Air Medical Journal 38 (2019) 95–99

Contents lists available at ScienceDirect

Air Medical Journal

journal homepage: http://www.airmedicaljournal.com/

Original Research

Analysis of Transport to an American College of Surgeons Level I Trauma Center

Daniel Hakakian, BS [1], Karen Kong, BS [1], Dorian Atanas Bogdanovski, MPH [1], Andrew Benvenuto, BS [1], Louis Thomas DiFazio, MD, FACS [1], Renay Durling-Grover, RN, MSN, CEN [1], Rolando Hector Rolandelli, MD, FACS [1], Zoltan H. Nemeth, MD PhD [1,2,3]*

[1] Department of Surgery, Morristown Medical Center, Morristown, NJ
[2] Department of Anesthesiology, Columbia University Medical Center, NY, NY
[3] Department of Surgery, Rutgers New Jersey Medical School, Newark, NJ

A B S T R A C T

Introduction: Efficient patient transportation by ground emergency medical services (GEMS) or helicopter emergency medical services (HEMS) to a trauma center is vital for optimal care. We investigated differences between the modes of transport in terms of demographics, injury, scene location, and outcome.
Setting: Morristown Medical Center (MMC), Morristown, NJ
Methods: All 903 trauma admissions in 2016 by advanced life support (ALS) to MMC, a Level I Trauma Center, were retrospectively analyzed.
Results: 22% of admissions were HEMS and 78% were GEMS. HEMS patients had higher Injury Severity Scores (ISS) ($p<0.001$); however, mortality and length of stay were not statistically different. The percentage of pediatric patients transported by HEMS that were discharged home after emergency department evaluation was greater than the older populations ($p<0.001$). Older age and higher ISS had the largest impact on mortality ($p<0.001$).
Conclusion: We believe our current use of HEMS is adequate since patient outcomes between HEMS and GEMS was similar, even though HEMS patients have higher ISS. However, helicopter use in the pediatric population was over-utilized, possibly due to the scarcity of hospitals capable of managing pediatric traumas. Implementation of the Air Medical Prehospital Triage scoring system may also help correct for these unnecessary HEMS transports.

According to the World Health Organization, 9% of global mortality is caused by injuries from traffic accidents, violence, falls, and other traumatic causes.[1] In fact, trauma is the main cause of mortality in the United States for people aged 46 years and younger.[2,3] An integral part of treating trauma patients is prehospital care and emergency medical services (EMS). The timely and efficient transport to trauma centers within the "golden hour" can be crucial in determining the outcomes of patients.[4,5] The 2 methods of emergency medical transport to a trauma center are helicopter emergency medical services (HEMS) and ground emergency medical services (GEMS). Although helicopters travel faster than ambulances, a more recent Cochrane Review concluded that it was difficult to determine the added advantage of HEMS compared with GEMS because of the lack of high-quality evidence and conflicting studies.[6]

Several publications that used the American College of Surgeons National Trauma Data Bank concluded that HEMS use is associated with improved survival after controlling for confounding variables.[7,8] Other retrospective studies have also shown lower mortality in HEMS patients when analyzing patients with more severe injuries.[9,10] In contrast, there are studies that have reported no added benefit or difference in survival between patients transported by GEMS and patients transported by HEMS.[11-13] Additionally, some institutions have recognized that HEMS is overused in subpopulations such as children and that patients with only minimal injuries are unnecessarily triaged to HEMS.[12,14]

Because of the absence of high-quality evidence regarding GEMS and HEMS, additional research is warranted.[6] The purpose of this study was not only to compare the outcomes of the patients

* Address for correspondence: Zoltan H. Nemeth, MD, PhD, Department of Surgery, Morristown Medical Center, 100 Madison Ave #88, Morristown, NJ 07960
E-mail address: Zoltan.Nemeth@atlantichealth.org (Z.H. Nemeth).

1067-991X/$36.00

https://doi.org/10.1016/j.amj.2018.11.013

transported by GEMS and HEMS but also to analyze the factors related to the trauma, such as the mechanism of injury and distance from the scene to our institution. In this study, we hypothesized that patients transported by HEMS would have more serious injuries and come from further distances. As a result, we expected to see worse outcomes in the trauma patients transported by HEMS. In light of prior studies,[12,13] we wanted to also examine if HEMS was inadvertently overused in our study setting with the intention of helping trauma patients faster.

