauma Multicenter Study.** Sarani B, Smith ER, Shapiro G, et al. *J Trauma Acute Care Surg* 2020;20:68-72.
4. **Response Time Threshold for Predicting Outcomes of Patients with Out-of-Hospital Cardiac Arrest.** Huang LH, Ho Y, Tsai M, Wu W, Cheng F. *Emerg Med International*. 2021; published on-line, Article ID 5564885, available at: https://doi.org/10.1155/2021/5564885

1. **Physician-Staffed Ambulance and Increased In-Hospital Mortality of Hypotensive Trauma Patients Following Prolonged Prehospital Stay: A Nationwide Study.** Yamamoto R, Suzuki M, Yoshiawa J, et al. *J Trauma Acute Care Surg*. ePub online ahead of print. 2021.

Prehospital physicians are a component of emergency medical system scene response in many parts of the world. They often work side-by-side with paramedics to provide various resuscitative procedures. Prior studies have shown physician-staffed ambulances and helicopters have an increased survival rate for out-of-hospital cardiac arrest, reduced complications of pediatric airway management, and had fewer hypoxic episodes in patients with traumatic brain injury. In contrast, some studies from the Netherlands and Germany demonstrated that prehospital physicians intervening on scene for severe injuries did not result in a survival benefit, while another study from France showed a slight improvement in mortality. However, most recent studies target isolated traumatic brain injury. This study sought to determine the effect of physician staffed ambulances on mortality in the hypotensive trauma patient.

In Japan, the usual ambulance staffing typically consists of three EMS personnel who can perform cardiopulmonary resuscitation. Additionally, most EMS crews have an “emergency life-saving technician” who can obtain intravenous access and place a supraglottic airway device. Paramedics may also administer epinephrine and perform endotracheal intubation. No EMS personnel perform invasive interventions such as intraosseous access, needle decompression or tube thoracostomy. A physician-staffed ambulance has one or two physicians (usually emergency medicine specialists) in addition to the EMS personnel. The physicians can transfuse blood, perform a resuscitative thoracotomy, and do other invasive procedures depending on their equipment and skill level. However, surgical hemostasis for major hemorrhage is not feasible due to limited resources.

The authors conducted a retrospective cohort study using data from the Japan Trauma Data Bank (JTDB). Patients included in the study were trauma patients who were hypotensive (systolic blood pressure ≤ 90 mmHg) and transported by either a physician-staffed ambulance or EMS-staffed ambulance. The primary outcome measure was in- hospital mortality. Secondary outcomes include cardiac arrest or hypotension at hospital arrival, length of hospital stay, scene time, transport time, and total prehospital time.

Of the 361,706 trauma patients in the database, 14,652 hypotensive patients were transported by EMS and eligible for the study. Of these, 738 patients (5%) were transported by physician-staffed ambulances. As expected, patients who were transported by the physician-staffed ambulance were more severely injured, however, the statistical analysis adjusted for this difference, so it did not factor into the final outcome.

In-hospital mortality was significantly higher among patients who were transported by the physician-staffed ambulance than those who were transported by the ambulance staffed by EMS personnel. This finding held true even in the adjusted analysis for injury severity. The physician- staffed ambulance had a longer response time, longer scene time, longer transportation time, and longer total prehospital time compared to the EMS-staffed ambulance. Subgroup analysis showed this relationship between increased in-hospital mortality among the physician-staffed ambulance to apply for both pediatric and adult patients, severely and non-severely injured patients, and of the early and late periods of injury during the trial. However, patients with traumatic cardiac arrest did show a reduced mortality if transported by a physician-staffed ambulance. Interestingly, the most severely hypotensive (SBP of 50-90 mmHg) patients had a statistically significant increased mortality if transported on the physician-staffed ambulance.

There are several explanations for the findings of this study. The longer prehospital time of the physician-staffed ambulance would affect survival in the hypotensive trauma patient, since no surgical hemostatic interventions were performed on scene. While previous studies demonstrated better airway management and oxygenation by physicians treating patients with traumatic brain injury, little can be done by them to stop massive hemorrhage on scene.

In summary, the physician-staffed ambulance had increased in-hospital mortality among hypotensive trauma patients. They also had a longer prehospital time compared to EMS personnel-staffed ambulances.

2. Early Predictors of Near-Shore Spinal Injuries among Emergency Department Patients. Lurie T, Berman E, Hassan S, et al. J Emerg Med. 2021;60:17-24.

Spinal and spinal cord injuries (SI and SCI respectively) are the most serious of the various commonly seen water and beach injuries. They can be profoundly life-altering and pose a significant hardship and burden for patients, patient families and society. In some case, early recognition and surgical intervention can improve patient outcomes and neurological status.

The intent of this study was to identify early (time of injury) and potentially predictive signs and symptoms of SI. The authors performed a retrospective, multicenter study of adult patients transported by ambulance or helicopter from the beach in Ocean City, Maryland, a community with nine miles of beaches, to local hospital emergency rooms or trauma centers. Patients who were comatose, intubated, or otherwise unable to communicate their symptoms were excluded as were those with missing hospital records.

The primary outcome measure was SI which included spinal fractures, ligamentous disruption or spinal cord involvement as identified by x-ray, CT scan or MRI. Secondary outcomes of spinal cord injury (SCI) included spinal cord hemorrhage, compression, edema or cord contusion.

Between 2006 and 2017, 1,222 adult patients were transported. Thirty-six percent (445) of those patients presented with suspected SI, of which, 278 were included in this study. Ambulance transport accounted for 77% and helicopter transport for 23%. Ninety-nine percent (442) of those patients were transported to study hospitals. Most of the patients were male (77%), with a mean age of 42 years.

