Injury Death and Access to Emergency Medical Care Across Massachusetts

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Abstract

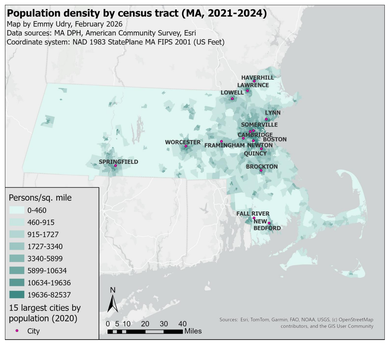
Access to emergency medical care (EMC), whether through emergency medical services (EMS) or emergency department (ED) visits, varies significantly across the state of Massachusetts (MA). Variation results from many factors (e.g., ambulance response times, proximity to an ED) and can significantly influence patient outcomes. This project analyzes how geographic accessibility of EMC resources varies across MA. Additionally, this project investigates the association between EMC resource access and accidental injury mortality rates (AIMR) across MA. Data on ambulance response times (RT), trauma center locations, and socioeconomic variables (e.g., poverty, population density) were aggregated from MATRIS, MA DPH, MassGIS, and the American Community Survey. Data were mapped and trends were analyzed in ArcGIS Pro. Bivariate access to EMC resources was determined from median ambulance RTs and drive time (DT) to the nearest trauma center. Strong geographic associations were found between low population density each of the following: high median ambulance RTs, poor trauma center access, and poor EMC access. A moderate geographic association was found between high median ambulance RTs and high AIMR. Such associations show the consequences (higher AIMR) of poor emergency medical resource distribution across MA.

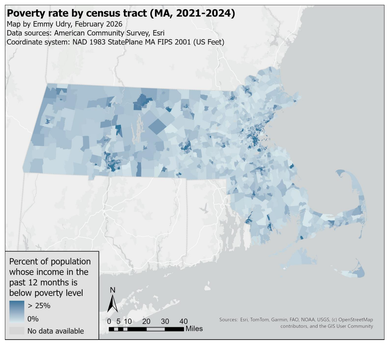
Introduction

In emergency medicine, the "Golden Hour" refers to the 60-minute time period following a traumatic injury when resuscitation and stabilization are most beneficial[1]. The goal of EMS is to stabilize a traumatic injury patient and transport them to definitive care within the "Golden Hour". A decrease in odds of patient mortality is seen when ambulance response times and/or transport times are decreased[1]. Response time is defined as the time from dispatch of EMS resources to the time that resource arrives on the scene of an emergency; transport time is defined as the time an ambulance leaves the scene of an emergency to the time it arrives at an ED.

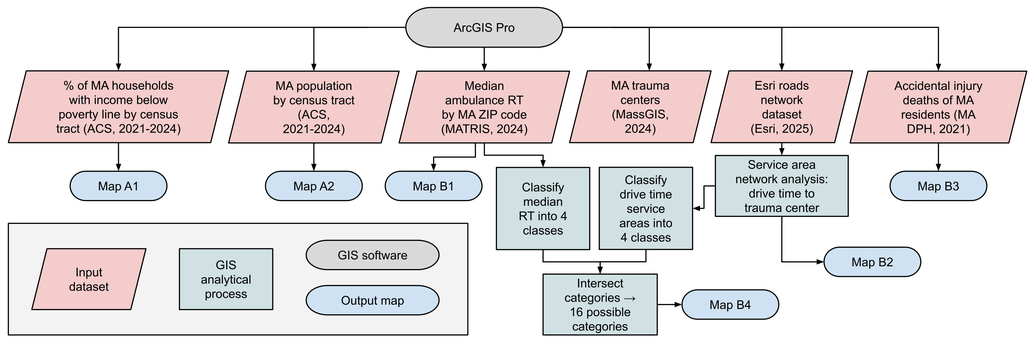
Access to healthcare is multi-dimensional[2] and influenced by many factors, from geographic to socioeconomic. Access to healthcare can be quantified through patient outcomes. However, patients do not exist in a vacuum, and social determinants of health cannot be disregarded. Accidental injury mortality rates (AIMR) are of particular interest in quantifying access to emergency care because the course of a traumatic injury is often more direct and isolated than that of an illness. Furthermore, geographic accessibility of emergency medical care (EMC) resources is of particular interest because of its direct influence on traumatic injury patient outcomes.