Methods

This single-center retrospective study was completed using data from the Trauma Registry at Morristown Medical Center (MMC), an American College of Surgeons level I regional trauma center. The quality of the data was checked by reviewing data entry, missing data, and outliers to ensure accuracy and consistency. Every trauma patient evaluated at MMC was entered into this database, along with detailed information about their hospital course. Patients admitted between January 1, 2016, and December 31, 2016, were considered if they were transported to the hospital by EMS because of trauma. This study period was chosen because all advanced life support (ALS) calls used electronic health records at this point, allowing us access to record specific information such as the time of dispatch and scene location. Only admissions in which ALS transported the patient to MMC were considered because patients transported by ALS had the most consistent and complete documentation available to MMC. In addition, it is highly unlikely that patients who do not meet the criteria for ALS transport would be transported by helicopter.

We compared patients who traveled to MMC by ground ambulance with patients who traveled to MMC by helicopter. Prehospital care to our institution is dictated by the Center for Disease Control and Prevention (CDC) "Guidelines for Field Triage of Injured Patients,"[15] and EMS personnel follow the New Jersey Department of Health (NJ DOH) "Fly or Drive Criteria" when determining which mode of transport is best.

Data regarding age, sex, emergency department (ED) disposition, mechanism of injury, zip code of incident, date, time of dispatch, time of arrival at scene, time of departure from scene, and time of arrival at receiving facility were recorded and analyzed. Continuous data were tested for normality (Minitab 17.1.0; Minitab, Inc, State College, PA) and were found to be nonparametric. Mann-Whitney and chi-square tests were used to analyze the data. Although the study was underpowered in terms of mortality, a multivariate logistic regression was also created using Minitab to observe risk factors for mortality in trauma.

The SAS software (University Edition; SAS Institute, Inc, Cary, NC) function ZIPCITYDISTANCE was used to calculate the distances between the zip codes of the scene and MMC by measuring the geodetic distance (shortest distance along earth's surface) between the centroid of the zip code where the scene happened and the centroid of Morristown.[16] The Atlantic Health Institutional Review Board approved this study.

Results

The total number of ALS trauma patient transports to MMC in 2016 was 903. One hundred ninety-seven (21.82%) patients were transported via helicopter, and 706 (78.18%) were transported via ground ambulance. The study population consisted of 89 (9.86%) patients aged 0 to 18 years, 336 (37.21%) patients aged 19 to 49 years, and 478 patients (52.93%) aged 50 years and older.

Compared with the GEMS group, the HEMS group was found to be significantly younger, have a higher rate of motor vehicle crashes and motorcycle crashes, have a lower rate of falls, have a higher Injury Severity Score (ISS), be more likely to undergo operation, and be less likely to be discharged home from the emergency room (Table 1). All HEMS admissions had full trauma activation, whereas only 73.51% of GEMS admissions did. Other GEMS admissions only had partial activation, consults, or no trauma activation. The mean length of hospital stay was not significantly different between the 2 groups (Table 1).

Table 1
Age, Injury, Hospital Response, and Patient Outcomes

	Mode of Transport		
	HEMS (n = 197)	GEMS (n = 706)	*P* Value
Age, n (%)			
0-18	27 (13.71)	62 (8.78)	.04
19-49	95 (48.22)	241 (34.14)	<.001
50+	75 (38.07)	403 (57.08)	<.001
Mechanism of injury, n (%)			
Fall	56 (28.43)	310 (43.91)	<.001
Motorcycle crash	22 (11.17)	33 (4.67)	<.001
MVC	102 (51.78)	297 (42.07)	.015
ISS ± SEM	9.87 ± 0.72	7.15 ± 0.31	<.001
Full trauma activation, n (%)	197 (100)	519 (73.51)	<.001
ED disposition, n (%)			
OR	30 (15.23)	62 (8.78)	.008
Intensive care unit	55 (27.92)	170 (24.08)	.27
Floor	42 (21.32)	136 (19.26)	.52
Telemetry	6 (3.05)	66 (9.35)	.004
Home	41 (20.81)	206 (29.18)	.02
Mortality	13 (6.60)	44 (6.23)	.85
Hospital LOS ± SEM	6.23 ± 0.78	5.47 ± 0.48	.08

ED = emergency department; GEMS = ground emergency medical services; HEMS = helicopter emergency medical services; ISS = Injury Severity Score; LOS = length of stay; MVC = motorcycle vehicle crash; OR = operating room; SEM = standard error of the mean.
The total number of advanced life support trauma admissions to Morristown Medical Center was 903. Chi-square tests were used for categoric data, and Mann-Whitney tests were used for continuous data.

