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RACISM, EQUITY AND DISPARITIES IN TRAUMA (S ROGERS AND TL ZAKRISON, SECTION EDITORS)

Disparities Among Trauma Patients and Interventions to Address Equitable Health Outcomes

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Abstract

Purpose of Review Examine the state of health disparities among trauma patients and review the current evidence on disparity interventions.

Recent Findings Successful interventions to address disparity among trauma patients include increasing trauma care accessibility in high demand locations, expansion of healthcare insurance, disrupting local and systemic practice through quality improvement frameworks, and identifying social drivers of health.

Summary Geography, race, ethnicity, income, and health insurance coverage continue to account for disparate health outcomes among trauma victims. These outcomes include healthcare accessibility, in-hospital mortality, and access to rehabilitative care among others. Current interventions to address these disparities are focused on improving healthcare accessibility, including specialized trauma centers, interrupting local practice, and understanding the role social determinants of health play into outcomes. Future research is needed to identify unmeasured determinants of health while continuing to address disparity at a healthcare level.

Keywords Trauma disparities · Health equity · Social determinants of health · Trauma advocacy · Healthcare accessibility · Health disparity

Introduction

Better technology, economic productivity, medical breakthroughs, and social reform have all increased living standards in the USA. However, these advances have not been shared among all and have led to a wide range of disparities. Health disparities are prevalent in the USA and it is increasingly recognized that the social determinants of health are a significant driving factor. The social determinants are a reflection of one's social environment and include the access to healthy food, sustainable housing, dependable jobs, and quality healthcare (see Fig. 1). A significant body of literature shows that people injured as a result of either blunt or penetrating trauma are commonly afflicted by disparities in health outcomes [1]. These disparities are associated with where an individual resides, their racial and ethnic background, their earned income, and whether they have health insurance [2]. Through an understanding of factors that contribute to disparate health outcomes and the interventions to address said gaps, we expect clinicians, policy makers, and healthcare advocates will be better prepared to address the root causes and close health outcome gaps among trauma patients.

This article is part of the Topical Collection on *Racism, Equity and Disparities in Trauma*

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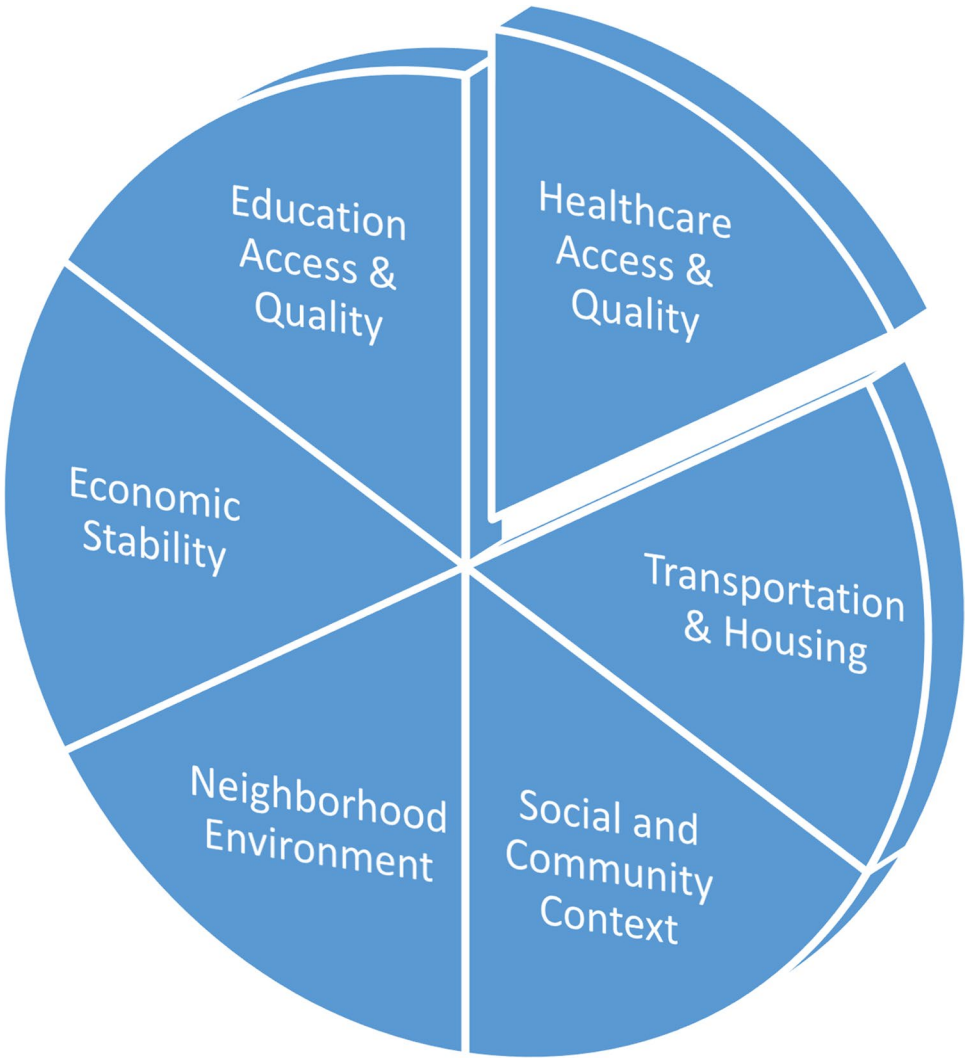

