National patterns in emergency department diagnoses and mortality: insights from the Nationwide Emergency Department Sample

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ABSTRACT

Background Emergency departments (EDs) are the frontline of acute care in the USA, yet contemporary data on the most common presentations and causes of mortality remain limited. Understanding these patterns is critical for guiding triage, resource allocation and public health priorities. Therefore, using a nationally representative sample of US ED visits from 2016 to 2021, this study aimed to characterise the most common ED diagnoses and leading causes of ED mortality and to assess differences in these patterns across age, sex, race/ethnicity and urban-rural populations.

Methods We conducted a retrospective cohort study of the Nationwide Emergency Department Sample from 2016 to 2021, encompassing more than 680 million weighted ED visits. Outcomes included the five most common presenting diagnoses and causes of ED mortality, stratified by age, sex, race/ethnicity and urban-rural status. Diagnoses were grouped into clinically relevant categories, including acute coronary syndromes (ACS), severe respiratory compromise, trauma and sepsis.

Results During 2016–2021, there were 680 207 479 ED visits and 1 189 848 ED deaths. Chest pain was the leading diagnosis from 2016 to 2019 (4.3–4.4%); in 2021, COVID-19 became the most common presentation (4.8% vs 4.2% for chest pain). Urinary tract infections were more frequent in women (2.6%), whereas sepsis was more common in men (1.6%). Younger adults presented with respiratory infections, abdominal pain and headaches, while older adults had higher rates of sepsis, chronic obstructive pulmonary disease exacerbations and pneumonia. Racial differences were evident: COVID-19 was most frequent in Hispanic patients (3.4%), sepsis in Asian/Pacific Islanders (2.1%) and alcohol intoxication in Native Americans (2.0%). Cardiac arrest was the leading cause of ED death (58–77%). Trauma (7.9%) and self-harm (0.8%) disproportionately affected younger adults, whereas sepsis (up to 2.7%), respiratory compromise (up to 3.7%) and ACS (0.6–1.4%) contributed more to mortality among older adults, women and racial minorities.

Conclusion This national analysis highlights evolving ED utilisation, COVID-19 impact and persistent age-based, sex-based and race-based disparities. Although cardiac arrest dominates ED mortality, the excess burden of sepsis, respiratory failure, ACS, trauma and self-harm in specific populations underscores opportunities to refine triage, target prevention and improve emergency care allocation.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Emergency departments (EDs) manage a broad range of acute illnesses, but contemporary national data on the leading ED diagnoses and causes of ED mortality across demographic groups remain limited.

WHAT THIS STUDY ADDS

⇒ In this nationally representative analysis of more than 680 million US ED visits, chest pain was the leading ED diagnosis before the COVID-19 pandemic, while COVID-19 became the most common presentation in 2021. Cardiac arrest accounted for most ED deaths, with substantial differences in ED diagnoses and mortality across age, sex, race/ethnicity and rural-urban populations.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ These findings provide a contemporary national benchmark for ED utilisation and mortality that may help guide risk-stratified triage, equitable resource allocation, pandemic preparedness and targeted strategies to reduce demographic disparities in preventable ED mortality.

INTRODUCTION

Emergency departments (EDs) are a cornerstone of the US healthcare system, providing urgent care for acute and often life-threatening conditions. In 2021, there were nearly 140 million ED visits nationwide, equivalent to 43 visits per 100 persons, compared with 114 million visits in 2003.[1 2] This rising demand reflects an ageing population, the increasing burden of chronic disease and persistent barriers to outpatient care. As ED use grows, concerns regarding outcomes, including mortality, have intensified, particularly in the context of strained resources and overcrowding.[3]

Studies in other countries have demonstrated that crowding and delays in emergency care are associated with excess mortality.[4 5] Within the USA, research has primarily focused on individual high-risk conditions such as sepsis and acute respiratory failure, which are known to carry substantial mortality and resource demands.[6–8] Despite the scale and complexity of emergency care,

few investigations have provided a national overview of the most common diagnoses seen in EDs and the conditions most frequently associated with death.

A clear understanding of which presentations dominate ED visits, and which carry the greatest risk of mortality, is essential to guide preparedness, inform quality improvement efforts and establish benchmarks for future research. By quantifying the burden of ED presentations and outcomes, this study provides contemporary national data that can inform health system planning, surveillance and strategies aimed at improving emergency care delivery. Using the Nationwide Emergency Department Sample (NEDS), a nationally representative all-payer database of US ED visits, we aimed to determine the most common diagnoses and leading causes of mortality in US EDs from 2016 to 2021 and to assess how these patterns vary by age, sex, race/ethnicity and urban-rural status.

METHODOLOGY

Data source

We conducted a retrospective cohort study using data from the NEDS for the years 2016–2021.[9 10] NEDS is part of the Healthcare Cost and Utilization Project (HCUP), sponsored by the Agency for Healthcare Research and Quality, and is the largest publicly available all-payer emergency care database in the USA. It captures approximately 20% of hospital-based ED visits through a stratified sampling design and allows generation of nationally representative estimates. NEDS is accessible to any qualified researcher through the HCUP central distributor following completion of a data use agreement and required training; the authors were not involved in the design or collection of the database. As an all-payer database, NEDS includes ED encounters across all primary payer types (eg, Medicare, Medicaid, private insurance and uninsured patients), thereby reflecting a broad cross-section of the US population. However, it excludes federal healthcare facilities such as Veterans Affairs and Department of Defense hospitals. To generate national estimates, HCUP provides discharge-level weights that account for the complex sampling design, including hospital characteristics and sampling strata. Application of these weights allows each sampled ED encounter to represent multiple encounters at the national level. Accordingly, 'weighted national estimates' and 'weighted ED encounters' refer to extrapolated counts that approximate the total number of ED visits across the USA rather than raw sampled observations. After applying the provided discharge-level weights, the dataset represented more than 680 million weighted ED encounters across 6 years.