Furthermore, mortality between the 2 groups was not significantly different (Table 1). When analyzing the subset of patients with an ISS over 15, the mortality rates were still not significantly different (22.22% for HEMS and 25.96% for GEMS, $P = .63$). Additionally, patients originating from scene locations greater than 15 miles from MMC were isolated and observed independently, and mortality was still not significantly different (4.60% for HEMS and 4.89% for GEMS, $P = .90$).

Slightly more than half of the pediatric population (0-18 years) transported by HEMS were discharged home after ED evaluation (51.85% of pediatric HEMS transports) (Fig. 1). This was significantly greater than those aged 19 to 49 years (17% of 19-49 HEMS

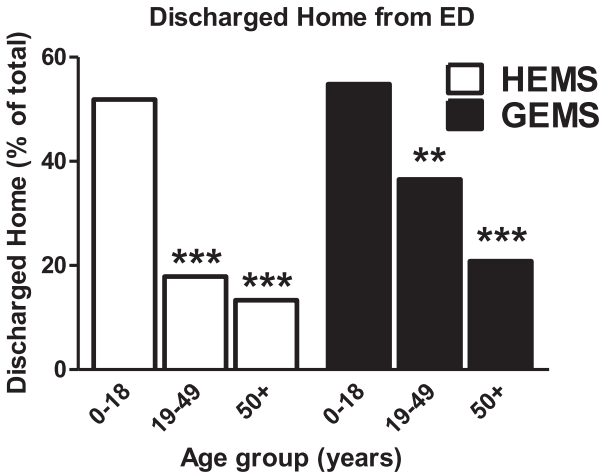

Figure 1. The percentage of patients discharged home from the ED in each age group. An analysis of the percentage of people in each age group discharged home from the ED. Significance was tested comparing the 0 to 18 age group with the 19 to 49 and 50+ age groups within each mode of transport. $^{**}P < .01$. $^{***}P < .005$.

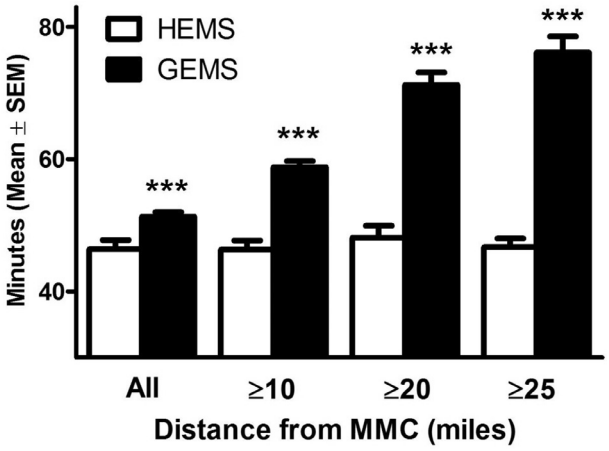

Figure 2. The time between dispatch of ALS and arrival at MMC. Differences in times between HEMS and GEMS depending on the distance from MMC are shown here. "All" signifies all transportations with recorded times, no matter the distance between the scene and MMC. ≥ 10, ≥ 20, and ≥ 25 include all transportation greater than or equal to the respective miles from MMC. ***$P < .005$. SEM = standard error of the mean.

