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Research Article

Ethnic differences in injury mortality rates among adult emergency healthcare service users in high-income countries: a scoping review

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Abstract

Background: Ethnic disparities in healthcare access and outcomes have been widely reported across different settings. In this scoping review, we aimed to explore whether adults from minority racial and ethnic backgrounds face higher risks of death after presenting with injuries to emergency healthcare services in high-income countries.

Methods: We searched five electronic databases [Cumulative Index to Nursing and Allied Health Literature, MEDLINE, Cochrane, Scopus and PsycInfo® (American Psychological Association, Washington, DC, USA)] for peer-reviewed studies published between January 2010 and March 2024. We included studies that compared mortality outcomes by race or ethnicity in emergency healthcare settings such as ambulance services, trauma centres and hospital emergency departments in high-income countries.

Results: Out of the 1873 articles identified, 32 met the inclusion criteria. Of these, 20 reported higher risk of mortality for ethnic minority patients compared to White patients following injury. Most studies were conducted in the USA with limited representation from other high-income countries such as Canada and Israel. This strong emphasis on USA-based research limits how well the findings apply to other countries with different healthcare systems. A major issue identified across the studies was the inconsistency in how race and ethnicity were recorded and reported. This lack of standardisation makes it difficult to compare results across studies and may hide the true extent of disparities.

Future work: To better understand and address ethnic disparities in trauma care, future research should adopt consistent and inclusive ethnicity coding to improve data quality and comparability across studies. Studies should be conducted in a wider range of high-income countries and include pre-hospital settings, where disparities may first appear. This will help build a more globally relevant evidence base. Researchers should also take an intersectional approach, examining how ethnicity combines with other social determinants to influence outcomes. In addition to mortality, future studies using longitudinal and mixed-methods designs should explore long-term recovery and access to rehabilitation to gauge the full impact of these health disparities.

Limitations: The review focused solely on mortality outcomes, limiting insight into broader health outcomes such as long-term recovery, quality of life or patient experiences. It also did not explore how ethnicity interacts with other social factors such as gender, income, disability or immigration status. These gaps obscure the full extent of inequalities in emergency care.

Conclusion: This review adds to the growing evidence that ethnic minority patients in high-income countries could be at a higher risk of injury-related deaths. However, inconsistent ethnicity coding and a USA-centric evidence base limit the generalisability of findings. To create fairer and more effective emergency care systems, future research

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must improve data quality, broaden its geographic scope and consider the complex social factors that shape health outcomes.
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Introduction

The burden of injury is increasing worldwide. In 2019, 4.4 million people died due to unintentional or intentional injuries, accounting for approximately 8% of all global deaths.[1] Epidemiological and observational studies have reported a rising burden of injury in both high-income countries (HICs)[2–5] and low-middle-income countries,[5–8] underscoring an urgent need for healthcare systems to address the growing challenges posed by injury.

Ethnic disparities in access to care and the use of services have been frequently reported in different healthcare settings.[9,10] Studies exploring the disproportionate effect on injury outcomes among ethnic minority populations have mostly focused on the paediatric population.[11–21] However, little international literature exists on disparities in injury outcomes in adults.[22–24] Existing reviews included papers only from the USA[10,22,23] or Canada.[24] Systematic review and meta-analysis of studies in the USA[10,22,23] and Canada[24] have observed that patients from minority ethnic backgrounds experienced worse injury outcomes compared to their White counterparts.[22,23] However, no existing reviews have described the disparities in outcomes experienced by people from ethnic minority backgrounds across multiple HICs[25] when they use emergency healthcare services for injuries.

These disparities are not only a reflection of an individual patient's characteristics but are often rooted in deep systemic issues within the healthcare systems, combined with the wider determinants of health,[26] for example, the difference in healthcare policies in HICs, such as the presence of universal healthcare coverage within Europe and the UK, and the lack of that in the USA.[27] The 2023 Commonwealth Fund, International Health Policy (IHP) Survey[28] highlighted that adults in the USA experienced highest income-related disparities in healthcare affordability compared to the adults in other HICs. The same survey also reported that adults in HICs, such as Germany and the Netherlands, faced the lowest income-related disparities in healthcare affordability. Such differences not only exist between different HICs but also within each HIC in terms of geographical health disparities, that is, urban and rural health care. A secondary analysis of the 2020 Commonwealth Fund IHP cross-sectional survey across adults of 11 HICs (Australia, Canada, France, Germany, the Netherlands, New Zealand, Norway, Sweden, Switzerland, the UK and the USA) revealed that adults residing in rural areas of the USA were the most likely to forgo necessary medical care. By contrast, adults living in rural areas in Norway and Sweden were among the least likely to report unmet healthcare needs.[29]

Building on the findings of the previous reviews, the current scoping review aims to describe the peer-reviewed published literature by comparing mortality by race or ethnicity of injured adults presenting to emergency healthcare services in HICs. This review forms part of the larger mixed-methods study – Building an understanding of Ethnic minority people's Service Use Relating to Emergency care for injuries (BE SURE).[30] The findings of this scoping review will inform the subsequent qualitative and quantitative analysis of the BE SURE study.

Methods

Review design

This scoping review was conducted following the Joanna Briggs Institute (JBI)[31] methodology and drew on ideas from the scoping review methodology, as proposed by Arksey and O'Malley.[32] The Preferred Reporting Items for Systematic Reviews and Meta-Analysis Extension for Scoping Reviews (PRISMA-ScR)[33] and JBI reporting checklists were used in designing and delivering this scoping review.

Eligibility criteria

Articles reporting a comparison of mortality by ethnicity among injured adults presenting to emergency healthcare services in HICs were included. Articles focusing exclusively on children (below 18 years of age) were excluded due to the existence of numerous published narrative, systematic, scoping and literature reviews and observational studies reporting on this population.[11–21] To capture *the* maximum number of articles satisfying the inclusion criteria, studies reporting on both adults and children were included if the median age of the cohort was above 18 years.

In health research, the terms race and ethnicity are often used interchangeably due to a lack of universally accepted

definitions.[34,35] Therefore, a pragmatic decision was made to include papers reporting on either race, ethnicity or both. All minority racial and ethnic groups, as reported by the authors of the included studies, were grouped into a single broad category of 'ethnic minority populations'. This group was then compared with the broad category of 'majority ethnic populations' consisting of all the majority racial and ethnic groups as defined by the study authors. The authors of the included studies defined ethnic minority populations as Black, African American, Asian, Hispanic/Latino, non-Hispanic Black, Native American, Native Hawaiian/Pacific Islander, On-reserve Canadians and Israeli Arabs. And the ethnic majority populations were White, Off-reserve Canadians and Israeli Jews.

Similarly, the terms 'injury' and 'trauma' are inconsistently defined across the literature. Some studies refer to 'traumatic injury', others use trauma or 'injury' interchangeably, often without clear distinctions. To ensure consistency in this review, a pragmatic decision was made by the review team to include studies mentioning physical injuries and traumatic injuries; specifically, those that are severe and life-threatening injuries, For the purposes of this scoping review, the term 'injury' is used to encompass both general injuries and traumatic injuries. We excluded papers mentioning psychological trauma.

Studies were excluded if they did not mention race or ethnicity, did not specify injury as the cause for seeking emergency health care, failed to present mortality data disaggregated by race or ethnicity or focused on non-emergency care settings such as scheduled appointments, outpatient department services and elective procedures. The inclusion and exclusion criteria were guided by the Participants, Concept, Context framework, as recommended by the JBI for Scoping Reviews[31] (*Table 1*).

Data sources and search strategy

Five electronic databases [Cumulative Index to Nursing and Allied Health Literature, MEDLINE, Cochrane, Scopus and PsycInfo® (American Psychological Association, Washington, DC, USA)] were searched for peer-reviewed articles that fulfilled the eligibility criteria. The reference list of all the primary studies and the identified systematic[22,23] and scoping reviews[10,24] were hand-searched for relevant studies. A concept table was developed and reviewed by the university librarian before conducting the search.

The search strategy was developed based on two research questions: first, 'What is the relationship between mortality rates and the racial or ethnic background of injured adults who seek emergency healthcare services in high-income countries?' Second, 'How are race and ethnicity documented in the studies included in this review?' To address these questions, the database search comprised five concept clusters: (1) population, (2) emergency healthcare service use, (3) patient category, (4) clinical care and (5) injury (see *Report Supplementary Material 1*). AK and GN conducted the initial search by combining five concept clusters with the Boolean operator AND (see *Report Supplementary Material 1*). The date limit applied

TABLE 1 Inclusion and exclusion criteria

	Inclusion criteria	Exclusion criteria
Participants	Adults with race, ethnicity or both reported and recorded presenting to emergency healthcare services with injuries, including traumatic injuries	Studies reporting paediatric population only. People with no ethnicity or race recorded; no injury reported or no use of emergency healthcare services. People using emergency healthcare settings for psychological trauma
Concept	Results reporting all cases of adult mortality compared by race, ethnicity or both	Results with no mention of mortality, results reporting mortality for one population group
Context	Ambulance, ED or TC[a] Organisation for Economic Co-operation and Development countries, HICs, as defined by the World Bank[25] Papers extracted from citation search of the identified systematic review and scoping review Languages – any Full-text papers Dates – January 2010–March 2024	Non-emergency care settings, i.e. intensive care unit referrals/treatment, community, primary care, outpatients, elective surgery Low- to middle-income countries Papers/reports presenting no results, including protocols and commentaries

ED, emergency department; TC, trauma centre.
a Trauma centre – In the USA, emergency healthcare facilities that are equipped to deal with injuries and accidents are defined as TCs.[36]

to the search was from 1 January 2010 to 13 May 2022. Later, the search was updated to the following date limit: 1 January 2010–21 March 2024.