Fig. 1 Social determinants of health and the role of healthcare

Disparities in the Trauma Population

Trauma care should be first-come, first-serve, and should not depend on race, ethnicity, insurance coverage, or geography. However, these factors are each associated with reduced access to healthcare services and health outcome disparity [1]. While broader social drivers underpin these differences, identifying health outcomes that are most affected may provide opportunities for action at the healthcare level.

Healthcare Accessibility

Increased time and distance to healthcare intervention are associated with worse outcomes including mortality among those injured by trauma [3, 4]. As a result, people living in rural communities typically experience longer travel times to a trauma center. In fact, nearly 30 million US residents must travel more than 1 h to access level 1 or 2 trauma center care [5]. Living in a rural setting, poverty, and a lack of commercial health insurance are all strongly associated with more than 1-h travel time to a trauma center [5].

US trauma centers are most often found in dense, populated urban cities. Non-white patients including those from Black and Hispanic backgrounds more likely live within 1 h of a trauma center [5, 6]. The "golden hour" of trauma describing the 1-h time window to intervention has not reliably demonstrated improved outcomes including survival [7, 8]. And while urban cities are more likely to have trauma centers within 1 h of where many victims live, the time to intervention may be shorter than 1 h. Literature has suggested both penetrating and blunt trauma benefit from shorter intervention times, significantly shorter than 1 h, and that just a few minutes or miles can make differences in morbidity and mortality [3, 9, 10].

In-Hospital and Post-hospital Outcomes

The factors associated with reduced access to timely care such as income, insurance status, and race are also associated with increased hospital morbidity and mortality [5, 11]. Increases in hospital mortality and length of stay among traumatic brain injury patients are associated with a lack of commercial insurance coverage and to a lesser extent race [12]**.** Similarly, in pedestrian motor vehicle collisions, being of Black and Hispanic race (as compared to white) and lacking commercial insurance were associated with increased in-hospital mortality [13].

Access to rehabilitation centers and long-term care facilities after hospitalization is an important part of long-term trauma care and the lack of such resources can worsen long-term recovery from traumatic injury. Low socioeconomic status, lacking healthcare coverage, and race/ethnicity are all patient-related factors that have been associated with reduced access to post-trauma care. With respect to post-discharge healthcare utilization after trauma for otherwise similarly injured, matched patients, studies have observed that minority patients are less likely to receive rehabilitation after hospitalization even when controlling for insurance status and injury severity [14]. Minority patients also have fewer injury-related outpatient visits after discharge [15]. Among those with traumatic brain injuries, Black patients are more likely to experience a complication during care and less likely to receive outpatient rehabilitation services as compared to white patients [12].