Study population and outcomes

We included all ED visits during the study period. The primary outcomes were (a) the most frequent ED diagnoses and (b) ED mortality, defined as death occurring during the ED encounter prior to admission.

Variables and diagnostic categories

Demographic variables included age, sex, race and rural versus urban hospital location. Diagnoses were classified using International Classification of Diseases, 10th revision (ICD-10). To better reflect clinical presentations, we created composite categories based on the top 20 most occurring ICD-10 codes within each subgroup:

- *Severe respiratory failure and arrest*: J96.00, J96.01, J96.90 and R09.2, capturing acute respiratory failure or arrest.
- To avoid splitting similar undifferentiated presentations, we grouped ICD-10 codes into composites: chest pain (R07.89, R07.9), acute upper respiratory infection (J06.9, J02.9) and abdominal pain (R10.9, R10.13)
- *Cardiac arrest*: I462 (due to underlying cardiac condition), I46.8 (other underlying condition) and I46.9 (unspecified cause).
- *Acute myocardial infarction*: I213, I2119, I214 and I219.
- *Traumatic injuries:* S0190XA, S0180XA, S0990XA, T794XXA, S0193XA, S0183XA, S21102A, S21132A, S21302A and S21332A.
- Encounters coded as R99 ('Ill-defined and unknown cause of mortality') were excluded, accounting for approximately 0.5–1.9% of observations across the analysed subgroups.

A complete listing of all composite diagnostic categories and their constituent ICD-10 codes, along with the rationale for each grouping, is provided in online supplemental table 1.

Statistical analysis

This study was descriptive in nature. National estimates were generated using HCUP-recommended discharge-level survey weights to account for the complex sampling design of NEDS. Categorical variables were summarised using frequencies and weighted proportions. Continuous variables were reported as weighted means where applicable. No inferential statistical testing or regression modelling was performed, as the objective was to characterise national patterns in ED presentations and mortality rather than assess causal associations. All analyses were conducted using SAS V.9.4 and Python V.3.11.4.

Ethics and regulatory considerations

This study used the NEDS from HCUP, a publicly available, de-identified database. As no patient identifiers are included, the study was exempt from institutional review board approval in accordance with US federal regulations for research involving non-identifiable data (45 CFR 46). The use of HCUP data complied with the HCUP data use agreement. No patient consent was required.

RESULTS

A total of 680 207 479 ED visits were analysed between 2016 and 2021. During this period, 1 189 848 ED deaths were identified and included in the mortality analysis.

Leading diagnoses in the ED

From 2016 through 2019, the most common ED diagnoses were chest pain (4.26–4.35%), urinary tract infection (UTI; 1.81–1.96%), headache (1.44–1.57%), abdominal pain (1.24–1.56%) and sepsis (1.31–1.41%). In 2020, chest pain remained most frequent (4.24%), followed by COVID-19 (2.80%), UTI (1.59%), sepsis (1.54%) and abdominal pain (1.05%). By 2021, COVID-19 became the leading diagnosis (4.77%), followed by chest pain (4.20%), UTI (1.59%), sepsis (1.38%) and headache (1.28%) (figure 1A).

Urban versus rural variations in leading ED diagnoses

Chest pain was the most common diagnosis in both urban and rural EDs (4.30% and 4.27%, respectively). UTI ranked second, with a higher prevalence in rural EDs (2.05% vs 1.75% urban). In urban EDs, sepsis (1.39%), abdominal pain (1.29%) and headache (1.21%) completed the top five, whereas in rural EDs, COVID-19 (1.27%), sepsis (1.23%) and low back pain (1.15%) were more prominent (figure 2A).