Evidence screening and selection of sources

An initial two-stage screening of titles and abstracts was independently conducted by two reviewers (GN and AK) to determine the eligibility of the articles for inclusion. In cases where a consensus could not be reached, a senior researcher (HS) was consulted. During the full-text screening stage, three reviewers (GN, FB and SH) independently assessed each article, ensuring that every paper was assessed by at least two reviewers. Any disagreements during this stage were resolved through team discussions (including GN, FB, SH, HS and AK), with final decisions made by a senior member of the review team (AK). The study selection process is illustrated in the PRISMA-ScR Flow diagram (*Figure 1*).

Primary reviewer (GN) hand-searched citation lists of all included papers to identify further eligible papers. The review team (GN, FB, SH, AK and HS) agreed to a final list of papers for data extraction. As per the updated JBI guidelines for conducting scoping reviews, a formal quality assessment or critical appraisal was not performed, as the primary objective of a scoping review is to map the existing evidence base rather than provide a clinically focused answer to a specific research question.[37]

Data charting

A standardised template for data extraction adapted from JBI was developed in a Microsoft Excel® (Microsoft Corporation, Redmond, WA, USA) spreadsheet. The data extraction template included the following categories: study date, location, sample size, number of study sites, study design, age, source(s) of data collection, population, outcome of comparison mortality and statistical summary (see *Report Supplementary Material 2*). Prior to data extraction, this template was piloted by each reviewer (GN, FB and SH) on two papers and necessary changes were made to produce the final data extraction template.

Following the piloting of the data extraction table, each reviewer independently extracted data from one-third of the papers included in the final screening stage. The review team (GN, FB, SH, AK and HS) met fortnightly in a hybrid meeting [combining face-to-face and Zoom (Zoom Video Communications, San Jose, CA, USA) meetings] during the evidence synthesis, screening and data extraction phases to monitor progress and address any emerging issues. Any disagreements during data extraction were resolved in team meetings, with critical input from senior members of the review team (AK and HS).

Patient and public involvement

The progress of the review was also shared with the wider members of the research team during regular quarterly Research Management Group (RMG) meetings and Study Steering Group meetings. Both groups included lay public contributors who commented on our approach to the review and interpretation of results. They offered insights into how the findings might be applied in real-world settings and the language used to communicate findings. The final version of this scoping review manuscript was completed after incorporating feedback from the RMG.

Results

Overview

A total of 1873 studies were identified in the initial search; after removing 284 duplicates, 1589 were eligible for title screening. Following title and abstract screening, 30 articles were eligible for full-text screening, of which 13 met the inclusion criteria. An additional eight articles were identified through hand-searching systematic[22,23] and scoping reviews.[10] A further 11 articles were identified through hand-searching the reference list of the eligible full-text papers; therefore, a total of 19 papers were included through hand search. Overall, a total of 32 articles were deemed eligible for inclusion in the review.

Characteristics of included studies

Study setting and location

Of the 32 articles included in this scoping review, most (n = 29)[38–66] were from the USA, 2 were from Israel[67,68] and 1 from Canada.[69] In terms of study settings where reported, 25 studies[38–40,42–50,52–56,58,59,64–67,69] were conducted in trauma centres (TCs), 4 in hospital EDs[46,47,57,68] and 3 in pre-hospital settings[51,60,63] (*Table 2*). According to the American Trauma Society, a TC in the USA is a specialised emergency healthcare facility that provides care for patients with severe and life-threatening injuries. These centres are designated at various levels (I–V) based on the resources available and the volume of patients treated.[36]

Data sources

Almost half (n = 18) of the included papers reported data from the NTDB of the USA.[39,40,43,45,47–50,52–56,59,61–64] Five studies presented NTDB data spanning from 2002 to 2006,[39,40,45,52,64] while three reported NTDB data from 2002 to 2012.[55,56,63] One study reported NTDB data from 2003

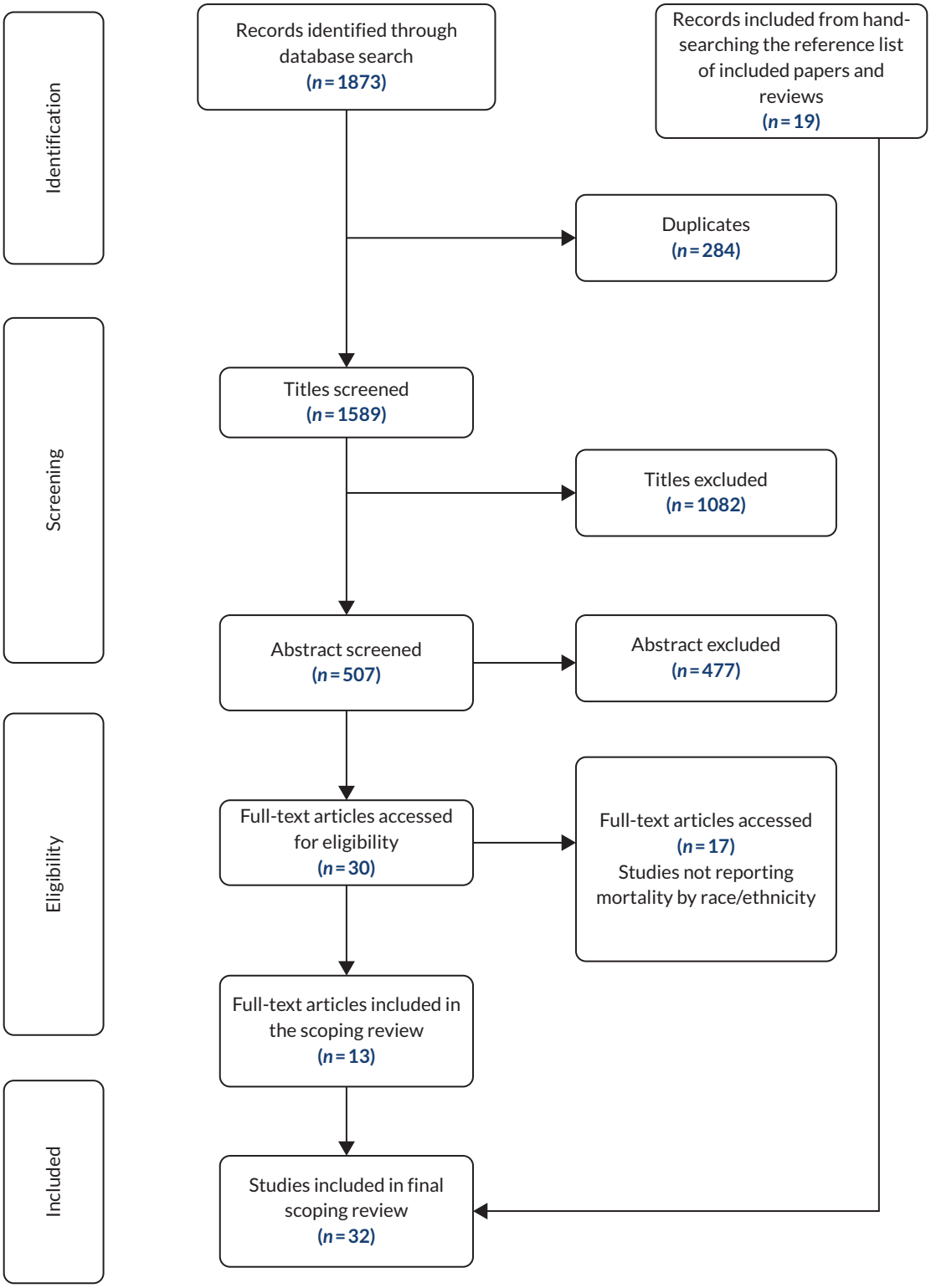

FIGURE 1 The PRISMA-ScR flow chart.

to 2010,[54] and another did not specify the exact date of the NTDB data used.[53] The remaining eight papers reported NTDB somewhere between 2007 and 2015.[43,47–50,57,59,61,62] Additionally, two of the studies reported data from the Israeli National Trauma Registry (INTR) from 2008 to 2017.[67,68]

Other included papers reported data from varied sources, including the British Columbia Trauma Registry (BCTR) and the British Columbia Coroner's Service (BCCS),[69] Data repository of the Military Health System (MHS),[38] the New York State Department of Health State-wide planning and

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TABLE 2 Summary of study characteristics