Interventions Addressing Disparities

Interventions to reduce health outcome disparity among trauma patients focus on increasing trauma care accessibility, expanding healthcare coverage, restructuring workflow to address individual behavior, and better understanding of opportunities to address the social determinants of health at the hospital level. We will discuss these measures, the current available evidence, and how advocacy efforts can be targeted (see Table 1).

Trauma Deserts and the Lack of Accessible Care

Trauma deserts describe areas where trauma services are in high demand but in low supply. Factors that are associated with higher transport times and distances within dense, urban environments include Black race, lack of healthcare insurance coverage, and low income [16]. Efforts that have focused on opening trauma centers in trauma deserts to make trauma care more accessible have been shown to reduce morbidity and mortality in the trauma population [17]. A recent study measuring the impact of a new level one trauma center in a dense, urban US city found overall reductions in hospital transport times and a particularly pronounced effect among Black patients from low-income zip codes who previously experienced higher transport times compared to white patients [18]. The opening of the trauma center in this cohort was also associated with a 0.5% increase in survival for each 5-min decrease in transport time, further supporting the notion that the "golden hour" of trauma care is more nuanced [19].

Health outcome disparity among trauma patients also depends on the trauma center and its resources. Trauma centers in high demand but located in underserved and marginalized communities tend to be less resourced due to a combination of challenges that include less donor funding, lower rates of commercially insured patients, and higher complexity care [20]. Patient factors also contribute as patients from these underserved communities are more likely to seek care at these perceived less costly, closer to come, but under-resourced hospitals. As a result, healthcare outcomes including mortality, hospital length of stay, and hospital charges have been shown to be more dependent on the specific hospital administering the care and less dependent on one's neighborhood environment, age, injury severity, injury mechanism, and comorbidities [21].

While transferring patients to hospitals that are better suited for a particular problem and better resourced is an intuitive solution that can lift the burden of less-resourced hospital systems, it is often challenging to transfer patients. While patients with higher injury severity are more likely to be transferred, so are those with higher median household

Table 1 Current interventions addressing trauma disparities

Interventions addressing trauma disparities	Examples
Trauma center accessibility	Placing trauma centers in deserts; equipping low resource hospitals; facilitating inter-hospital transfers
Healthcare coverage	Expanding health insurance coverage
Legislative organization	Transparent data collection and storage; more centralized funding mechanisms
Individual and hospital level change	Quality improvement frameworks; leveraging healthcare information technology to identify bias and disparity; clinical decision support systems
Social determinants of health	Research further factors driving disparate outcomes; research into hospital level modifiable factors

incomes. Additionally, patients that are older, female, and Black or "other race"; earn lower median household income; live in low population density areas; and have a higher number of chronic conditions are less likely to be transferred [22].

Improving equitable resource allocation to hospitals caring for complex trauma patients remains an important focus of advocacy efforts to ensure that trauma centers are well equipped to handle the demands of such care.

Expansion of Healthcare Coverage

Because a lack of healthcare insurance has been associated with poorer healthcare outcomes, much work has gone into expanding healthcare coverage. Universal and equally accessible military insurance through Tricare has reduced racial disparities among trauma patients, including injury complications, hospital readmission, post-discharge healthcare utilization, and mortality [23]. In children, racial disparities in post-discharge care were eliminated with universal insurance (Tricare) presumably by increasing access to outpatient services broadly and within each racial group [24].

Passage of the Affordable Care Act was a transformational step to ensure broader healthcare coverage for US citizens. However, studies assessing the impact of the Affordable Care Act have conflicted. Studies have demonstrated reductions in uninsured rates, reduced delays in necessary care, and increased physician visits and reductions in disparity along racial and ethnic lines [25]. In trauma patients, expansion has improved rates of insurance coverage and reduced uninsured rates, but has not significantly reduced in-hospital mortality nor the rates of unplanned readmissions [26]. Additionally, the rates on post-discharge care utilization have been conflicted [27].

It remains unclear whether a lack of insurance coverage is the independent driver leading to worse health outcomes or merely a surrogate marker for factors involved in one's social determinants of health. The data on accessible health insurance is limited in that most studies have been collected and analyzed retrospectively through databases. Studies have suggested that the lack of insurance in a trauma population likely serves as a confounding variable and a marker for broader social determinants of health [11].

