Ambulance Response in Eight Minutes or Less: Are Comorbidities a Factor

Blaine Rourke, DO; Heather Rhodes, PhD; Antonio Pepe, MD

Background

EMS provides the essential link between the location of a trauma and definitive pre- hospital critical care. The scene time is defined as the initial call for dispatch and the arrival of EMS, which is an important element regarding the possibility of early mortality.[1] Early arrival times leads to expedited stabilization and timely triage.[1] A recent publication described the majority of trauma related deaths (86%) occur before hospital arrival and of those deaths 39% were considered preventable.[1] There are six known challenges that may extend scene times, which include poor management of the scene, lack of rules and regulations, poor time management, inadequate training, poor communication and coordination, and low quality of victim management.[1] Evaluating EMS performance measures is critical, particularly in a rural trauma system. One of the most common EMS performance measurements is the response time threshold (RTT), which is easily quantifiable.[2] Using the RTT to investigate vital connections between delay at the scene could be used to improve EMS performance measures. The current response time guideline that EMS must meet a response time criterion of eight minutes or less in at least 90% of responses, and is based upon the medical cardiac arrest model.[3]

Objective

This present investigation was undertaken to provide information regarding the influence of prolonged scene times and develop a rural education and outreach plan to improve patient mortality and pre- hospital critical care.

Methods

This research was determined to be exempt/excluded from Institutional Review Board (IRB) oversight in accordance with current regulations. The data was summarized and analyzed using a multivariable logistic regression in SPSS-28.

Study Period
Inclusive years July 1, 2016, to February 28, 2022

Inclusion Criteria
All adult trauma patients (≥18 years)

Analysis
Descriptive Statistics with a Multicollinearity Test and Logistic Regression

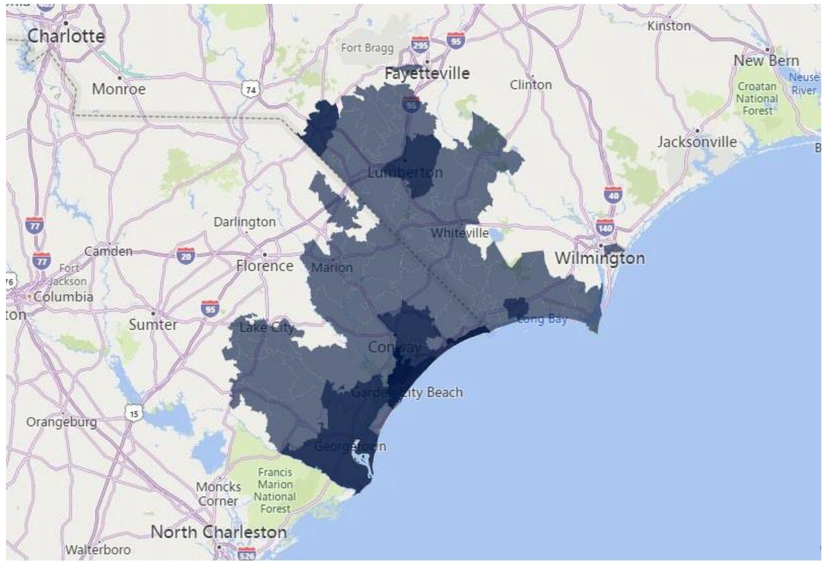
This research was supported (in whole or in part) by HCA Healthcare and/or an HCA Healthcare affiliated entity. The views expressed in this publication represent those of the author(s) and do not necessarily represent the official views of HCA Healthcare or any of its affiliated entities.

Results

Logistic Regression Analysis of All Adult (≥ 18 years) Trauma Patients, Inclusive Years July 1, 2016 to February 28, 2022 (N=19321)

Outcome/Dependent Variable: Scene Time Greater Than Eight Minutes	P-Value	Odds Ratio
Transferred In	<.01	.03
Pre-Hospital Cardiac Arrest	.03	3.08
Mode of Injury		
Gunshot Wound	<.01	.46
Motorcycle Collision	.01	.67
Pre-existing Comorbidity		
Alcohol Use Disorder	.03	1.65
Chronic Renal Failure	.05	3.36
Constant	<.01	.003

Heat map of all known injury zip codes relating to scene times greater than eight minutes during the study period.



Discussion

This South Carolina trauma system is mostly rural, there is only one adult Level I trauma center in a 112-mile radius. Due to the large catchment area it is imperative to utilize all current resources in place to improve the speed of treatment in the pre-hospital setting. In this current research, there was a higher likelihood of meeting the eight minutes or less guideline among particular mechanisms of injury that included gun violence and motorcycle trauma. One influence of prolonged scene times outside of the eight-minute window included out-of-hospital cardiac arrest (OHCA). Trauma patients who had a OHCA were 3.08 times more likely to have a scene time greater than eight minutes. A previous study found that EMS response time was prolonged in OHCA, particularly in rural communities; however, there were no statistically significant differences in 30-day survival when compared to early hospital arrival times.[4] This research identified several pre-existing comorbidities that predicted scene times greater than eight minutes. Adult trauma patients who had a diagnosis of alcohol use disorder were 1.65 times more likely to have a scene time grater than eight minutes. This could account for known challenges of poor communication and coordination with low quality victim management. Further, patients with chronic kidney disease (CKD) were 3.36 times more likely to have a scene time greater than eight minutes. CKD alters homeostatic pathways and adversely affects the respiratory, cardiac, and central nervous system on a microvascular level.[5,6] This comorbidity should not be overlooked in pre-hospital critical care.

Conclusion

This research identified an opportunity to improve rural trauma team response time, which is only reaching 63% of the patient population within eight minutes. Pre-hospital cardiac arrest and unique pre- existing comorbidities may play a role in extended response times by EMS.

References

1. S Vanga, P Ligrani, M Anderson. Effects of different crash data variables on EMS response time for a rural county in Alabama. *J Family Med Prim care*. 2022;11(4):1462- 1467. doi: 10.4103/jfmpc.jfmpc_1592_21
2. J Fitch. Response times: Myths, measurements and management. *J Emerg Med Serv*. 2005;30(9):46-56. https://pubmed.ncbi.nlm.nih.gov/16381089/
3. P Pons, V Markovchick. Eight minutes of less: Does the ambulance response time guideline impact trauma patient outcome? *J Emerg Med*. 2002;23(1):43-8. doi: 10.1016/s0736-4679(02)00460-2
4. K Ringgren, K Kragholm, F Lindgren, et al. Out-of-hospital cardiac arrect: Does rurality decrease chances of survival? Resusc Plus. 2022;9:100208. doi: 10.1016/j.resplu.2022.100208
5. N Ahmed, R Mathew, Y Kuo, et al. Risk of in-hospital mortaility in severe acute kidney injury after traumatic injuries: A national trauma quality program study. *Trauma Surg Acute Care Open*. 2021;6(1):e000635. doi:10.1136/tsaco-2020-000635
6. D Lorelli, K Kralovich, C Seguin. The impact of pre-existing end-stage renal disease on survival in acutely injured trauma patients. *Am Surg*. 2001:67(7):693-696. Retrieved September 23, 2022 https://pubmed.ncbi.nlm.nih.gov/11450792/