Study, date	Location, study setting	Sample size	Study design	Age of the study population (years)	Data source(s)	Study population as defined by the authors	Outcome of comparison mortality	Definition/s of mortality
Chaudhary *et al.*, 2018[38]	USA, TCs	87,112	Retrospective cross-sectional routine data analysis	18–64	Data repository of the MHS; 2006–14	White, Black, others and missing patients	No significant difference between Black and White patients in 30 days post discharge risk-adjusted mortality rate and 90 days post discharge risk- adjusted mortality rate for traumatic injuries	30 days post discharge mortality and 90 days post discharge mortality
Crompton *et al.*, 2010[39]	USA, TCs	53,121	Retrospective cross-sectional routine data analysis	≥ 18	NTDB; 2002–6	White, Black and Hispanic patients	Higher odds of mortality were observed in Black patients compared to White patients after a motorcycle crash	In-hospital mortality
Downing *et al.*, 2011[40]	USA, TCs	192,488	Retrospective cross-sectional routine data analysis	19–30	NTDB; 2002–6	White and minority patients	Minority trauma patients had decreased survival than White patients.	In-hospital mortality
Dy *et al.*, 2016[41]	USA, EDs	197,290	Retrospective cross-sectional routine data analysis	All ages	New York State Department of Health State-wide Planning and Research Cooperative System; 1998–2010	White, Black, Asian, other and missing patients	Black patients were at greater risk for 1-year mortality than White patients with hip fractures	In-hospital mortality within 1 year after hip fracture surgery
Elkbuli *et al.*, 2022[42]	USA, TCs	6453	Retrospective cross-sectional routine data analysis	All ages	ACS-TQP-PUF; 2016–8	White/Caucasian Black/African American, Asian, Other and unknown patients	White/Caucasian patients experienced a significantly lower overall adjusted mortality after ED resuscitation	After leaving ED/ED transfer
Gerry *et al.*, 2016[43]	USA, TCs	739,149	Retrospective cross-sectional routine data analysis	18–64	NSP of the NTDB; 2010–2	White, Black and other race	Black race was associated with a significant predictor of mortality for severely injured patients	In-hospital mortality
Glance *et al.*, 2013[44]	USA, TCs	191,887	Observational l cohort study	≥ 16	Data from Pennsylvania Trauma Outcome Study; 2000–9	Black and White	Trauma patients admitted in hospitals, and high concentrations of Black patients (> 20%) had approximately 75% higher odds of death than trauma patients in hospitals treating low proportions of Blacks (< 3%)	In-hospital mortality

Study, date	Location, study setting	Sample size	Study design	Age of the study population (years)	Data source(s)	Study population as defined by the authors	Outcome of comparison mortality	Definition/s of mortality
Greene *et al.*, 2010[45]	USA, TCs	1E+ 06	Retrospective cross-sectional routine data analysis	≥ 65	NTDB; 2002–6	White, Black, Hispanic and Other	Compared to White patients, Black, Hispanic and Asian patients have higher odds of in-hospital trauma mortality	In-hospital mortality
Grenn *et al.*, 2022[46]	USA, TCs	24,019	Retrospective cross-sectional routine data analysis	≥ 18	UMMC; 2010–20	Non-Hispanic White, non-Hispanic Black, White and Black patients	Black trauma patients had lower overall adjusted odds of mortality rates than White's trauma patients	In-hospital mortality
Haider *et al.*, 2012[47]	USA, EDs	311,568	Retrospective cross-sectional routine data analysis	18–64	NTDB; 2007–8	White, Black and Hispanic patients	White, Black and Hispanic patients treated at hospitals with higher proportions of minorities (Black and Hispanic patients combined) had higher odds of death than patients treated at hospitals with > 50% White patients	In-hospital mortality
Haider *et al.*, 2013[48]	USA, TCs	556,720	Retrospective cross-sectional routine data analysis	≥ 16	NTDB; 2007–10	White, Black, Hispanic, Black and Hispanic combined patients	White, Black and Hispanic trauma patients treated at low mortality TCs (predominantly consisting of White patients) had a higher chance of survival than the patients of similar race/ethnicity and equivalent injuries treated at high mortality TCs (predominantly consisting of patients from ethnic minority backgrounds)	In-hospital mortality
Haines *et al.*, 2018[49]	USA, TCs	152,655	Retrospective cross-sectional routine data analysis	≥ 15	NTDB; 2007–12	Asian, Black, Native American, White, Hispanic, non-Hispanic and other patients	Hispanic and Asian thoracic trauma patients had slightly higher odds of death compared to White thoracic trauma patients. However, no significant differences were noted in the Black and Native American patients compared to White patients	In-hospital mortality

continued

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TABLE 2 Summary of study characteristics (*continued*)

Study, date	Location, study setting	Sample size	Study design	Age of the study population (years)	Data source(s)	Study population as defined by the authors	Outcome of comparison mortality	Definition/s of mortality
Haines *et al.*, 2019[50]	USA, TCs	131,461	Retrospective cross-sectional routine data analysis	15–89	NTDB; 2012–5	Asian, Black, Native American, White, Hispanic, non-Hispanic and other patients	Asian, Black and Native American TBI patients had slightly lower percentages of mortality than White TBI patients Similarly, Hispanic White TBI patients had lower percentages of mortality than non-Hispanic White TBI patients	In-hospital mortality
Haskins *et al.*, 2013[51]	USA, pre-hospital and ED	5861	Retrospective cross-sectional routine data analysis	≥ 15	NASS-CDS; 2000–8	White, Black and Hispanic	Black, White and Hispanic patients injured in a car crash all had similar odds of survival up to reaching the hospital. However, when treated at a hospital, Blacks were less likely to survive compared to White patients	1. Died on the scene of an accident or in transit. 2. Died within 30 days of being treated at the hospital
Losonczy *et al.*, 2014[52]	USA, TCs	760,598	Retrospective cross-sectional routine data analysis	18–64	NTDB; 2002–6	White, Black and Hispanic patients	The odds of death were significantly higher in Black and White uninsured, moderately injured patients However, for all uninsured and minority patients with severe injury, the odds of death were significantly higher than the insured White reference group	In-hospital mortality
Maybury *et al.*, 2010[53]	USA, TCs	26,404	Retrospective cross-sectional routine data analysis	≥ 16	NTDB; exact date not mentioned	White, African American and Hispanic patients	African American and Hispanic pedestrian crash patients had higher odds of death compared to White patients	In-hospital mortality
McClellan *et al.*, 2013[54]	USA, TCs	708	Retrospective cross-sectional routine data analysis	All ages	NTDB; 2003–10	Black, White, Hispanic and other race	Black race was found to be an independent risk factor for mortality in patients in extremis	In-hospital mortality
McQuistion *et al.*, 2016[55]	USA, TCs	142,004	Retrospective cross-sectional routine data analysis	14–89	NTDB; 2002–12	White, Black, Hispanic, Asian, Native American patients	Asian patients had equal odds of death compared to White patients following a TBI. Black and Hispanic patients were less likely to die in hospital. Native American patients showed no significant differences from White people for in-hospital mortality	In-hospital mortality

Study, date	Location, study setting	Sample size	Study design	Age of the study population (years)	Data source(s)	Study population as defined by the authors	Outcome of comparison mortality	Definition/s of mortality
Moreira *et al.*, 2015[56]	USA, TCs	58,626	Retrospective cross-sectional routine data analysis	18–65	NTDB; 2002–12	White, Black and Hispanic patients	Black patients had higher odds of overall mortality compared to White and Hispanic patients following arterial trauma	In-hospital mortality
Nistler *et al.* 2023[57]	USA, EDs	4191	Retrospective cross-sectional routine data analysis	Exact age not specified	Boston Violence Intervention Advocacy Program	White, Black and Hispanic patients	Black patients had a lower risk of death compared to White patients after initial penetrating injuries and within 3 years	1-year and 3-year all- cause mortality after being discharged from an ED for an initial penetrating injury
Oyeniyi *et al.*, 2017[58]	USA, TCs	15,874	Retrospective cross-sectional routine data analysis	≥ 16	Trauma registry, morbidity and mortality reports,autopsy reports and electronic medical records; 2005–6 and 2012–3	Black, Hispanic/ Latino, Other and White race/ ethnicity	No differences in mortality by race or ethnicity were observed in TBI patients over two time periods (2005–6) and (2012–3)	In-hospital mortality, including patients who were dead on arrival
Polites *et al.*, 2018[59]	USA, TCs	348,394	Retrospective cross-sectional routine data analysis	≥ 16	NTDB; 2010–2	White, American Indian, Black, Native Hawaiian/ Pacific Islander, unknown and other patients	Black, Native Hawaiian or Pacific Islander, unknown and other race patients had increased adjusted odds of death compared to White severely injured patients	In-hospital mortality
Ray *et al.*, 2020[60]	USA, pre-hospital	2204	Retrospective cross-sectional routine data analysis	Exact age not specified	MCCO linked data to IEMS records; 2011–8	White and Black patients	Compared to White, Black decedents were more likely to have died at the last EMS event and to have had their only EMS event occur on the same day as death	EMS drug overdose deaths
Schoenfeld *et al.*, 2013[61]	USA, TCs	75,351	Retrospective cross-sectional routine data analysis	Exact age not specified	NSP of NTDB; 2008	White, non-White, Black/African American (Black is a subset of non-White) race	Non-White race and Black/ African American race had significantly increased risk of mortality after spinal trauma compared to White race	In-hospital mortality
Scott *et al.*, 2013[62]	USA, TCs	1,063,314	Retrospective cross-sectional routine data analysis	16–64	NTDB; 2007 and 2010	White and Black patients	The adjusted relative risk of mortality was significantly lower for White patients compared to Black patients	In-hospital mortality

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TABLE 2 Summary of study characteristics (*continued*)