Table 2
Multivariate Logistic Regression Model for Mortality

Factor	Coefficient (SE)	OR (95% CI)	*P* Value
ISS	0.124 (0.015)	1.132 (1.099-1.166)	<.001
Distance	−0.032 (0.026)	0.968 (0.919-1.020)	.224
Fall injury	−0.868 (0.584)	0.420 (0.134-1.318)	.152
Motorcycle injury	−0.716 (0.877)	0.489 (0.088-2.724)	.401
MVC injury	−1.181 (0.578)	0.307 (0.099-0.953)	.052
HEMS	0.575 (0.500)	1.777 (0.667-4.738)	.257
Age	0.048 (0.010)	1.049 (1.029-1.070)	<.001
Time to arrival at MMC	0.003 (0.009)	1.0027 (0.984-1.022)	.781

CI = confidence interval; HEMS = helicopter emergency medical services; ISS = Injury Severity Score; MMC = Morristown Medical Center; MVC = motor vehicle crash; SE = standard error.
Distance refers to the distance from the scene to MMC and time to arrival at MMC refers to the length of time between the call to dispatch to the arrival of the ambulance at MMC. Minitab statistical analysis software was used.

transports, $P < .001$) and 50+ years (13% of 50+ HEMS transports, $P < .001$). GEMS had a similar pattern although a greater percentage of each age group was discharged home after evaluation from the ED.

GEMS averaged 51.30 minutes from the time of dispatch to arrival at MMC, and HEMS averaged 46.40 minutes ($P < .001$). For scenes at least 5 miles away, HEMS was significantly faster ($P < .001$) by about 7.5 minutes. For scenes at least 10 miles away from MMC, GEMS averaged 59 minutes ($P < .001$); for scenes at least 20 miles away, GEMS averaged 71 minutes ($P < .001$); and for scenes at least 25 miles away, GEMS averaged 76 minutes ($P < .001$). HEMS still averaged 49 minutes for scenes at least 10, 20, and 25 miles away (Fig. 3). Our database contained a few cases in which the time ALS was dispatched was missing. Three (1.5%) admissions by HEMS and 65 (9.2%) admissions by GEMS were lacking dispatch, response, and arrival times of the EMS. These inconsistencies were most likely because of the different software used to record the patient care reports and their inability to always be included in the overall medical report of the patient. As such, these cases were only excluded from this analysis of time but were used for the rest of the statistical analyses.

The average distance from the scene to MMC was significantly greater for HEMS (24.1 miles for HEMS vs. 11.3 miles for GEMS, $P < .001$). GEMS brought in patients mainly from Morris County and the surrounding counties, whereas HEMS transported most of their patients from Sussex County and Pennsylvania (Fig. 3).

In multivariate regression analysis, age and ISS were the only factors significantly associated with mortality (Table 2). The positive regression coefficient and the odds ratio greater than 1 for both factors indicate that higher age and ISS increase the risk for mortality.

Discussion

Contrary to our hypothesis, we did not find a difference in mortality between patients transported by HEMS and patients transported by GEMS. Other studies have shown similar results.[11-13] However, we believe our current use of HEMS is adequate because there are no differences in mortality, yet the patients transported by HEMS had more significant injuries (higher ISS and higher percentage of ED disposition to the operating room). Interestingly, a study published in