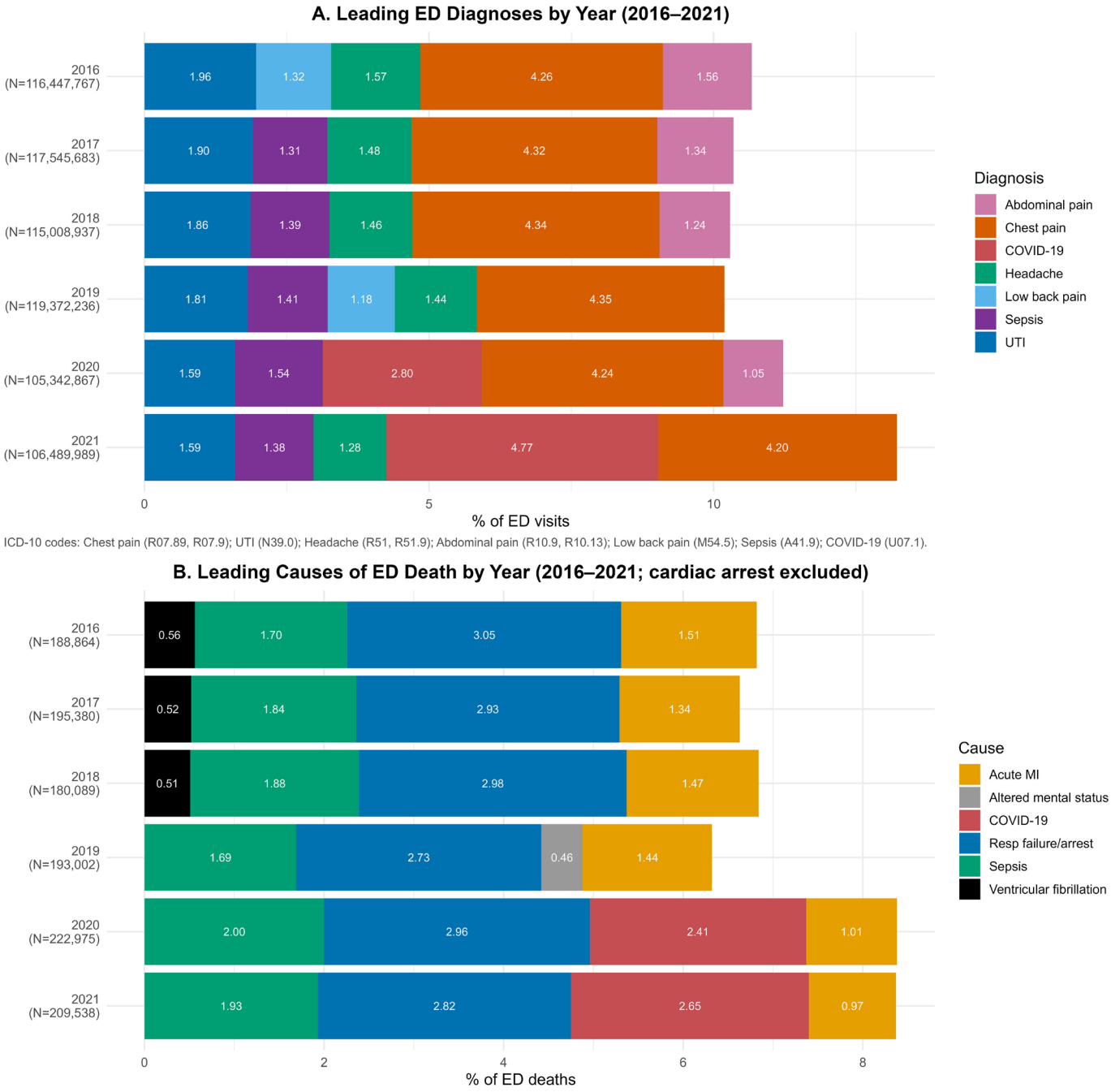


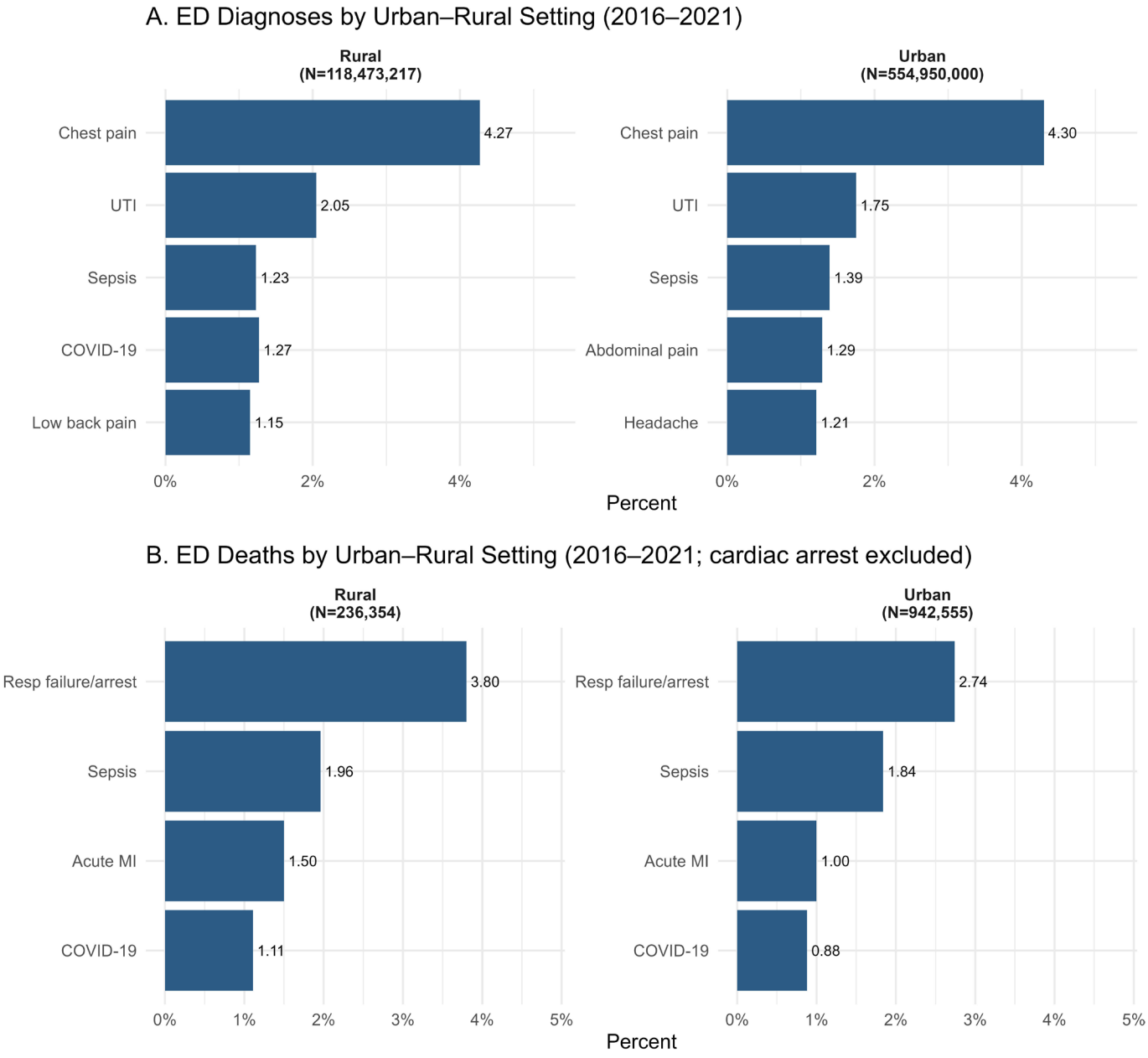
Figure 1 Emergency department diagnoses and deaths by year, 2016–2021. (A) Top ED diagnoses by year. (B) Leading causes of ED deaths by year. Note: cardiac arrest, the number one cause across all groups, is excluded for improved visualisation. ED, emergency department; ICD-10, International Classification of Diseases, 10th revision; UTI, urinary tract infection; MI, myocardial infarction.

Sex variations in leading ED diagnoses

Among males, chest pain was the most common diagnosis (4.44%), followed by sepsis (1.56%), COVID-19 (1.29%), low back pain (1.17%) and abdominal pain (1.03%). Among females, chest pain also ranked first (4.17%), but UTI was more frequent (2.58%), followed by headache (1.44%), abdominal pain (1.41%) and sepsis (1.21%) (figure 3A).