Study, date	Location, study setting	Sample size	Study design	Age of the study population (years)	Data source(s)	Study population as defined by the authors	Outcome of comparison mortality	Definition/s of mortality
Scott *et al.*, 2019[63]	USA, pre-hospital and ED	76,032	Retrospective cross-sectional routine data analysis	All ages	NTDB; 2002–12	White, Black, Hispanic, API and other patients	Black and Hispanic trauma patients were more likely to die from head and neck injuries sustained in bicycle-related accident than White patients	In-hospital (ED and TC) and outside ED and TC
Singer *et al.*, 2013[64]	USA, TCs	541,471	Retrospective cross-sectional routine data analysis	≥ 15	NTDB; 2002–6	White, Asian, Black, Hispanic, other patients	For younger (15- to 64-year-olds) blunt trauma patients, Black race and Hispanic ethnicity were associated with higher in-hospital trauma compared to White trauma patients. For elderly (≥ 65 years old) trauma patients, Hispanic ethnicity was associated with increased mortality. However, Black and White race patients had similar mortality and Asian race patients were associated with reduced mortality	In-hospital mortality
Strong *et al.*, 2016[65]	USA, TCs	7541	Retrospective cross-sectional routine data analysis	All ages	National Death Index: exact date not specified	White and Black	Elderly (≥ 65 years old) Black patients sustaining a fall had a slightly higher risk of in-hospital mortality than elderly White patients, although clinical significance is unclear However, 1-year post discharge, Black patients younger than 65 years old had higher odds of disease-related mortality compared with White patients	Injury and disease-related in-hospital and 1-year post discharge mortality
Tepas *et al.*, 2011[66]	USA, TCs	8758	Retrospective cross-sectional routine data analysis	≥ 18	Florida Agency for Healthcare Administration; exact date not specified	White, Black, Hispanic and other non-White patients	Neither race nor ethnicity was associated with an increased risk of mortality for trauma patients sustaining motor vehicular crash	In-hospital mortality
Abdel-Rahman *et al.*, 2019[67]	Israel, TCs	96,795	Retrospective cross-sectional routine data analysis	≥ 65	INTR; 2008–17	Israeli Jews and Israeli Arabs	No significant ethnic disparities in mortality among elderly trauma patients in Israel	In-hospital mortality

Study, date	Location, study setting	Sample size	Study design	Age of the study population (years)	Data source(s)	Study population as defined by the authors	Outcome of comparison mortality	Definition/s of mortality
Tiruneh *et al.*, 2020[68]	Israel, EDs	11,523	Retrospective cross-sectional routine data analysis	All ages	INTR; 2008–17	Israeli Jews and Israeli Arabs	The risk of in-hospital mortality was significantly higher among Israeli Arab road traffic accident patients than Israeli Jewish road traffic accident patients	In-hospital mortality
Bell *et al.*, 2011[69]	Canada, TCs	5811	Retrospective cross-sectional routine data analysis	All ages	The BCTR and BCCS; 2001–5	On-reserve and Off-reserve Canadians	Higher intentional and unintentional deaths due to injury were observed in on-reserve/aboriginal Canadians than in off-reserve/non-aboriginal Canadians	In-hospital mortality

ACS-TQP-PUF, American College of Surgeons Trauma Quality Programs Participant Use File; API, Asian/Pacific Islander; EMS, emergency medical services; IEMS, Indianapolis Emergency Medical Services; MCCO, Marion County Coroner's Office; NASS CDS, National Automotive Sampling System Crashworthiness Data System; NSP, National Sample Program; NTDB, National Trauma Data Bank; TBI, traumatic brain injury; UMMC, University of Mississippi Medical Centre.

Research Cooperative System,[41] the ACS-TQP-PUF,[42] data from Pennsylvania Trauma Outcome Study,[44] the UMMC,[46] the NASS CDS,[51] the Boston Violence Intervention Advocacy Program,[57] the Trauma registry morbidity and mortality reports, autopsy reports and electronic medical records,[58] the MCCO linked data to Indianapolis Emergency Medical Services (IEMS),[60] the National Death Index[65] and Florida Agency for Healthcare Admissions.[66]

Race, ethnicity or both as reported by the authors

Among the included studies, six[39,48,51,52,56,57] reported a comparison between White, Black and Hispanic patients. Four[44,60,62,65] studies reported a comparison between Black and White patients and one[43] reported a comparison between White, Black and other patients. Furthermore, two[67,68] studies reported a comparison between Israeli Jews and Israeli Arabs. Two studies[49,50] compared Asian, Black, Native American, White, Hispanic, non-Hispanic and other patients. Additionally, two[45,54] papers reported a comparison between White, Black, Hispanic and other patients. The remaining papers each reported a unique comparison including – White, Black, Hispanic and other patients;[45] White, Black, Hispanic, Black and Hispanic combined;[47] on-reserve and off-reserve Canadians;[69] White and minority patients;[40] White, Black, Asian, other and missing patients;[41] White/Caucasians, Black/African American, Asian, other and unknown patients;[42] White, African American and Hispanic patients;[53] non-Hispanic White, non-Hispanic Black, White and Black patients;[46] White, Black, Hispanic, Asian and Native American patients;[55] Black, Hispanic/Latino, other and White race/ethnicity;[58] White, American Indian, Black, Native Hawaiian/Pacific Islander, unknown and other patients;[59] White, non-White, Black/African American (Black is a subset of non-White) patients;[61] White, Black, Hispanic, Asian/Pacific Islander (API) and other patients;[63] White, Black, Hispanic, API and other patients;[64] White, Black, Hispanic and Other non-White patients.[66] *Figure 2* depicts how race and ethnicity were coded by the authors of the included studies.

Age of study population

In terms of age of the study population, nine studies[38–40,43,46,48,52,56,57,66] reported data on patients aged ≥ 18 years; seven papers[38,41,42,54,63,65,68] included patients of all age groups; six studies[44,48,53,58,59,62] reported data for patients aged 16 years or older; five studies[49–51,55,64] reported data on patients aged ≥ 15 years and two[45,67] reported data on patients aged 65 years or older. Two papers[60,61] did not specify age criteria for inclusion (*Table 3*).

Outcome of comparison of mortality by ethnicity

Higher mortality was noted in Israeli Arabs,[68] on-reserve/aboriginal Canadians,[69] Black, Hispanic and Asian groups,[40] Black/African American,[39,41–43,45,51–54,56,59–65] Hispanic[45,49,52,53,63,64] Asian,[42,45,49] Native Hawaiian or Pacific Islander patients,[59] non-White[56] unknown,[42,59] and other patients.[42,59] In comparison, mortality was lower in Israeli Jews,[68] off-reserve Canadian,[69] White,[39–41,45,49,51,53,54,56,59–65] White/Caucasians[42] and Hispanic[56] patients. In a subgroup analysis, one study[64] reported no difference in mortality between elderly (≥ 65 years old) Black and White patients who sought emergency care for injuries and accidents. However, the study reported reduced mortality rates in elderly (≥ 65 years old) Asian patients compared to White, Black, Hispanic and other patients (see *Table 2*).

Six of the included studies[38,51,55,58,66,67] reported no significant difference in mortality across various ethnic groups. However, within subgroup analyses, one study[51] indicated an increased risk of mortality in Black patients compared to White patients when treated in hospital ED, while another study[55] reported a decrease in hospital mortality in Black patients compared to White patients (see *Table 2*). Additionally, some studies[46,50,57] reported reduced mortality among ethnic minority patients compared to those from majority ethnic groups. For instance, one study[46] indicated reduced mortality among Black patients compared to non-Hispanic White patients, with similar findings for Asian, Black and Native American patients. Another study[50] reported reduced mortality in Hispanic White patients compared to non-Hispanic White patients. Finally, one study also observed lower mortality in Black patients compared to White patients[57]

Three studies[44,47,48] examined mortality outcomes based on the proportion of minority (Black and Hispanic) patients being treated at a hospital. These studies found that trauma patients of all racial and ethnic backgrounds seeking emergency health care for injuries and accidents had higher mortality rates when treated at hospitals with higher concentration of minority patients when compared to patients with similar injuries treated at hospitals with lower proportions of minority patients (Black and Hispanic).

Discussion

Overview

With only a limited number of studies identified outside the USA, this scoping review observed higher mortality rates among people from ethnic minority backgrounds presenting to the emergency healthcare services with injuries in HICs. Notably, there was a considerable variation in how race and ethnicity were defined and coded across the included studies. Furthermore, the majority of the reviewed literature originated from the USA, with only a