This project examines median ambulance response times (RT) by ZIP code and the time it takes to drive to the nearest trauma center in MA. These factors are considered separately and together to understand how access to EMC varies across MA. Additionally, AIMR trends are considered as a potential outcome of EMC access trends. Lastly, socioeconomic and demographic factors (population density and poverty rate) are considered as important context and potential social determinants.

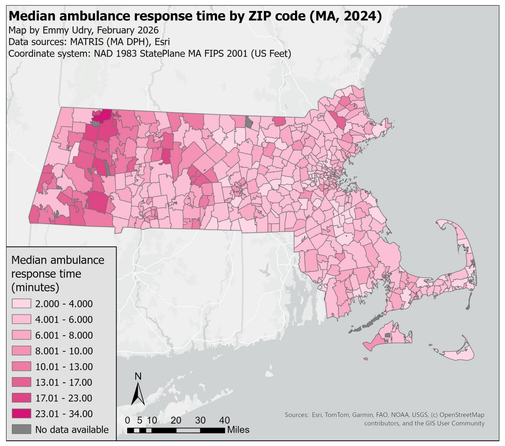


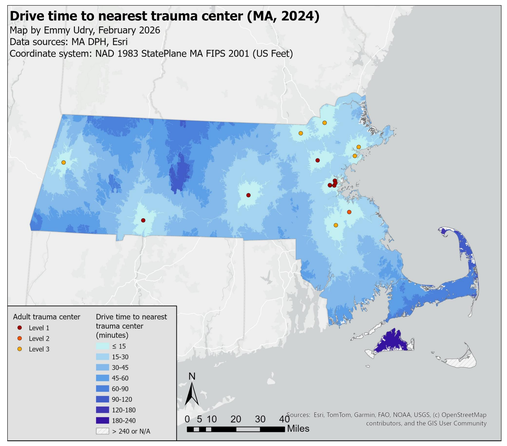


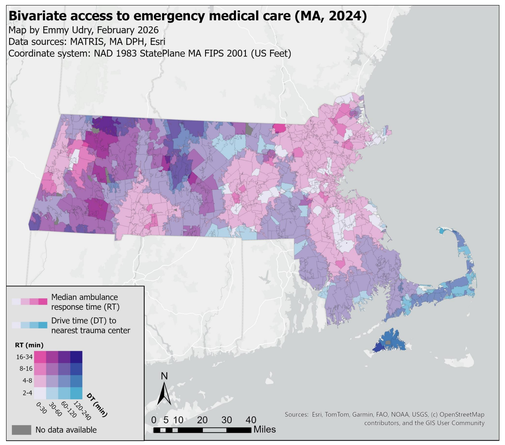
Methods

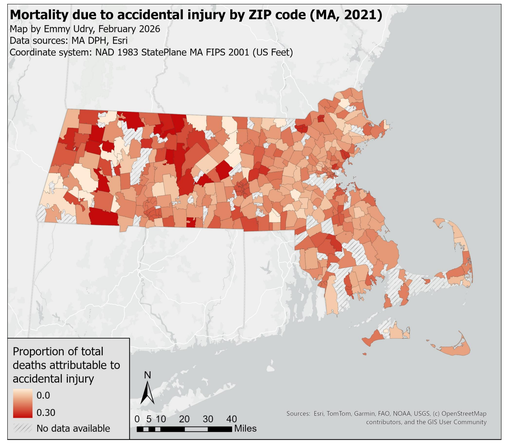


Results









Discussion

Hotspots of poor access to EMC are seen in many areas of Western and Central MA. Higher AIMRs are also seen in many of these areas, suggesting a possible association. Across MA, strong geographic associations are seen between low population density and each of the following: high median ambulance RTs, poor trauma center access, and poor EMC access. A moderate geographic association was also seen between high median ambulance RTs and high AIMRs. However, this research is not without limitations. Median ambulance RTs and AIMRs were not available for all MA ZIP codes. Additionally, drive time to out-of-state trauma centers was not considered, a possibility for many MA residents who live near the state border. Furthermore, all data was aggregate, so direct relationships between variables cannot be determined and only general trends can be visualized.

To solidify conclusions from these findings, further research must be done into EMS staffing numbers and models, shift structures, organizational models (career vs. volunteer vs. on-call), locations of EMS bases and posts, and locations of other first response organizations (fire departments and police stations). Additionally, further research into EMC access, AIMRs, and socioeconomic and geographic variables should be conducted to determine the direction and strength of the relationships between them. These findings and further research can provide critical insight into regions of poor access to EMC and in need of increased or redistributed EMC resources. Overall, these findings are a step towards increasing geographic equity in access to EMC resources across MA.

References

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