Age group variations in leading ED diagnoses

ED presentations varied substantially by age. Among patients aged 18–29 years, acute upper respiratory infection (3.08%) was the most common, followed by chest pain (2.74%), abdominal pain (2.30%), UTI (1.96%) and headache (1.41%). In those aged 30–49 years, chest pain predominated (4.77%), followed by abdominal pain (2.43%), headache (1.55%), low back pain (1.42%) and UTI (1.38%). Patients aged 50–69 years most frequently presented with chest pain (5.50%), sepsis (1.71%), chronic obstructive pulmonary disease (COPD) exacerbation (1.50%), COVID-19 (1.42%) and UTI (1.41%). In patients aged ≥70 years, chest pain (3.48%) and sepsis (3.23%) were the most common, followed by UTI (2.89%), syncope (1.63%) and pneumonia (1.52%) (figure 4A).



ICD-10 codes — Diagnoses: Chest pain (R07.89, R07.9); UTI (N39.0); Sepsis (A41.9); Abdominal pain (R10.9, R10.13); Headache (R51); Low back pain (M54.5); COVID-19 (U07.1). Deaths: Resp failure/arrest (J96.00, J96.01, J96.90, R09.2); Sepsis (A41.9); Acute MI (I21.3, I21.19, I21.4, I21.9); COVID-19 (U07.1). Cardiac arrest excluded.

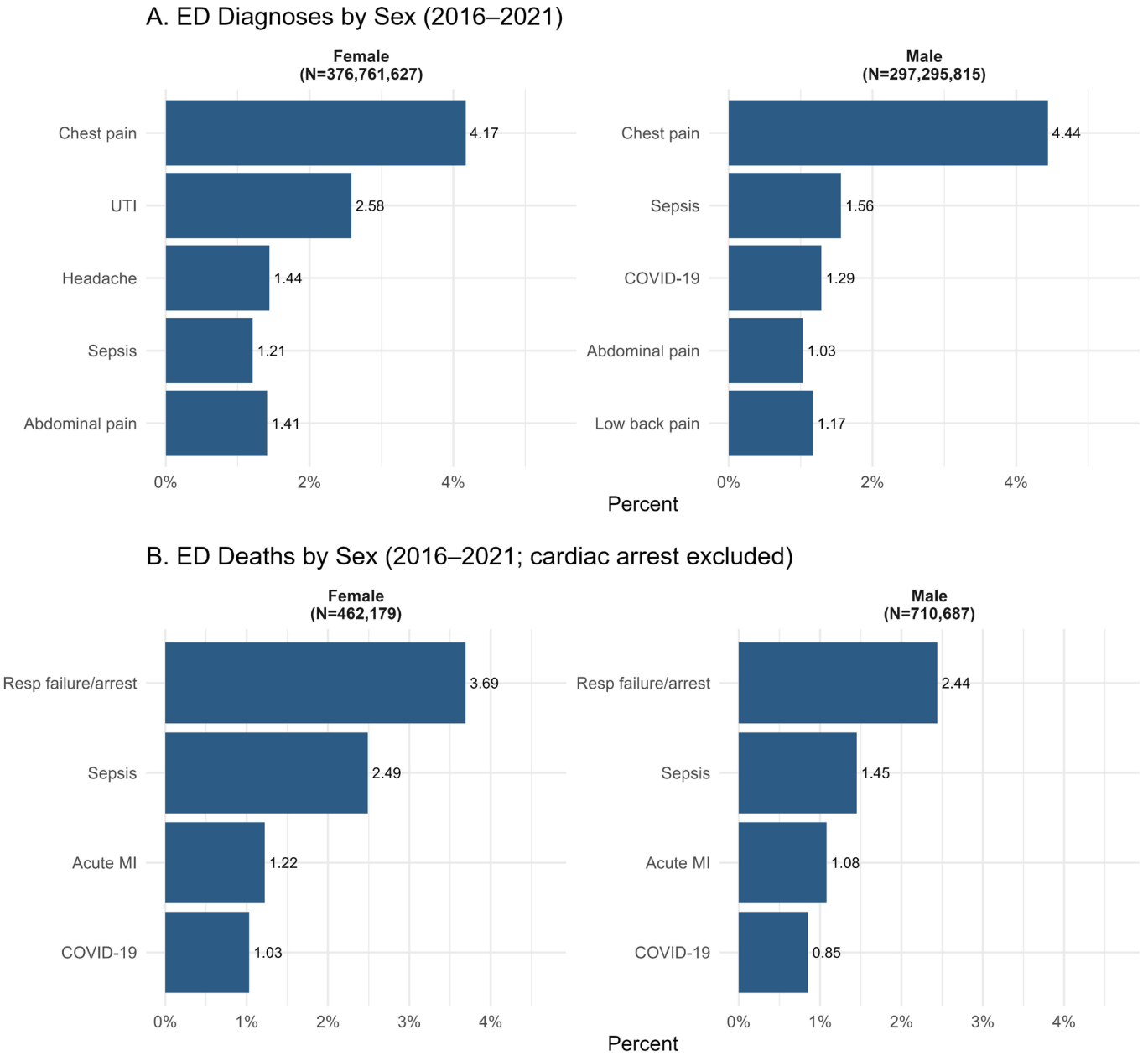
Figure 2 Emergency department diagnoses and deaths by urban-rural status. (A) Top ED diagnoses stratified by urban versus rural EDs. (B) Leading causes of ED deaths stratified by urban versus rural EDs. Note: cardiac arrest, the number one cause across all groups, is excluded for improved visualisation. ED, emergency department; ICD-10, International Classification of Diseases, 10th revision; UTI, urinary tract infection; MI, myocardial infarction.