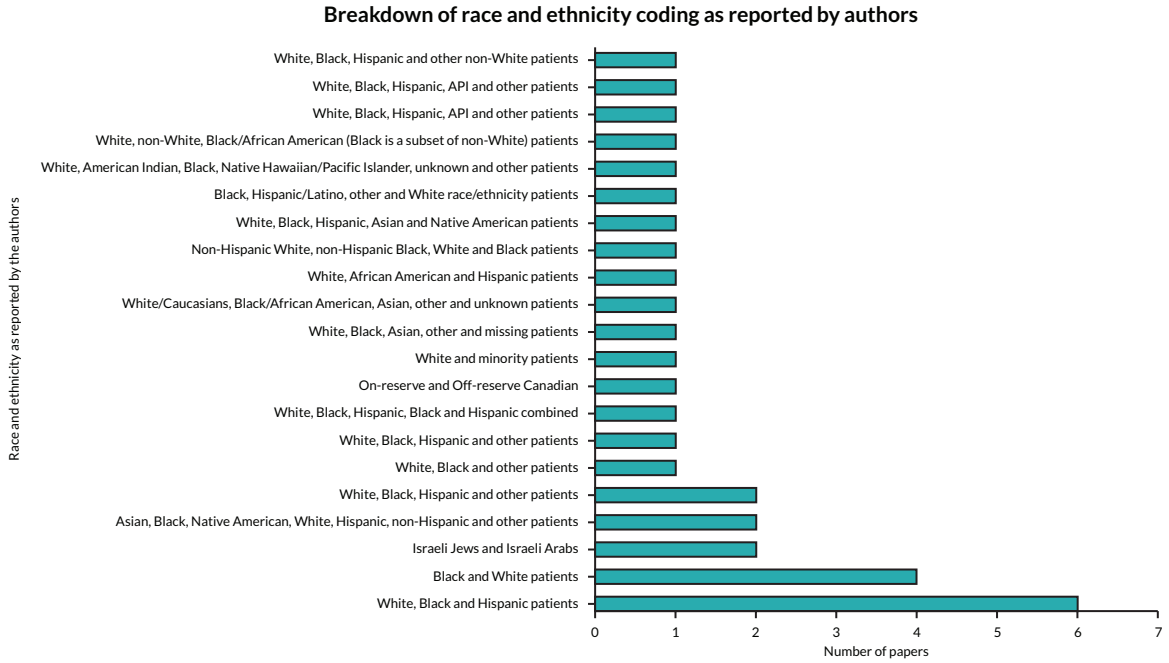

FIGURE 2 Breakdown of race and ethnicity coding as reported by authors.

TABLE 3 Age of study population

Age group	Study references
All age groups	38,41,42,54,63,65,68
≥ 65 years	45,67
≥ 18 years	38–40,43,46,48,52,56,57,66
≥ 16 years	44,48,53,58,59,62
≥ 15 years	49–51,55,64
Not specified	60,61

few studies being conducted in countries such as Israel and Canada. Potential reasons for these findings are discussed in the following section.

Injury mortality by ethnicity

Higher mortality among adults from ethnic minority backgrounds presenting to emergency healthcare services with injuries in HICs was reported in 20 of the 32 included studies.[39–43,45,49,52–54,59–65,68,69] These findings are consistent with previous systematic reviews published in 2013 on adults[22] and adults and children,[23] which identified minority ethnic status as an independent risk factor for trauma-related mortality in patients in the USA.

Three studies[44,47,48] further examined the impact of hospital patient demographics, reporting that trauma patients – regardless of race or ethnicity had higher odds of death when treated at hospitals serving a higher proportion of ethnic minority patients (Black and Hispanic) when compared to those treated at a hospital with a higher proportion of majority ethnic patients. Similar findings were noted in additional studies,[70–78] suggesting that differences in injury outcomes among racial and ethnic groups may be influenced by broader social and structural factors, not just by ethnicity alone. These include hospital infrastructure, insurance status coverage, availability of resources and the overall quality of care.[79]

Some EDs in the USA have begun screening for social determinants of health (SDOH) to address inequalities.[80] This includes screening for social risks, such as housing, food or financial insecurity, to better understand patients' needs and connecting them with support services to help improve health outcomes, especially for vulnerable populations. Others have sought to address these disparities by training healthcare staff to be more culturally aware and reduce bias, along with hiring a more

diverse workforce, to improve communication, trust and outcomes for minority groups.[81]

Race and ethnicity coding as reported by the authors of the included papers

A high degree of heterogeneity was observed in terms of how race and ethnicity were coded across the included articles. The most common coding schemes for race and ethnicity involved comparisons between Black and White patients (i.e. racial comparisons),[44,60,62,65] or combined racial and ethnic comparisons such as Black, Hispanic and White patients.[39,47,51,52,56,57] These patterns align with the findings from a recent systematic review published in 2022,[35] which examined the conceptualisation of race and ethnicity in USA-based research from 1995 to 2018. That review identified 'Black and White' (racial comparison), 'Hispanic and non-Hispanic' (ethnic comparison) and 'Black, White and Hispanic' (combined ethnic and racial comparison) as the most frequently used classifications. However, these classifications may not be appropriate for HICs outside of the USA who may have their own categories.

Furthermore, this scoping review identified the use of ambiguous racial and ethnic categories, such as 'other' or 'unknown' in 10 studies.[41–43,45,49,50,54,59,63,64] The use of such broad or undefined categories may lead to misrepresentation of health disparities, limit comparability across studies, introduce bias and hinder effective policy and clinical responses. It also raises ethical concerns by potentially reinforcing systemic inequities. Standardised and inclusive data practices have the potential to improve accuracy and equity in health research and help target resources to where it is most needed.[26]

The geographic location of the included papers and their study settings

This review identified papers reporting racial and ethnic disparities following emergency healthcare service usage for injury in the USA,[38–66] Israel[67,68] and Canada.[69]

However, none of the peer-reviewed published literature were from any other HICs, indicating a significant gap in injury research by ethnicity within these countries. The predominance of USA-based studies in this review presents challenges for generalisability as trauma outcomes in the USA are shaped by substantial structural variations in healthcare infrastructure, funding mechanisms and access pathways. The absence of a universal healthcare system, combined with disparities in insurance coverage, geographic access to emergency healthcare settings and differences in hospital resources, particularly between public and private institutions, can potentially influence health outcomes. A recent study found that uninsured trauma patients were more likely to have life-sustaining treatment withdrawn earlier than those with private insurance or Medicaid even after accounting for other medical- and hospital-related factors.[82] Rural populations may also face limited access to fewer level 1 TCs, limiting access to high-level emergency care.[83] While urban populations may experience resource strain, such as a limited number of physicians available for the total population or limited number of hospital beds.[84] These systemic factors should be considered when interpreting findings, as conclusions drawn from the USA context may not be directly applicable to countries with more uniform or publicly funded healthcare systems.

Twenty-nine of the included papers[38–50,52–59,61,64–68] were *conducted* in emergency hospital settings, with only 2[51,63] studies conducted in both emergency pre-hospital and hospital settings and only 1[60] in emergency pre-hospital settings (see *Table 2*). The lack of injury research in emergency pre-hospital settings could be due to the complexities of conducting pre-hospital research and conducting research on people from ethnic minority populations. Barriers can include poor coding of ethnicity data in pre-hospital settings and lack of access to interpreters.[85,86]

Recommendation for future research

Future studies should prioritise investigating the impact of hospital-level clustering of ethnic minority patients presenting with injury, particularly in facilities reporting higher mortality rates. Understanding how such clustering influences outcomes is essential for addressing systemic disparities in injury-related health care. To improve data quality and comparability, robust and inclusive ethnicity coding should be implemented consistently across both pre-hospital and hospital settings. Additionally, there is a need to expand injury-related research beyond the commonly studied HIC countries (e.g. the USA, Israel and Canada) to include other HICs and pre-hospital environments, where disparities may first emerge and significantly influence patient outcomes. Researchers should adopt standardised definitions and report disaggregated data by race, ethnicity and other demographic variables. This will improve transparency and facilitate meaningful cross-study comparisons.

Importantly, future research should integrate data across the entire continuum of emergency care – from the initial contact with EMS, through treatment in EDs or TCs, to follow-up 30–90 days post discharge. This comprehensive approach will help clarify the full impact of racial and ethnic disparities on injury outcomes. Finally, studies should

explore how race and ethnicity intersect with the SDOH – such as gender, socioeconomic status, disability and immigration status to shape trauma outcomes. A recent study[87] found that women tend to wait slightly longer than men when receiving emergency care after a traumatic injury. On average, women spent about 12 minutes more in the ED. While this time difference is small, it was consistent. More importantly, the study showed that women were less likely to be sent home after treatment and were more likely to be transferred to a nursing or rehabilitation facility even when their injuries were similar to men's. These differences suggest that gender may influence how people are treated following trauma. Longitudinal research designs are recommended to assess long-term recovery trajectories, while qualitative methods should be employed to capture the lived experiences of patients from diverse backgrounds.

Strengths and limitations

This scoping review adds to the published research evidence base by examining disparities in mortality faced by adults from ethnic minority backgrounds in HICs when they use emergency healthcare services for injuries. We reviewed and reported our results in line with the PRISMA-ScR checklist. We also hand-searched the reference list of two systematic reviews[22,23] and a scoping review,[10] which were identified in the initial database search, along with the reference list of other full-text included articles retrieved through the initial database search, to ensure comprehensive coverage.

Our multidisciplinary research team, comprising of emergency medicine clinicians, general practitioners, paramedics and academics specialising in mixed-methods, qualitative research, quantitative research, public health and trials, brought diverse perspectives and helped us to interpret the findings through a multidisciplinary lens. This enriched our analysis and allowed us to consider the broader social and structural factors influencing health outcomes. However, the review focused exclusively on studies reporting mortality differences by ethnicity and did not explore other injury outcomes such as time to treatment, time to discharge or how ethnicity intersects with social determinants such as gender, socioeconomic status, disability or immigration status. This limits the ability of the review to fully understand the complex, layered nature of health inequalities.[26]

Most included studies were conducted in the USA, whose healthcare system differs significantly from those in other HICs, limiting generalisability. Additionally, 18 studies reported data from the National Trauma Data Bank (NTDB) often covering overlapping time periods, which may have led to the duplication and over-representation of certain findings. Finally, no clinical audits or grey literature were included in this scoping review as initial searches of grey literature databases (e.g. Bielefeld Academic Search Engine) and Google Scholar yielded no relevant results.