Spine injuries occurred in 102 (37%) patients, with spinal cord injuries found in 41 patients (15%). Older age was associated with both SI and SCI. As one might expect, diving in the near shore (shallow water) increased the likelihood of SI and SCI. Tingling or numbness as well as any abnormal extremity strength were highly predictive of SCI. Interestingly, midline spinal tenderness did not increase the likelihood of SI. Larger waves, measured by near shore buoys, at the time of injury, were also indicative of SI. For each additional meter of wave height, the likelihood of SI increased fourfold.

Near shore EMS and emergency department clinicians may use these data to help predict which patient groups may benefit from transport to hospitals with early neurosurgery intervention. Additionally, public awareness campaigns could target all, and especially older, beach goers regarding the dangers of shallow water diving. Near beach communities could also impose beach restrictions during large wave days to help prevent injuries.

3. **Characteristics of Survivors of Civilian Public Mass Shootings: An Eastern Association for the Surgery of Trauma Multicenter Study.** Sarani B, Smith ER, Shapiro G, et al. *J Trauma Acute Care Surg* 2021; 90: 652–658.

Civilian public mass shootings (CPMS) are a growing problem in our society today. The care for the victims of these mass shootings has evolved over the last years.

The authors conducted a retrospective multi-center study to look at wounding patterns, survivability and weapons used in during such incidents which were identified using the New York Police Department and Mother Jones databases. Consecutive CPMS from July 1, 1999, to December 31, 2017 were identified and incidents taking place in a public venue that involved more than 4 deaths (not including the shooter) were included. Patient inclusion criteria included either primary transport to a state or American College of Surgeons Committee on Trauma (COT) designated trauma center (level 1, 2 or 3) or transferred from a non-trauma center to a trauma center and survived the incident. The majority of these patents were treated in a level one trauma center.

A total of sixty-nine (69) events involving 826 patients wounded by firearms were evaluated. Of these events, 31 incidents involving 191 patients transported to 21 trauma centers were included in the study. The firearms used in the events were: rifle (58%), handgun (40%) and shotgun (14%). Of note, 7% of patients were shot with multiple different firearms. The injury severity score (ISS) was highest for patients that presented with shotgun wounds and lowest with wounds that occurred from a rifle. It should be remembered that these were patients that survived the incidents and did not include fatalities.

Ambulance transport accounted for fifty-eight (58%) of patients, private vehicle for 42%, helicopter 8% and law enforcement for 3%. Patients transported via private vehicle had a significantly lower ISS than those transported by either ambulance or helicopter. Times from incident to trauma center arrival for ambulance and private vehicle were similar at 50 and 51 minutes respectively whereas helicopter times were longer at 76 minutes.

The most common site of injury in the survivors was an extremity (54% of patients), followed by the chest (35%), abdomen (28%) and head (15%), unlike previous studies of fatalities that showed that head, chest and abdominal wounds predominate in those patients. In addition, nearly twenty-seven (27%) of the surviving victims were discharged from the Emergency Department to home.

A major limitation of this study was that over fifty (50%) of the events were excluded from the study due to various reasons, the most significant of which the lack of a point of contact at the receiving hospital. Other exclusions included unknown admitting hospital and hospitals unwilling to participate.

The data presented in this study looking at survivors of mass shootings support previous studies that examined the fatalities resulting from CPMS. Patients that survived were demonstrated to have less severe injuries and required less advanced interventions both in the prehospital environment and in the hospital.

An important take away point from this study is that hospital emergency departments need to be prepared for a sudden and rapid influx of patients arriving by private vehicle which in this study accounted for over 40% of victims. EMS triage and transport decisions should, whenever possible, take into account this influx of patients via private vehicle and adjust their transport destinations accordingly.

4. Response Time Threshold for Predicting Outcomes of Patients with Out-of-Hospital Cardiac Arrest.
Huang LH, Ho Y, Tsai M, Wu W, Cheng F. *Emerg Med International*. 2021

The importance of ambulance response times to improved patient outcomes has long been a part of EMS system management. However, the optimal time response time and how it affects a variety of patients remains a controversy. While most would argue that shorter response times are better, others argue that the data in support of this, with perhaps rare exceptions such as cardiac arrest, are non-existent or weak.

This paper sought to determine the EMS response time threshold for survival to hospital discharge for victims of out-of-hospital cardiac arrest.

The authors conducted a retrospective observational analysis using their EMS database looking at cardiac arrest patients transported between January, 2015 and December, 2019. The database includes demographic information, scene details, interventions performed by bystanders and EMS responders, as well as patient outcome and disposition.

There were a total of 10,933 out of hospital cardiac arrests in the database. Of this number, 6,742 cases were analyzed for this study. Exclusions included pediatric patients under the age of 18 years, death due to trauma, burns, or drowning, patients with pre-existing do-not-resuscitate (DNR) orders, patients who were transferred after initial treatment at another hospital, and patients with missing outcomes or incomplete data.

Response times of 6.2 minutes or less were statistically and significantly associated with survival to hospital discharge. If the cardiac arrest occurred at a public place or bystander CPR was performed the response time threshold increased to 7.2 and 6.3 minutes respectively. If the cardiac arrest was unwitnessed, the threshold for response time was reduced to 4.2 minutes unless an AED was available and used in which case the response time threshold was 5 minutes.

The limitations of this study include the fact that it was a retrospective study and that it only included patients from one city that has a single tiered EMS response system.

This study reinforces several points. First, early CPR and AED defibrillation make a significant difference in patient outcomes for victims of cardiac arrest. Second, it confirms prior studies that demonstrated that shorter EMS response times do make a difference in the care of cardiac arrest patients, particularly in the absence of bystander interventions such as CPR or AED utilization. It also implies that public education and training can also improve outcomes as has been previously reported.