Racial variations in leading ED diagnoses

Across racial groups, chest pain was the leading ED diagnosis, ranging from 4.55% among Asian/Pacific Islander patients to 4.20% among white patients. COVID-19 consistently ranked second, with the highest prevalence among Hispanic patients (3.44%). Among white patients, UTI (1.73%), sepsis (1.66%) and syncope (1.08%) were also common. In black patients, acute upper respiratory infection (2.20%), UTI (1.56%) and low back pain (1.18%) were prominent. Hispanic patients frequently presented with abdominal pain (2.29%), acute upper respiratory infection (1.88%) and UTI (1.81%). Among Asian/Pacific Islander patients, sepsis (2.05%), abdominal pain (1.90%) and dizziness (1.71%) were common, while alcohol intoxication (1.96%), abdominal pain (1.88%) and UTI (1.37%) featured prominently among Native American patients (figure 5A).

Leading causes of mortality in the ED

Between 2016 and 2021, cardiac arrest was the leading cause of ED mortality, accounting for 70.12–73.60% of deaths annually. Severe respiratory compromise ranked second (2.73–3.05%). With the COVID-19 pandemic, COVID-19 emerged as the third leading cause of ED death in 2020 (2.41%) and 2021 (2.65%). Sepsis consistently ranked fourth (1.69–2.00%), while acute cardiovascular emergencies, including ST-elevation myocardial infarction (0.97–1.51%) and



ICD-10 codes — Diagnoses: Chest pain (R07.89, R07.9); Sepsis (A41.9); COVID-19 (U07.1); Low back pain (M54.5); Abdominal pain (R10.9, R10.13); UTI (N39.0); Headache (R51). Deaths: Resp failure/arrest (J96.00, J96.01, J96.90, R09.2); Sepsis (A41.9); Acute MI (I21.3, I21.19, I21.4, I21.9); COVID-19 (U07.1). Cardiac arrest excluded.

Figure 3 Emergency department diagnoses and deaths by sex. (A) Top ED diagnoses by sex. (B) Leading causes of ED deaths by sex. Note: cardiac arrest, the number one cause across all groups, is excluded for improved visualisation. ED, emergency department; ICD-10, International Classification of Diseases, 10th revision; UTI, urinary tract infection; MI, myocardial infarction.

ventricular fibrillation (0.51–0.56%), regularly appeared among the top five causes (figure 1B).

Urban versus rural variations in leading ED mortality causes

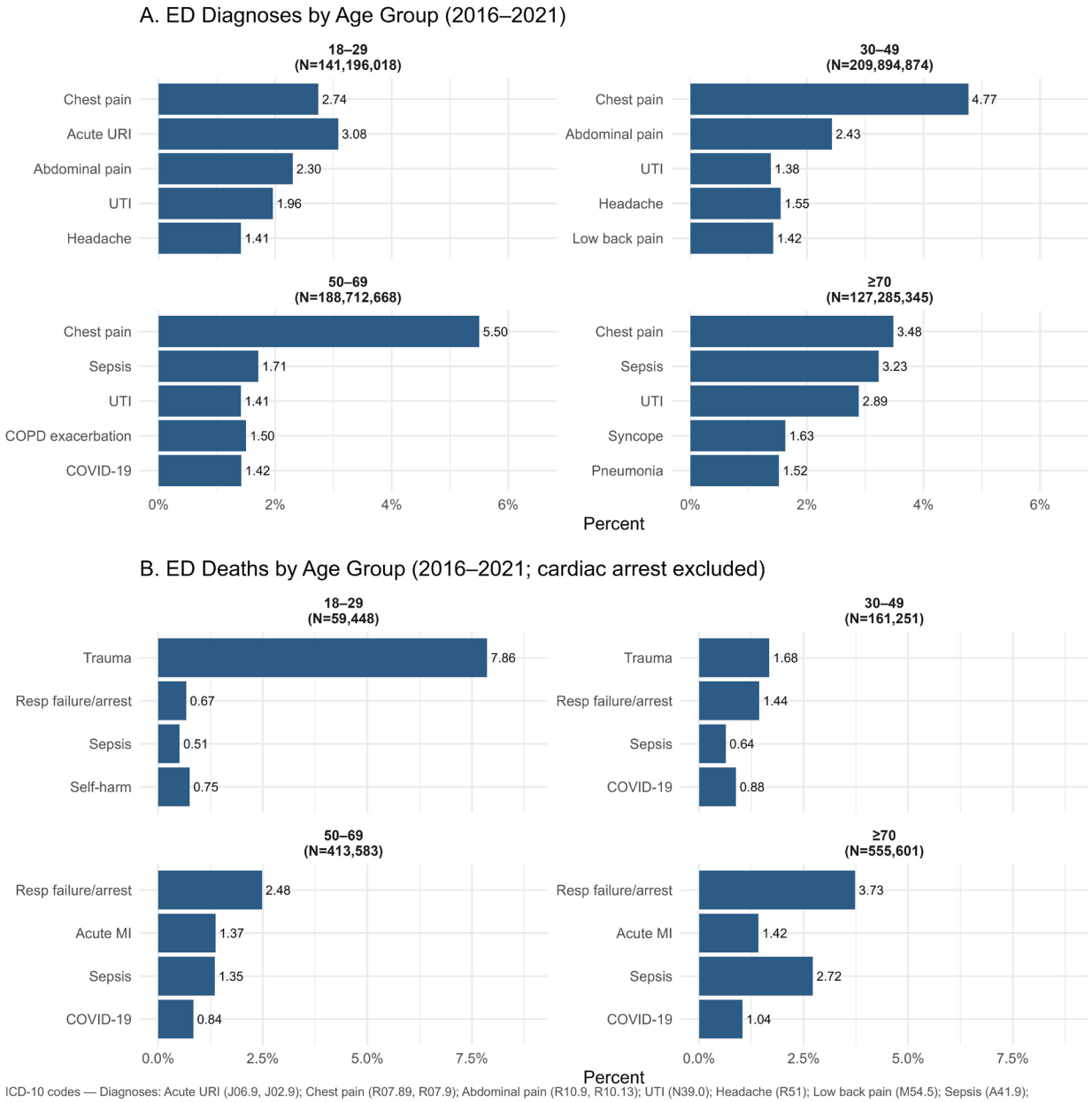
Cardiac arrest was the leading cause of ED mortality in both urban (73.49%) and rural (65.20%) settings. Severe respiratory compromise accounted for a greater proportion of deaths in rural EDs (3.80% vs 2.74% urban). Sepsis (urban 1.84%, rural 1.96%), myocardial infarction (urban 1.00%, rural 1.50%) and COVID-19 (urban 0.88%, rural 1.11%) completed the top causes (figure 2B).