Conclusion

This review updates existing reviews and reports on differences in mortality in adults by ethnicity when presenting to emergency services in HICs. Of the 32 included papers, 20 reported an increased risk of mortality among ethnic minority patients. However, a high degree of heterogeneity was also noted in terms of race and ethnicity coding as reported by the authors, reflecting inconsistencies in the way demographic data were collected and reported. This can potentially obscure the true extent of disparities.

Despite broadening the scope of the review to include all HICs, the majority of studies were conducted in the USA, with a few published in Israel and Canada, indicating a research gap in other HICs. This geographic concentration limits the generalisability of findings globally and underscores the need for more inclusive research in countries with high ethnic minority populations. Importantly, these disparities are not merely clinical but are deeply embedded in broader systemic and structural contexts. Factors such as systemic racism, socioeconomic inequality, immigration status and access to care intersect to shape both injury risk and outcomes. Addressing these disparities requires a multifaceted approach.

Potential interventions include improving access to trauma care in underserved areas, standardising and strengthening ethnicity data collection and integrating social risk screening into emergency care. Culturally competent care, workforce diversity and community engagement are also critical. Moreover, policy reforms that reduce financial barriers and promote equity-focused quality improvement can help create more just and responsive emergency care systems.

Future research should adopt an intersectional lens to explore how ethnicity interacts with the SDOH. Longitudinal and mixed-methods study designs could be used to capture both clinical outcomes and lived experiences.

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Data-sharing statement

All data relevant to the review are included in the article or uploaded as supplementary information.

Ethics statement

Ethical review and approval for the broader BE SURE study was obtained from the Health Research Authority (22/WA/0080), 5 April 2022.

Information governance statement

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List of supplementary material

Report Supplementary Material 1
Search strategy

Report Supplementary Material 2
Data extraction template

Supplementary material can be found on the NIHR Journals Library article page (https://doi.org/10.3310/GJAK4819).

Supplementary material has been provided by the authors to support the article and any files provided at submission will have been seen by peer reviewers, but not extensively reviewed. Any supplementary material provided at a later stage in the process may not have been peer reviewed.

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List of abbreviations

API	Asian/Pacific Islander
BCCS	British Columbia Coroner's Service
BCTR	British Columbia Trauma Registry
BE SURE	Building an understanding of Ethnic minority people's Service Use Relating to Emergency care for injuries
ED	emergency department
EMS	emergency medical services
HIC	high-income country
IEMS	Indianapolis Emergency Medical Services
IHP	International Health Policy
INTR	Israeli National Trauma Registry
JBI	Joanna Briggs Institute
MCCO	Marion County Coroner's Office
MHS	Military Health System
NASS CDS	National Automotive Sampling System Crashworthiness Data system
NTDB	National Trauma Data Bank
PRISMA-ScR	Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews
RMG	Research Management Group
SDOH	social determinants of health
TBI	traumatic brain injury
TC	trauma centre
UMMC	University of Mississippi Medical Centre

References

1. World Health Organization. *Preventing Injuries and Violence: An Overview*. Publication of the World Health organization; 2022. URL: www.who.int/publications/i/item/9789240047136 (accessed 12 January 2025).
2. Kendrick D, Vinogradova Y, Coupland C, Mulvaney CA, Christie N, Lyons RA, Towner EL; UK Burden of Injuries Study Group. Recovery from injury: the UK burden of injury multicentre longitudinal study. *Inj Prev* 2013;**19**:370–81. https://doi.org/10.1136/injuryprev-2012-040658
3. Jones S, Macey S, Lyons R, Pinder L, Turner S, Lingard S, *et al*. *The Burden of Injury in Wales*. Public Health Wales. 2012. URL: https://phw.nhs.wales/services-and-teams/observatory/data-and-analysis/publication-documents/burden-of-injury-2012/20-09-burdenofinjuryin-wales2012-final-pdf/ (accessed 12 February 2025).
4. Mathers CD, Vos ET, Stevenson CE, Begg SJ. The burden of disease and injury in Australia. *Bull World Health Organ* 2001;**79**:1076–84. URL: https://pubmed.ncbi.nlm.nih.gov/11731817 (accessed 11 December 2024).
5. Haagsma JA, Graetz N, Bolliger I, Naghavi M, Higashi H, Mullany EC, *et al*. The global burden of injury: incidence, mortality, disability-adjusted life years and time trends from the Global Burden of Disease study 2013. *Inj Prev* 2016;**22**:3–18. https://doi.org/10.1136/injuryprev-2015-041616
6. Gosselin RA, Spiegel DA, Coughlin R, Zirkle LG. Injuries: the neglected burden in developing countries. *Bull World Health Organ* 2009;**87**:246-a. https://doi.org/10.2471/blt.08.052290
7. Nantulya VM, Reich MR. The neglected epidemic: road traffic injuries in developing countries. *BMJ* 2002;**324**:1139–41. https://doi.org/10.1136/bmj.324.7346.1139
8. Ghaffar A, Hyder AA, Masud TI. The burden of road traffic injuries in developing countries: the 1st national injury survey of Pakistan. *Public Health* 2004;**118**:211–7.
9. Lau M, Lin H, Flores G. Racial/ethnic disparities in health and health care among US adolescents. *Health Serv Res* 2012;**47**:2031–59. https://doi.org/10.1111/j.1475-6773.2012.01394.x
10. Vigneault LP, Diendere E, Sohier-Poirier C, Abi Hanna M, Poirier A, St-Onge M. Acute health care among Indigenous patients in Canada: a scoping review. *Int J Circumpolar Health* 2021;**80**:1946324. https://doi.org/10.1080/22423982.2021.1946324

11. LaPlant MB, Hess DJ. A review of racial/ethnic disparities in pediatric trauma care, treatment, and outcomes. *J Trauma Acute Care Surg* 2019;**86**:540–50. https://doi.org/10.1097/TA.0000000000002160

12. Kachmar AG, Connolly CA, Wolf S, Curley MAQ. Socioeconomic status in pediatric health research: a scoping review. *J Pediatr* 2019;**213**:163–70. https://doi.org/10.1016/j.jpeds.2019.06.005

13. Monuteaux MC, Mannix R, Fleegler EW, Lee LK. Predictors and outcomes of pediatric firearm injuries treated in the emergency department: differences by mechanism of intent. *Acad Emerg Med* 2016;**23**:790–5. https://doi.org/10.1111/acem.12984

14. Rosenbaum K, Grigorian A, Yeates E, Kuza C, Kim D, Inaba K, *et al*. A national analysis of pediatric firearm violence and the effects of race and insurance status on risk of mortality. *Am J Surg* 2021;**222**:654–8. https://doi.org/10.1016/j.amjsurg.2020.12.049

15. Slain KN, Wurtz MA, Rose JA. US children of minority race are less likely to be admitted to the pediatric intensive care unit after traumatic injury, a retrospective analysis of a single pediatric trauma center. *Inj Epidemiol* 2021;**8**:1–0. https://doi.org/10.1186/s40621-021-00309-x

16. Farooq B, Clements C, Hawton K, Geulayov G, Casey D, Waters K, *et al*. Self-harm in children and adolescents by ethnic group: an observational cohort study from the Multicentre Study of Self-Harm in England. *Lancet Child Adolesc Health* 2021;**5**:782–91. https://doi.org/10.1016/S2352-4642(21)00239-X00239-X

17. Rangel EL, Burd RS, Falcone RA Jr. Socioeconomic disparities in infant mortality after nonaccidental trauma: a multicenter study. *J Trauma Acute Care Surg* 2010;**69**:20–5. https://doi.org/10.1097/TA.0b013e3181bbd7c3

18. Lee SL, Yaghoubian A, Stark R, Munoz V, Kaji AH. Are there racial disparities in the use of restraints and outcomes in children after motor vehicle crashes? *J Pediatr Surg* 2012;**47**:1192–5. https://doi.org/10.1016/j.jpedsurg.2012.03.057

19. Borg BA, Krouse CB, McLeod JS, Shanti CM, Donoghue L. Circumstances surrounding gun violence with youths in an urban setting. *J Pediatr Surg* 2020;**55**:1234–7. https://doi.org/10.1016/j.jpedsurg.2019.09.015

20. Short SS, Liou DZ, Singer MB, Bloom MB, Margulies DR, Bukur M, *et al*. Insurance type, not race, predicts mortality after pediatric trauma. *J Surg Res* 2013;**184**:383–7. https://doi.org/10.1016/j.jss.2013.03.061

21. Cassidy LD, Lambropoulos D, Enters J, Gourlay D, Farahzad M, Lal DR. Health disparities analysis of critically ill pediatric trauma patients in Milwaukee, Wisconsin. *J Am Coll Surg* 2013;**217**:233–9. https://doi.org/10.1016/j.jamcollsurg.2013.04.018

22. Haider AH, Weygandt PL, Bentley JM, Monn MF, Rehman KA, Zarzaur BL, *et al*. Disparities in trauma care and outcomes in the United States: a systematic review and meta-analysis. *J Trauma Acute Care Surg* 2013;**74**:1195–205. https://doi.org/10.1097/TA.0b013e31828c331d

23. Sanchez C, Shaikh S, Dowd B, Santos R, McKenney M, Elkbuli A. Disparities in adult and pediatric trauma outcomes: a systematic review and meta-analysis. *World J Surg* 2020;**44**:3010–21. https://doi.org/10.1007/s00268-020-05591-2

24. Moore M, Conrick KM, Fuentes M, Rowhani-Rahbar A, Graves JM, Patil D, *et al*. Research on injury disparities: a scoping review. *Health Equity* 2019;**3**:504–11. https://doi.org/10.1089/heq.2019.0044

25. World Bank Open Data. *Data for High Income, OECD Members, Upper Middle Income*. 2023. URL: https://data.worldbank.org/?locations=XD-OE-XT (accessed 13 February 2025).