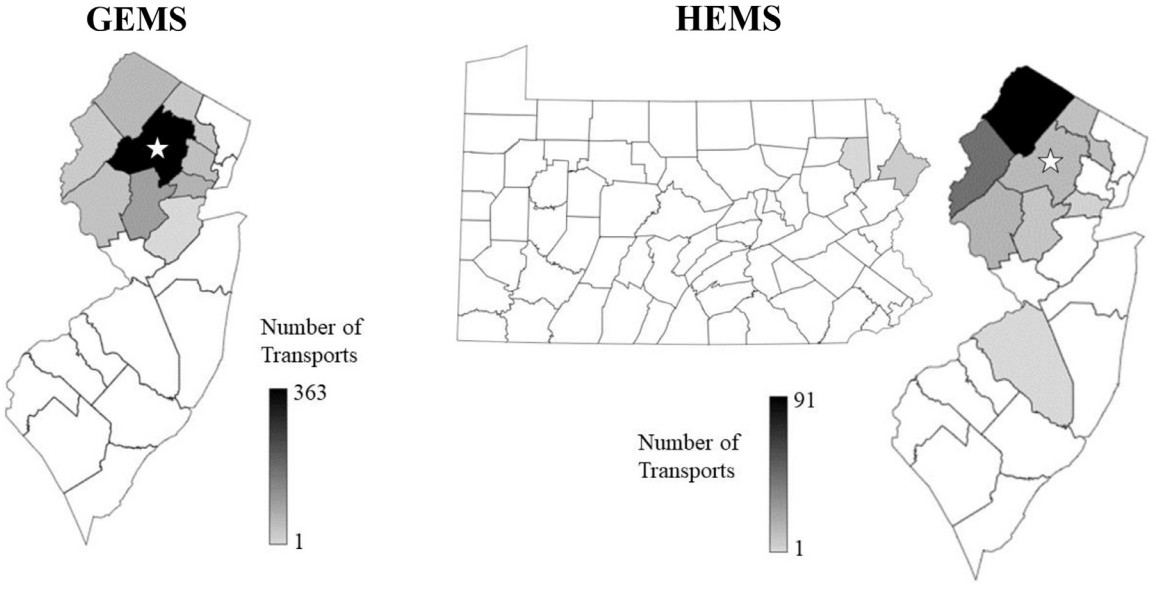

Figure 3. The distribution of admissions of HEMS versus GEMS by county. Helicopters transported patients in New Jersey and Pennsylvania, whereas ground ambulances only transported patients within New Jersey. The scale is specific to each mode of transport. White coloring indicates that no transportations occurred in that county. The star indicates Morris County where MMC is located.

Surgery[17] found that HEMS improves survivability when comparing HEMS and GEMS transports with similar prehospital transport times. They concluded that even if the durations of transport end up being similar, the patients may have better outcomes just from the level of care in HEMS.[17] This conclusion may help explain why HEMS patients had similar outcomes even though their injuries were more severe, in addition to the faster transport.

However, because there are still patients who are being discharged home after transport by HEMS, there is still room for further improvement in determining which patients will actually benefit from HEMS over GEMS transport. Currently, the NJ DOH has triage trauma guidelines similar to the CDC "Guidelines for Field Triage of Injured Patients" that determine whether adult and pediatric patients should be transported to a trauma center or a local hospital. The NJ DOH also has "Fly or Drive Criteria" that serve as guidelines for whether to use HEMS or GEMS after the patient has been designated as a trauma patient. The guidelines recommend GEMS transport for unentrapped patients who are within 30 minutes ground travel time from a trauma center, HEMS for entrapped patients if the helicopter can reach the scene while the patient is being rescued, and HEMS for incidents involving more than 3 critical patients.[18] However, the guidelines do not use clinical factors to determine whether a patient should be flown or driven.

Because a higher ISS is significantly associated with HEMS but ISS cannot be effectively evaluated in the field, the NJ DOH "Fly or Drive Criteria" could benefit from adding anatomic and physiological criteria to its guidelines. A method that could be implemented both at our institution and other trauma centers in addition to a time-based guideline is the Air Medical Prehospital Triage (AMPT) guidelines described by Brown et al.[8] These guidelines determine which trauma patients would most likely benefit from transportation by HEMS. The AMPT guidelines would be relatively easy to implement because many of the NJ DOH triage guidelines are similar to the AMPT ones, and EMS personnel would just need to know the point system used in AMPT. The important factors in the AMPT score included a Glasgow Coma Scale score less than 14, respiratory rate less than 10 or greater than 29 (per minute), unstable chest wall fractures, suspected hemothorax or pneumothorax, paralysis, injuries to 3 or more body regions, and the combination of at least 1 physiologic and 1 anatomic criteria as outlined in the CDC's field triage guidelines to trauma centers.[8,15] This scoring system was validated by using the Pennsylvania Trauma Outcomes Study registry, and was also shown to be cost-effective.[19,20] Another benefit of this scoring system is that it is relatively simple and straightforward to use, which allows efficiency and clarity at the trauma scene.[8] Using clinical indications to determine the patients who will benefit the most from HEMS will help improve the efficiency of patient transport decisions and hopefully reduce the amount of patients who are discharged home from the ED after being brought in by HEMS. Studies observing patients of all ages have found that HEMS may be overused. Cheung et al[21] used the American College of Surgeons National Trauma Data Bank and found that 36% of adult patients transported by helicopter had minor injuries. A level I trauma center in Arizona found 27.5% of all helicopter-transferred patients were minimally injured.[2] These high percentages of minimally injured patients transported by HEMS also support implementation of the AMPT scoring system.