Sex variations in leading ED mortality causes

Cardiac arrest remained the leading cause of ED mortality among both males (73.81%) and females (69.56%). Severe respiratory compromise was more frequent among females (3.69% vs 2.44% in males). Sepsis ranked third (female 2.49%, male 1.45%), followed by acute myocardial infarction and COVID-19 in both sexes (figure 3B).

Age group variations in leading ED mortality causes

Cardiac arrest accounted for the majority of ED deaths across all age groups, ranging from 56.71% in patients aged 18–29 years to a peak of 77.73% in those aged 50–69 years, before declining to 69.29% in patients aged ≥70 years. Among younger adults (18–29 years), traumatic injuries (7.86%) and self-harm due to hanging



ICD-10 codes — Diagnoses: Acute URI (J06.9, J02.9); Chest pain (R07.89, R07.9); Abdominal pain (R10.9, R10.13); UTI (N39.0); Headache (R51); Low back pain (M54.5); Sepsis (A41.9); COPD exacerbation (J44.1); COVID-19 (U07.1); Syncope (R55); Pneumonia (J18.9).
Deaths: Trauma (S01.90XA, S01.80XA, S09.90XA, T79.4XXA, S01.93XA, S01.83XA, S21.102A, S21.132A, S21.302A, S21.332A); Resp failure/arrest (J96.00, J96.01, J96.90, R09.2); Sepsis (A41.9); Self-harm/hanging (T71.1XXA); Acute MI (I21.3, I21.19, I21.4, I21.9); COVID-19 (U07.1). Cardiac arrest excluded.

Figure 4 Emergency department diagnoses and deaths by age group. (A) Top ED diagnoses by age group. (B) Leading causes of ED deaths by age group. Note: cardiac arrest, the number one cause across all groups, is excluded for improved visualisation. COPD, chronic obstructive pulmonary disease; ED, emergency department; ICD-10, International Classification of Diseases, 10th revision; UTI, urinary tract infection; URI, upper respiratory infection; MI, myocardial infarction.

(0.75%) were prominent causes of death. In adults aged 30–49 years, trauma (1.68%), severe respiratory compromise (1.44%), COVID-19 (0.88%) and sepsis (0.64%) ranked among the leading causes. In patients aged 50–69 years and ≥70 years, severe respiratory compromise, sepsis, acute coronary syndromes (ACS) and COVID-19 contributed substantially to ED mortality (figure 4B).

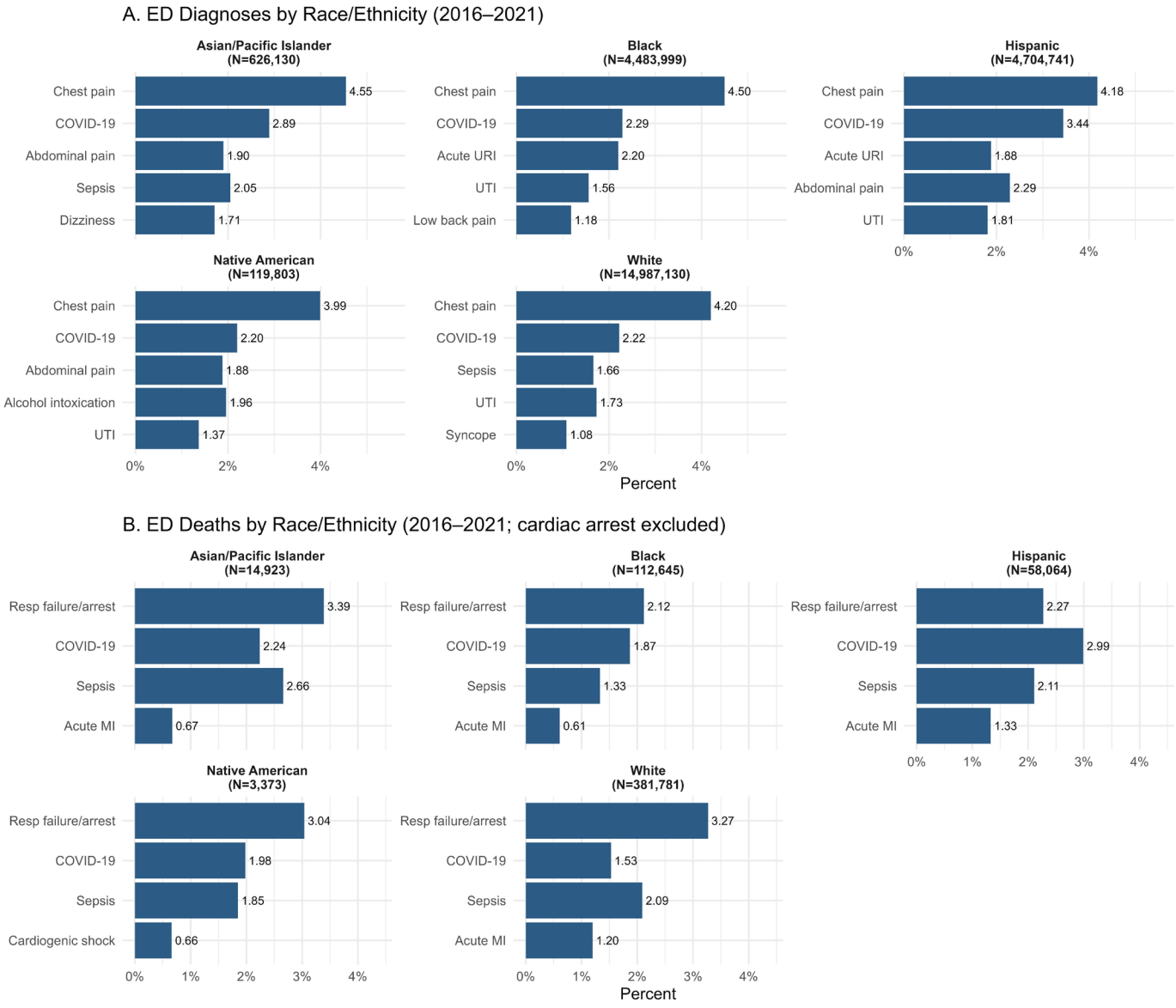
Racial variations in leading ED mortality causes