Coordinated Legislative Efforts

Trauma systems are managed by individual states whose trauma funding mechanisms differ. While this may lead to disparate outcomes, this remains a relative black box as the data are sparse and difficult to compare. Opportunities to coordinate management of trauma center data including funding and resource allocation at state and regional legislative levels would allow comparisons that could optimize and improve the efficiency and quality of trauma care provided in the USA [28].

Local Workflow and Practice

While many disparities in health outcomes are associated with factors outside the control of individual clinicians, increasingly successful frameworks have been applied that help curb disparity at the individual level.

Recent efforts focus on disrupting implicit bias, thereby increasing individual awareness of unconscious and unintentional drivers that may worsen disparity. While implicit bias training has its place, its effectiveness has been variable and it has not consistently shown to reduce healthcare disparities. Increasing research has approached bias and its resultant disparities through a quality improvement lens that focuses on systems of care that do not solely rely on the good will of people. Evidence has shown this to be successful in driving and supporting both personal and institutional accountability.

One such example is through healthcare information technology. By creating automatic systems that collect data including race/ethnicity, income, zip code, and insurance status, it provides opportunities for quality improvement methods to address healthcare gaps. The use of clinical decision support tools has been successfully used to identified clinician level disparities and form a basis for action on objective criteria [29, 30]. For example, an observational study found racial disparities in VTE prophylaxis among hospitalized trauma patients and after implementing a clinical decision-based support tool, rates of VTE improved and gaps were eliminated [29].

More broadly, systems that allow the collection of quality metrics can help hospital systems to identify disparities among their patients. Adjusting performance for race and ethnicity may minimize the impact of pay for performance and public reporting on hospitals that disproportionately care for minority patients by reducing the incentive to not care for poorer, higher risk patients. This would help link the gap between quality and equity which serves to address disparities in health outcomes and provides an important opportunity to link the value of performance measurement with improvements in quality of care [31].

The Role of Social Determinants of Health

Ultimately, healthcare is but one piece of the broad social milieu that contribute to outcomes in the USA. Many of the existing factors that drive important outcomes like the lack of economic resources and opportunities in underserved communities are lingering relics from historical policies that have set the stage for poorer performance along many indicators including healthcare outcomes. Because much of

the literature and data are retrospective, factors that directly drive the observed difference in outcome are not always clear nor definitive. For example, what is the impact that the lack of healthcare insurance has to directly drive mortality in trauma patients versus how much of the impact is attributed to additional co-existing factors such as the access to economic opportunities, education, social support networks, and other unmeasured variables. Along the same lines, there is a clear association of increased mortality among minorities injured by trauma**.** However, what are the cumulative effects of poverty, education, and living environment on outcomes and are there other important factors that we have yet to uncover? [1, 11].

The argument remains that there are likely unmeasured variables contributing to disparate outcomes and increased advocacy around more research is desperately needed. For example, increasingly the role of mental health and its impact on people injured by trauma has been described. People who live in areas that experience high rates of violent trauma experience significant levels of depression and post-traumatic stress disorder from prior personal trauma, adversity, neighborhood disadvantage, and poorer health. These factors that are important for normal functioning have been observed to effect preinjury health and in turn are associated with acute psychological reactions in almost half of trauma victims at 3 months after hospital discharge [32].

Advocacy efforts surrounding continued research into actionable determinants of health must be continued at individual, healthcare system, and societal levels in a coordinated fashion so that we continue to drive down disparity among trauma patients.

Conclusions

Geography, race, ethnicity, income, and health insurance coverage continue to account for disparate health outcomes among trauma victims. The extent to which these factors drive differences in healthcare accessibility, in-hospital mortality, and access to rehabilitative care among others and how much is attributable to other unmeasured social determinants of health is an important focus for future research. Additionally, continuing to address disparity at a healthcare level through better accessibility for trauma care, healthcare coverage, and coordinating efforts both legislatively and locally will continue to be important in providing equitable care and reducing health disparity in trauma patients.

Declarations

Conflict of Interest The authors declare no competing interests.

Human and Animal Rights and Informed Consent This article does not contain any study with human or animal subjects performed by any of the authors.

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