Most significantly, our analysis also showed that more than half of the pediatric population in our study was discharged home from the ED in both HEMS and GEMS. We believe that these patients may not have been suitable for the costly resource of HEMS because there was no hospital intervention outside the ED. However, because MMC is also a children's hospital and has the resources to treat pediatric traumas, EMS may transport pediatric traumas to our institution even if there is a closer hospital. In turn, HEMS may be chosen to transport the pediatric patients a greater distance in an effort to bring the child to MMC despite it being a minor trauma. A study published in *Injury* also found a higher percentage of pediatric patients needing less hospital intervention. Polites et al[14] reported that the majority of pediatric trauma patients (67.8%) transported by HEMS had a low ISS (ISS $\leq$ 15) and concluded that a survival benefit to HEMS for pediatric patients only exists with an ISS greater than 15.[14] One of the reasons that overuse of HEMS in pediatric patients is observed across various studies may be the lack of standardized trauma triage criteria for pediatric patients. The age that separates a child from an adult is not well-defined in the literature, and different guidelines use different ages as cutoffs. The CDC uses < 15 years as the age criteria for pediatric trauma but also cites studies that look only at children < 13 years and children 4 to 15 years old. The CDC even states in the triage guideline document that "the age that separates children from adults for purposes of field triage is difficult to define with certainty."[22] Further studies on trauma in pediatric patients need to be performed to be able to better standardize the criteria for pediatric patients, and guidelines similar to the AMPT guidelines should be developed in accordance with those findings to use HEMS more effectively in that patient population.

Some limitations were present in our study. This was a single-center retrospective study. Only 1 year's worth of data was available because of the more recent transition of the electronic health record to EMS, which is necessary in obtaining consistent and accurate data. The times analyzed in the study only reflected what ALS recorded. Basic life support could have been on the scene for some time before calling for ALS, so the total time a patient was in transit was not necessarily identified. In addition, HEMS takes a few extra minutes to completely transfer care compared with GEMS because they land on the roof.

The SAS function ZIPCITYDISTANCE was used to calculate the distance between the centroids of the 2 zip codes.[16] However, many scenes could have been located further from the center of the zip code. Also, admissions coming from Morristown had a distance of 0 because the zip code of MMC is the same. Because the distance calculated between the 2 zip codes was the geodetic distance, it does not accurately reflect the amount of miles that it takes to drive from the scene to the hospital because the routes are not a direct line to the hospital. It may be more attributable to HEMS because air travel has the liberty to travel in a direct line. A more comprehensive approach to calculating the distances would have been to use geographic information system; however, we did not have the capability to do so.

Lastly, this study only observed ALS calls in which ALS responded and transported. There could have been admissions that would have necessitated ALS; however, ALS may not have responded because of their lack of availability from treating another patient or their proximity from the scene. These were not included in this study because they did not travel with ALS to the hospital.

Conclusion

The literature on the usefulness and benefits of HEMS versus GEMS is mixed. Studies from individual hospitals or hospital groups have reported different results, possibly because of varying criteria for triaging to HEMS and varying distances covered by EMS. In our institution, we did not find a significant difference in mortality or hospital length of stay between HEMS and GEMS patients although this may be caused by a smaller sample size. We believe that our current use of HEMS is satisfactory because HEMS patients with more severe injuries get similar outcomes, but opportunities to improve the guidelines exist. Currently, the NJ DOH "Fly or Drive Criteria" do not include triaging based on injuries or their severity; however, our most important finding was the correlation of higher ISS with HEMS transport. In turn, we believe the use of the AMPT scoring system would aid in determining which patients to transport with a helicopter. Additionally, creating and implementing a similar system for pediatric patients may help reduce the high percentage

of pediatric patients who are discharged directly from the emergency department.

Acknowledgment

The authors thank Jaroslaw W. Bilaniuk, MD; Jennifer Theobald, BS; and Gabriella Elizabeth Foster, BS.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.amj.2018.11.013.