Cardiac arrest was the leading cause of ED death across all racial groups, accounting for 58.47–75.03% of deaths. Severe respiratory compromise, sepsis, COVID-19 and ACS consistently ranked among the leading causes, with notable variation by race. COVID-19 was the second leading cause of death among Hispanic patients (2.99%), while sepsis and respiratory compromise contributed proportionally more to mortality among Asian/Pacific Islander patients. Native American patients had the lowest proportion of cardiac arrest-related deaths (58.47%) and a higher contribution from respiratory compromise, COVID-19 and sepsis (figure 5B).

DISCUSSION

Overview of key findings

In this nationally representative analysis of more than 680 million ED visits and 1.2 million ED deaths, we identified demographic patterns in ED presentations and mortality. Chest pain was the leading ED diagnosis for most of the study period, although



ICD-10 codes — Diagnoses: Chest pain (R07.89, R07.9); COVID-19 (U07.1); UTI (N39.0); Sepsis (A41.9); Syncope (R55); Acute URI (J06.9, J02.9); Low back pain (M54.5); Abdominal pain (R10.9, R10.13); Dizziness (R42); Alcohol intoxication (F10.129).
Deaths: Resp failure/arrest (J96.00, J96.01, J96.90, R09.2); Sepsis (A41.9); COVID-19 (U07.1); Acute MI (I21.3, I21.19, I21.4, I21.9); Cardiogenic shock (R57.0). Cardiac arrest excluded.

Figure 5 Emergency department diagnoses and deaths by race/ethnicity. (A) Top ED diagnoses by race/ethnicity. (B) Leading causes of ED deaths by race/ethnicity. Note: cardiac arrest, the number one cause across all groups, is excluded for improved visualisation. ED, emergency department; ICD-10, International Classification of Diseases, 10th revision; UTI, urinary tract infection; URI, upper respiratory infection; MI, myocardial infarction.

COVID-19 became the most common diagnosis in 2021. Women more frequently presented with UTIs, whereas sepsis was more common among men. Older adults had higher burdens of sepsis, COPD exacerbations, pneumonia, respiratory failure and ACS, while younger adults more commonly presented with respiratory infections, abdominal pain and headache. Racial disparities were evident, with Hispanic patients experiencing the highest burden of COVID-19 diagnoses, Asian/Pacific Islander patients demonstrating elevated sepsis rates and alcohol-related presentations occurring more frequently among Native American patients. Cardiac arrest remained the leading cause of ED mortality, while trauma and self-harm disproportionately affected younger adults and sepsis, respiratory failure and ACS were more common among older adults, women and certain racial minorities.

Impact of the COVID-19 pandemic on ED utilisation

The COVID-19 pandemic substantially reshaped ED case mix and care delivery, as reflected by COVID-19 displacing chest pain as the most common ED diagnosis by 2021. Reductions in non-COVID presentations, altered health-seeking behaviour and surges in infectious disease collectively shifted the distribution of ED complaints, consistent with prior reports describing declines in non-urgent and cardiac visits during the pandemic.[11 12] These shifts had implications beyond volume alone, influencing staffing needs, diagnostic priorities and the ability to promptly identify time-sensitive non-infectious conditions during periods of system strain.[12–14] Such disruptions may have contributed to delayed presentations for acute myocardial infarction and stroke, reinforcing the need for adaptable triage systems and flexible ED capacity during public health emergencies.[15 16]

Demographic patterns in ED presentations

Several demographic patterns observed in presenting diagnoses align with established biological and social determinants of health. The female predominance of UTIs is consistent with known anatomic susceptibility,[17] whereas the higher frequency of sepsis among men may reflect greater comorbidity burden, delayed presentation and risk behaviours such as alcohol use.[18] The age gradient in ED diagnoses in addition to shifting from respiratory infections, abdominal pain and headache in younger adults to sepsis, COPD exacerbations and pneumonia in older adults likely reflects progressive frailty and chronic cardiopulmonary disease with ageing, supporting the use of geriatric-adapted ED pathways to expedite recognition and early intervention.[18 19] Among middle-aged adults, chest pain remained the predominant presentation, likely reflecting heightened cardiovascular risk awareness and the broad differential of cardiac and non-cardiac aetiologies prompting ED evaluation.[20 21]

Racial and socio-structural disparities

Racial differences in diagnoses and outcomes underscore the influence of structural and community-level factors. The high burden of COVID-19 diagnoses among Hispanic patients is consistent with prior reports linking disproportionate pandemic impact to occupational exposure, housing density and barriers to care and testing.[22] Native American patients exhibited elevated COVID-19 mortality and prominent alcohol-related presentations, reflecting social marginalisation and limited access to prevention and treatment services.[23] Asian/Pacific Islander patients demonstrated higher sepsis incidence and mortality. Although prior literature on racial differences in sepsis outcomes is mixed, these findings align with population-based studies documenting substantial sepsis burden across racial groups and may highlight underrecognised risks in Asian populations.[24 25] Collectively, these patterns suggest that ED utilisation and outcomes are shaped by social determinants and access to care in addition to underlying biology.