26. Flanagin A, Frey T, Christiansen SL; AMA Manual of Style Committee. Updated guidance on the reporting of race and ethnicity in medical and science journals. *JAMA* 2021;**326**:621–7. https://doi.org/10.1001/jama.2021.13304

27. Blumenthal D, Gumas E, Shah A. *Mirror, Mirror 2024: A Portrait of the Failing US Health System*. New York: The Commonwealth Fund; 2024. URL: www.commonwealthfund.org/publications/fund-reports/2024/sep/mirror-mirror-2024 (accessed 13 February 2025).

28. Gunja M, Gumas E, Williams RD, Doty M, Shah A, Fields K. The cost of not getting care: income disparities in the affordability of health services across high-income countries. *Eur J Public Health* 2024;**34**:ckae144-014. https://doi.org/10.26099/jbe9-c870

29. MacKinnon NJ, Emery V, Waller J, Ange B, Ambade P, Gunja M, Watson E. Mapping health disparities in 11 high-income nations. *JAMA Netw Open* 2023;**6**:e2322310. https://doi.org/10.1001/jamanetworkopen.2023.22310

30. Baghdadi F, Evans BA, Goodacre S, John PA, Hettiarachchi T, John A, *et al*. Building an understanding of Ethnic minority people's Service Use Relating to Emergency care for injuries: the BE SURE study protocol. *BMJ Open* 2023;**13**:e069596. https://doi.org/10.1136/bmjopen-2022-069596

31. Peters MD, Godfrey CM, Khalil H, McInerney P, Parker D, Soares CB. Guidance for conducting systematic scoping reviews. *Int J Evid Based Healthc* 2015;**13**141–6. https://doi.org/10.1097/XEB.0000000000000050

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32. Arksey H, O'Malley L. Scoping studies: towards a methodological framework. *Int J Soc Res Methodol* 2005;**8**:19–32. https://doi.org/10.1080/1364557032000119616

33. Tricco AC, Lillie E, Zarin W, O'Brien KK, Colquhoun H, Levac D, *et al*. PRISMA extension for scoping reviews (PRISMAScR): checklist and explanation. *Ann Intern Med* 2018;**169**:467–73. https://doi.org/10.7326/M18-0850

34. Lu C, Ahmed R, Lamri A, Anand SS. Use of race, ethnicity, and ancestry data in health research. *PLOS Glob Public Health* 2022;**2**:e0001060. https://doi.org/10.1371/journal.pgph.0001060

35. Martinez RA, Andrabi N, Goodwin AN, Wilbur RE, Smith NR, Zivich PN. Conceptualization, operationalization, and utilization of race and ethnicity in major epidemiology journals, 1995–2018: a systematic review. *Am J Epidemiol* 2023;**192**:483–96. https://doi.org/10.1093/aje/kwac146

36. American Trauma Society. *Trauma Center Levels Explained*. URL: www.amtrauma.org/page/traumalevels (accessed 14 December 2024).

37. Peters MD, Marnie C, Tricco AC, Pollock D, Munn Z, Alexander L, *et al*. Updated methodological guidance for the conduct of scoping reviews. *JBI Evid Synth* 2020;**18**:2119–26. https://doi.org/10.11124/JBIES-20-00167

38. Chaudhary MA, Sharma M, Scully RE, Sturgeon DJ, Koehlmoos T, Haider AH, Schoenfeld AJ. Universal insurance and an equal access healthcare system eliminate disparities for Black patients after traumatic injury. *Surgery* 2018;**163**:651–6. https://doi.org/10.1016/j.surg.2017.09.045

39. Crompton JG, Pollack KM, Oyetunji T, Chang DC, Efron DT, Haut ER, *et al*. Racial disparities in motorcycle-related mortality: an analysis of the National Trauma Data Bank. *Am J Surg* 2010;**200**:191–6. https://doi.org/10.1016/j.amjsurg.2009.07.035

40. Downing SR, Oyetunji TA, Greene WR, Jenifer J, Rogers SO, Haider AH, *et al*. The impact of insurance status on actuarial survival in hospitalized trauma patients: when do they die? *J Trauma* 2011;**70**:130–4; discussion 134. https://doi.org/10.1097/TA.0b013e3182032b34

41. Dy CJ, Lane JM, Pan TJ, Parks ML, Lyman S. Racial and socioeconomic disparities in hip fracture care. *J Bone Joint Surg* 2016;**98**:858–65. https://doi.org/10.2106/JBJS.15.00676

42. Elkbuli A, Fanfan D, Newsome K, Sutherland M, Liu H, McKenney M, Ang D. A national evaluation of emergency department thoracotomy practices: will a high-risk, low-yield procedure reveal potential management practice bias? *Surgery* 2022;**172**:410–20. https://doi.org/10.1016/j.surg.2021.10.020

43. Gerry JM, Weiser TG, Spain DA, Staudenmayer KL. Uninsured status may be more predictive of outcomes among the severely injured than minority race. *Injury* 2016;**47**:197–202. https://doi.org/10.1016/j.injury.2015.10.064

44. Glance LG, Osler TM, Mukamel DB, Meredith JW, Li Y, Qian F, Dick AW. Trends in racial disparities for injured patients admitted to trauma centers. *Health Serv Res* 2013;**48**:1684–703. https://doi.org/10.1111/1475-6773.12064.

45. Greene WR, Oyetunji TA, Bowers U, Haider AH, Mellman TA, Cornwell EE, *et al*. Insurance status is a potent predictor of outcomes in both blunt and penetrating trauma. *Am J Surg* 2010;**199**:554–7. https://doi.org/10.1016/j.amjsurg.2009.08.020

46. Grenn E, Kutcher M, Hillegass WB, Iwuchukwu C, Kyle A, Bruehl S, *et al*. Social determinants of trauma care: associations of race, insurance status, and place on opioid prescriptions, post discharge referrals, and mortality. *J Trauma Acute Care Surg* 2022;**92**:897–905. https://doi.org/10.1097/TA.0000000000003506

47. Haider AH, Ong'uti S, Efron DT, Oyetunji TA, Crandall ML, Scott VK, *et al*. Association between hospitals caring for a disproportionately high percentage of minority trauma patients and increased mortality: a nationwide analysis of 434 hospitals. *Arch Surg* 2012;**147**:63–70. https://doi.org/10.1001/archsurg.2011.287

48. Haider AH, Hashmi ZG, Zafar SN, Hui X, Schneider EB, Efron DT, *et al*. Minority trauma patients tend to cluster at trauma centers with worse-than-expected mortality: can this phenomenon help explain racial disparities in trauma outcomes? *Ann Surg* 2013;**258**:572–9; discussion 579. https://doi.org/10.1097/SLA.0b013e3182a50148

49. Haines KL, Zens T, Beems M, Rauh R, Jung HS, Agarwal S. Socioeconomic disparities in the thoracic trauma population. *J Surg Res* 2018;**224**:160–5. https://doi.org/10.1016/j.jss.2017.11.071

50. Haines KL, Nguyen BP, Vatsaas C, Alger A, Brooks K, Agarwal SK. Socioeconomic status affects outcomes after severity-stratified traumatic brain injury. *J Surg Res* 2019;**235**:131–40. https://doi.org/10.1016/j.jss.2018.09.072

51. Haskins AE, Clark DE, Travis LL. Racial disparities in survival among injured drivers. *Am J Epidemiol* 2013;**177**:380–7. https://doi.org/10.1093/aje/kws242

52. Losonczy LI, Villegas CV, Weygandt PL, Hall EC, Schneider EB, Cooper LA, *et al*. The severity of

disparity: increasing injury intensity accentuates disparate outcomes following trauma. *J Health Care Poor Underserved* 2014;**25**:308. https://doi.org/10.1353/hpu.2014.0021

53. Maybury RS, Bolorunduro OB, Villegas C, Haut ER, Stevens K, Cornwell EE, *et al*. Pedestrians struck by motor vehicles further worsen race-and insurance-based disparities in trauma outcomes: the case for inner-city pedestrian injury prevention programs. *Surgery* 2010;**148**:202–8. https://doi.org/10.1016/j.surg.2010.05.009

54. McClellan EB, Bricker S, Neville A, Bongard F, Putnam B, Plurad DS. The impact of age on mortality in patients in extremis undergoing urgent intervention. *Am Surg* 2013;**79**:1248–52.

55. McQuistion K, Zens T, Jung HS, Beems M, Leverson G, Liepert A, *et al*. Insurance status and race affect treatment and outcome of traumatic brain injury. *J Surg Res* 2016;**205**:261–71. https://doi.org/210.1016/j.jss.2016.06.087

56. Moreira CC, Farber A, Rybin D, Doros G, Kalish J, Eberhardt RT, *et al*. Racial differences in treatment approaches and mortality following arterial trauma. *Vasc Endovascular Surg* 2015;**49**:180–7. https://doi.org/10.1177/1538574415609606.