References

1. Organization WH. Injuries. World Health Organization. WHO Web site. http://www.who.int/topics/injuries/about/en/. Published 2010. Updated December 1, 2010. Accessed November 1, 2018.
2. Vercruysse GA, Friese RS, Khalil M, et al. Overuse of helicopter transport in the minimally injured: a health care system problem that should be corrected. *J Trauma Acute Care Surg*. 2015;78:510–515.
3. Rhee P, Joseph B, Pandit V, et al. Increasing trauma deaths in the United States. *Ann Surg*. 2014;260:13–21.
4. Wandling MW, Nathens AB, Shapiro MB, Haut ER. Association of prehospital mode of transport with mortality in penetrating trauma: a trauma system-level assessment of private vehicle transportation vs ground emergency medical services. *JAMA Surg*. 2018;153:107–113.
5. Feero S, Hedges JR, Simmons E, Irwin L. Does out-of-hospital EMS time affect trauma survival. *Am J Emerg Med*. 1995;13:133–135.
6. Galvagno Jr SM, Sikorski R, Hirshon JM, et al. Helicopter emergency medical services for adults with major trauma. *Cochrane Database Syst Rev*. 2015;12:CD009228.
7. Galvagno SM Jr, Haut ER, Zafar SN, et al. Association between helicopter vs ground emergency medical services and survival for adults with major trauma. *JAMA*. 2012;307:1602–1610.
8. Brown JB, Gestring ML, Guyette FX, et al. Development and validation of the Air Medical Prehospital Triage (AMPT) score for helicopter transport of trauma patients. *Ann Surg*. 2016;264:378–385.
9. Tsuchiya A, Tsutsumi Y, Yasunaga H. Outcomes after helicopter versus ground emergency medical services for major trauma—propensity score and instrumental variable analyses: a retrospective nationwide cohort study. *Scand J Trauma Resusc Emerg Med*. 2016;24:140.
10. Buchanan IM, Coates A, Sne N. Does mode of transport confer a mortality benefit in trauma patients? Characteristics and outcomes at an Ontario Lead Trauma Hospital. *CJEM*. 2016;18:363–369.
11. Bulger EM, Guffey D, Guyette FX, et al. Impact of prehospital mode of transport after severe injury: a multicenter evaluation from the Resuscitation Outcomes Consortium. *J Trauma Acute Care Surg*. 2012;72:567–573. discussion 573-565; quiz 803.
12. Delgado MK, Staudenmayer KL, Wang NE, et al. Cost-effectiveness of helicopter versus ground emergency medical services for trauma scene transport in the United States. *Ann Emerg Med*. 2013;62:351–364. e319.
13. Talving P, Teixeira PG, Barmparas G, et al. Helicopter evacuation of trauma victims in Los Angeles: does it improve survival. *World J Surg*. 2009;33:2469–2476.
14. Polites SF, Zielinski MD, Fahy AS, et al. Mortality following helicopter versus ground transport of injured children. *Injury*. 2017;48:1000–1005.
15. Sasser SM, Hunt RC, Faul M, et al. Guidelines for field triage of injured patients: recommendations of the National Expert Panel on Field Triage, 2011. *MMWR Recomm Rep*. 2012;61:1–20.
16. Functions and call routines: ZIPCITYDISTANCE Function - 9.2. SAS. http://support.sas.com/documentation/cdl/en/lrdict/64316/HTML/default/viewer.htm#a003113156.htm. Accessed December 20, 2017.
17. Brown JB, Gestring ML, Guyette FX, et al. Helicopter transport improves survival following injury in the absence of a time-saving advantage. *Surgery*. 2016;159:947–959.
18. Fly or Drive Criteria, New Jersey Department of Health, https://www.nj.gov/health/ems/special-services/fly-or-drive-criteria/, 2017, Published 2017. Accessed November 1, 2018.
19. Brown JB, Gestring ML, Guyette FX, et al. External validation of the Air Medical Prehospital Triage score for identifying trauma patients likely to benefit from scene helicopter transport. *J Trauma Acute Care Surg*. 2017;82:270–279.
20. Brown JB, Smith KJ, Gestring ML, et al. Comparing the Air Medical Prehospital Triage score with current practice for triage of injured patients to helicopter emergency medical services: a cost-effectiveness analysis. *JAMA Surg*. 2018;153:261–268.
21. Cheung BH, Delgado MK, Staudenmayer KL. Patient and trauma center characteristics associated with helicopter emergency medical services transport for patients with minor injuries in the United States. *Acad Emerg Med*. 2014;21:1232–1239.
22. Centers for Disease Control and Prevention. Guidelines for Field Triage of Injured Patients. *MMWR Recomm Rep*. 2009;58:23–26.