Patterns and determinants of ED mortality

Cardiac arrest overwhelmingly accounted for ED deaths across all subgroups, underscoring the high acuity of patients presenting in extremis and the limited window for successful resuscitation.[26 27] Survival following ED or out-of-hospital cardiac arrest remains poor compared with in-hospital events, emphasising the importance of interventions bridging prehospital and ED care, including bystander cardiopulmonary resuscitation (CPR), defibrillator availability, optimised prehospital coordination and standardised post-resuscitation pathways.[26 27] Important demographic differences in ED mortality persisted. Trauma and self-harm, particularly hanging, were major contributors among younger adults, highlighting preventable injury and unmet mental health needs.[28 29] In contrast, older adults experienced higher mortality from sepsis, respiratory compromise and ACS, conditions for which early recognition and protocolised management may improve outcomes.[24 25 30]

Sex-Based differences in outcomes

Sex-based differences in mortality warrant attention. Although ACS incidence was comparable between men and women, women exhibited proportionally higher mortality from ACS and respiratory compromise, consistent with prior evidence that atypical presentations may delay recognition and treatment.[31] Implicit bias and delayed recognition may also contribute to higher mortality from respiratory compromise among women.[32] While men had higher sepsis incidence, women experienced greater sepsis-related mortality in this cohort. Although prior studies have reported higher sepsis mortality among men, often attributed to biological immune differences and comorbidity burden,[33] our findings may instead reflect underrecognition, delayed treatment or differences in care delivery rather than intrinsic vulnerability.

Geographic disparities in emergency care

Geographic disparities further emphasise resource and access gaps. Rural EDs experienced a higher proportion of deaths from respiratory compromise compared with urban EDs, consistent with limited access to invasive ventilation, intensive care capacity and rapid transfer pathways in some rural settings.[34] Investments in ventilatory resources, tele-critical care partnerships and streamlined transfer protocols may help mitigate these rural-urban disparities.

Clinical and public health implications

Taken together, these findings underscore the need for adaptive and equitable emergency care strategies tailored to population-specific risk profiles. Refinement of triage protocols, including chest pain pathways and sepsis alerts, may improve early recognition of high-risk conditions, particularly among older adults. Incorporating trauma-informed care and suicide-risk screening into ED workflows may help address preventable mortality among younger patients. Targeted prevention strategies, including vaccination outreach, alcohol harm-reduction programmes and improved recognition of atypical ACS and respiratory presentations among women, may also help reduce disparities. Finally, investments in tele-critical care, critical care capacity and streamlined transfer systems may improve emergency care delivery in underserved and rural settings.

Future directions and pandemic preparedness

Although this study provides a national overview of ED diagnostic patterns and ED mortality, it also highlights important areas for further investigation. Future studies should examine the patient-level, hospital-level and health system-level factors underlying the observed differences across age, sex, race and ethnicity and urban-rural populations. In particular, additional work is needed to determine whether the disproportionate burden of sepsis, severe respiratory compromise, ACS, trauma and self-harm in specific populations reflects differences in underlying disease prevalence, delayed presentation, access to outpatient and preventive care, prehospital pathways, ED triage processes, hospital resources or diagnostic coding. Longitudinal analyses extending beyond 2021 will be important to determine whether the pandemic-associated shifts in ED utilisation were temporary disruptions or represent more durable changes in emergency care demand. These analyses may also inform pandemic preparedness by identifying diagnostic categories and populations most vulnerable to abrupt changes in ED demand during public health emergencies. Such data could support surge planning, staffing models, triage protocols and resource allocation strategies for future respiratory viral pandemics and other large-scale disruptions. Linkage of ED data with inpatient, outpatient, prehospital and vital statistics datasets could further clarify downstream outcomes, including hospitalisation, intensive care utilisation, post-ED mortality and potentially preventable deaths. Finally, prospective and health system-level studies are needed to

evaluate whether risk-stratified triage protocols, targeted prevention strategies, pandemic-responsive surge planning and resource allocation models can reduce disparities in ED mortality among high-risk populations.

Limitations

This study has several limitations. First, as an administrative claims database, NEDS relies on ICD-10 coding and is subject to coding errors, under-reporting and inter-hospital variability; although composite diagnostic groupings (eg, chest pain, severe respiratory compromise, ACS, trauma) improved interpretability, they may have obscured diagnostic nuance and misestimated individual conditions. Second, the absence of granular clinical data (including illness severity, diagnostics, treatment timing and provider decision-making) and the encounter-based, cross-sectional design preclude assessment of care quality, delays in management, longitudinal follow-up and downstream outcomes. Third, social determinants of health are not captured, limiting interpretation of sex, racial and urban-rural disparities and leaving residual confounding likely; although NEDS is an all-payer database that includes patients across multiple insurance types, it excludes federal healthcare systems (eg, Veterans Affairs and Department of Defense hospitals), which may limit representation of specific populations such as military personnel and veterans. Additionally, under-representation of certain groups (including Native American communities and smaller rural EDs) may affect the generalisability of findings to these populations. Lastly, we did not perform regression-based analyses (eg, Poisson or negative binomial models) or assess seasonal trends, as the study was designed to provide a descriptive overview of national patterns; future studies incorporating temporal modelling and risk-adjusted analyses may provide further insights. Pandemic-related disruptions during 2020–2021 may have influenced observed trends, and the descriptive design precludes causal inference or identification of modifiable risk factors.

CONCLUSIONS

This national analysis of over 680 million ED visits and 1.2 million ED deaths identified substantial demographic differences in ED presentations and mortality across the USA. Cardiac arrest accounted for most ED deaths, while trauma and self-harm disproportionately affected younger adults and sepsis, respiratory failure and ACS were more common among older adults. Significant racial and ethnic disparities were also observed in COVID-19-related outcomes. These findings highlight the importance of population-specific emergency care strategies and may help inform more equitable triage systems, resource allocation and prevention efforts aimed at reducing preventable ED mortality.

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