57. Nistler CM, James TL, Dugan E, Pino EC. Racial and ethnic disparities in violent penetrating injuries and long-term adverse outcomes. *J Interpers Violence* 2023;**38**:2286–312. https://doi.org/10.1177/08862605221090200

58. Oyeniyi BT, Fox EE, Scerbo M, Tomasek JS, Wade CE, Holcomb JB. Trends in 1029 trauma deaths at a level 1 trauma center: impact of a bleeding control bundle of care. *Injury* 2017;**48**:5–12. https://doi.org/10.1016/j.injury.2016.10.037

59. Polites SF, Leonard JM, Glasgow AE, Zielinski MD, Jenkins DH, Habermann EB. Undertriage after severe injury among United States trauma centers and the impact on mortality. *Am J Surg* 2018;**216**:813–8. https://doi.org/10.1016/j.amjsurg.2018.06.019

60. Ray B, Lowder E, Bailey K, Huynh P, Benton R, Watson D. Racial differences in overdose events and polydrug detection in Indianapolis, Indiana. *Drug Alcohol Depend* 2020;**206**:107658. https://doi.org/10.1016/j.drugalcdep.2019.107658

61. Schoenfeld AJ, Belmont PJ Jr, See AA, Bader JO, Bono CM. Patient demographics, insurance status, race, and ethnicity as predictors of morbidity and mortality after spine trauma: a study using the National Trauma Data Bank. *Spine J* 2013;**13**:1766–73. https://doi.org/10.1016/j.spinee.2013.05.028

62. Scott VK, Hashmi ZG, Schneider EB, Hui X, Enwerem NY, Efron DT, *et al*. Counting the lives lost: how many black trauma deaths are attributable to disparities? *J Surg Res* 2013;**179**:337. https://doi.org/10.1016/j.jss.2013.03.007

63. Scott LR, Bazargan-Hejazi S, Shirazi A, Pan D, Lee S, Teruya SA, Shaheen M. Helmet use and bicycle-related trauma injury outcomes. *Brain Inj* 2019;**33**:1597–601. https://doi.org/10.1080/02699052.2019.1650201

64. Singer MB, Liou DZ, Clond MA, Bukur M, Mirocha J, Margulies DR, *et al*. Insurance-and race-related disparities decrease in elderly trauma patients. *J Trauma Acute Care Surg* 2013;**74**:312–6. https://doi.org/10.1097/TA.0b013e3182788d8c

65. Strong BL, Torain JM, Greene CR, Smith GS. Outcomes of trauma admission for falls: influence of race and age on in-hospital and post-discharge mortality. *Am J Surg* 2016;**212**:638–44. https://doi.org/10.1016/j.amjsurg.2016.06.008

66. Tepas JJ III, Pracht EE, Orban BL, Flint LM. Insurance status, not race, is a determinant of outcomes from vehicular injury. *J Am Coll Surg* 2011;**212**:722–7. https://doi.org/10.1016/j.jamcollsurg.2010.12.029

67. Abdel-Rahman N, Yoffe N, Siman-Tov M, Radomislensky I, Peleg K; Israel Trauma Group. Achieving ethnic equality in the Israel trauma healthcare system: the case of the elderly population. *Isr J Health Policy Res* 2019;**8**:1–8. https://doi.org/10.1186/s13584-019-0294-8

68. Tiruneh A, Siman-Tov M, Radomislensky I, Peleg K; Israel Trauma Group. Inequality in in-hospital mortality due to road traffic accident between ethnic populations in specified groups living in the same country. *Isr J Health Policy Res* 2020;**9**:17. https://doi.org/10.1186/s13584-024-00613-z

69. Bell N, Schuurman N, Hameed SM, Caron N. Are we homogenising risk factors for public health surveillance? Variability in severe injuries on First Nations reserves in British Columbia, 2001–5. *Inj Prev* 2011;**17**:394–400. https://doi.org/10.1136/ip.2010.030866

70. Barnato AE, Lucas FL, Staiger D, Wennberg DE, Chandra A. Hospital-level racial disparities in acute myocardial infarction treatment and outcomes. *Med Care* 2005;**43**:308–19. https://doi.org/10.1097/01.mlr.0000156848.62086.06

71. Skinner J, Chandra A, Staiger D, Lee J, McClellan M. Mortality after acute myocardial infarction in hospitals that disproportionately treat Black patients. *Circulation* 2005;**112**:2634–41. https://doi.org/10.1161/circulationaha.105.543231

72. Lucas FL, Stukel TA, Morris AM, Siewers AE, Birkmeyer JD. Race and surgical mortality in the United States. *Ann Surg* 2006;**243**:281–6. https://doi.org/10.1097/01.sla.0000197560.92456.32

73. Hasnain-Wynia R, Baker DW, Nerenz D, Feinglass J, Beal AC, Landrum MB, *et al*. Disparities in health care are driven by where minority patients seek care: examination of the hospital quality alliance measures. *Arch Intern Med* 2007;**167**:1233–9. https://doi.org/10.1001/archinte.167.12.1233

74. Jha AK, Orav EJ, Li Z, Epstein AM. Concentration and quality of hospitals that care for elderly Black patients. *Arch Intern Med* 2007;**167**:1177–82. https://doi.org/10.1001/archinte.167.11.1177.

75. Gaskin DJ, Spencer CS, Richard P, Anderson GF, Powe NR, Laveist TA. Do hospitals provide lower-quality care to minorities than to Whites? *Health Aff* 2008;**27**:518–27. https://doi.org/10.1377/hlthaff.27.2.518

76. Hausmann LR, Ibrahim SA, Mehrotra A, Nsa W, Bratzler DW, Mor MK, Fine MJ. Racial and ethnic disparities in pneumonia treatment and mortality. *Med Care* 2009;**47**:1009–17. https://doi.org/10.1097/MLR.0b013e3181b9e800

77. Ly DP, Lopez L, Isaac T, Jha AK. How do black-serving hospitals perform on patient safety indicators?: Implications for national public reporting and pay-for-performance. *Med Care* 2010;**48**:1133–7. https://doi.org/10.1097/MLR.0b013e3181f81c7e

78. Mayr FB, Yende S, D'Angelo G, Barnato AE, Kellum JA, Weissfeld L, *et al*. Do hospitals provide lower quality of care to Black patients for pneumonia? *Crit Care Med* 2010;**38**:759–65. https://doi.org/10.1097/CCM.0b013e3181cb08e0

79. Jetha A, Navaratnerajah L, Shahidi FV, Carnide N, Biswas A, Yanar B, Siddiqi A. Racial and ethnic inequities in the return-to-work of workers experiencing injury or illness: a systematic review. *J Occup Rehabil* 2023;**33**:432–49. https://doi.org/10.1007/s10926-023-10119-1

80. Loo S, Molina M, Ahmad NJ, Swanton M, Chen O, Boggs KM, *et al*. Implementing social determinants of health screening in US Emergency Departments. *JAMA Netw Open* 2025;**8**:e250137. https://doi.org/10.1001/jamanetworkopen.2025.0137

81. Hayba N, Cheek C, Austin E, Testa L, Richardson L, Safi M, *et al*. Strategies to improve care in the emergency department for culturally and linguistically diverse adults: a systematic review. *J Racial Ethn Health Disparities* 2025;**12**:326–46. https://doi.org/10.1007/s40615-023-01876-z

82. Hoit G, Wijeysundera DN, Hamad DM, Nauth A, Atrey A, Halai M, *et al*. Insurance type and withdrawal of life-sustaining therapy in critically injured trauma patients. *JAMA Netw Open* 2024;**7**:e2421711. https://doi.org/10.1001/jamanetworkopen.2024.21711

83. MacKenzie EJ, Hoyt DB, Sacra JC, Jurkovich GJ, Carlini AR, Teitelbaum SD, Teter H Jr. National inventory of hospital trauma centers. *JAMA* 2003;**289**:1515–22. https://doi.org/10.1001/jama.289.12.1515

84. Greenwood-Ericksen M, Kamdar N, Lin P, George N, Myaskovsky L, Crandall C, *et al*. Association of rural and critical access hospital status with patient outcomes after emergency department visits among Medicare beneficiaries. *JAMA Netw Open* 2021;**4**:e2134980. https://doi.org/10.1001/jamanetworkopen.2021.34980

85. Phung VH, Siriwardena N, Windle K, Asghar Z, Barot M, Kai J, Johnson M. *Ethnicity and Prehospital Emergency Care Provided by Ambulance Services*. 2015. URL: https://raceequalityfoundation.org.uk/health-and-care/ethnicity-and-prehospital-emergency-care-provided-by-ambulance-services/ (accessed 9 March 2025).

86. Phung VH, Windle K, Siriwardena AN. Responding to Diversity and Delivering Equality in Prehospital Care: Statutory Responsibilities, Best Practice and Recommendations. In Wankhade P, Mackway-Jones K, editors. *Ambulance Services: Leadership and Management Perspectives*. Cham: Springer; 2015. pp. 119–33.

87. Ingram ME, Nagalla M, Shan Y, Nasca BJ, Thomas AC, Reddy S, *et al*. Sex-based disparities in timeliness of trauma care and discharge disposition. *JAMA Surg* 2022;**157**:609–16. https://doi.org/10.1001/jamasurg.2022.1550