Trends and Disparities in Leukemia and Sepsis Mortality Rates in the United States (1999–2023): Insights From the CDC WONDER Database on Demographic and Geographic Variations

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Introduction

Leukemia and sepsis are major contributors to mortality in the United States, with evolving medical treatments influencing mortality trends. Leukemia mortality has shown a steady decline over recent decades, while sepsis-related deaths have remained high or even increased in some years. The reasons behind these differing trends are multifactorial, including advancements in leukemia treatment, improvements in early detection, and the complex nature of sepsis, which often complicates recovery from other illnesses. Understanding national mortality patterns and identifying disparities is crucial to inform targeted public health strategies, improve health outcomes, and reduce health inequalities, particularly among vulnerable demographic and geographic groups. This study examines national trends in sepsis and leukemia mortality from 1999 to 2023, with a specific focus on demographic and geographic disparities, to better guide public health interventions and policy.

Objectives

The primary objectives of this study were to:

1. Analyze the trends in leukemia and sepsis mortality in the United States from 1999 to 2023.
2. Assess how these trends differ by sex, race/ethnicity, region, and urbanization.
3. Identify key demographic and geographic disparities in mortality rates to inform targeted health interventions.
4. Investigate the impact of medical advancements and public health initiatives on reducing leukemia mortality and sepsis-related deaths.

Methods

Mortality data were sourced from the CDC WONDER Multiple Cause of Death database for the years 1999 to 2020, using ICD-10 codes for leukemia (C91–C95) and sepsis (A40–A41). Age-adjusted mortality rates (AAMRs) were calculated per 100,000 population using the 2000 U.S. standard population. To identify trends and changes in mortality over time, Joinpoint regression was used to estimate annual percentage change (APC) and average annual percentage change (AAPC) with corresponding 95% confidence intervals (CIs). Statistical significance was set at $p < 0.05$. The analysis was stratified by the following factors:

Sex: Males vs. females
Race/Ethnicity: Non-Hispanic White, Non-Hispanic Black, Hispanic, and Other
Region: Northeast, Midwest, South, and West
Urbanization: Rural vs. urban areas

Results

- **Total Mortality:** Between 1999 and 2023, there were 4,419,229 sepsis-related deaths and 683,156 leukemia-related deaths in the United States.
- **Sepsis Mortality Trends:** Sepsis-related age-adjusted mortality rates (AAMRs) slightly increased from 64.16 per 100,000 in 1999 to 67.50 per 100,000 in 2023, reflecting a persistent burden of sepsis-related deaths.
- **Leukemia Mortality Trends**: In contrast, leukemia-related AAMRs declined over the same period, from 11.65 per 100,000 in 1999 to 9.09 per 100,000 in 2023, demonstrating the impact of medical advances in leukemia treatment.
- **Combined Mortality Trends:** The combined mortality rate for sepsis and leukemia decreased from 1.28 per 100,000 in 1999 to 0.98 per 100,000 in 2023, driven by the decline in leukemia-related deaths.

Demographic Disparities:

- **Sex:** Males consistently experienced higher mortality rates compared to females for both sepsis and leukemia.
- **Racial Disparities**: Non-Hispanic Black individuals had the highest AAMR for both sepsis and leukemia in 1999 and 2020, showing persistent racial health disparities.
- **Geographic Disparities**:
  - ❖ In 1999, the Northeast had the highest sepsis and leukemia mortality rates. By 2020, the Midwest and West had surpassed the Northeast, with both regions showing the highest mortality rates for sepsis.
  - ❖ Rural areas saw a slight increase in mortality rates by 2020, while urban areas experienced a statistically significant decline in AAMRs, reflecting the impact of improvements in healthcare access and treatment.
- **Sex-Based Trends**: Both males and females showed statistically significant declines in mortality rates for both sepsis and leukemia, indicating improvements in medical care, disease management, and prevention.

Discussion

Trends in Mortality:
- Leukemia mortality has significantly decreased in the U.S. from 1999 to 2023.
- Sepsis-related deaths remain high, with minimal improvement over the same period.

Demographic Disparities:
- Males exhibit higher mortality rates compared to females.
- Non-Hispanic Black individuals experience disproportionately higher mortality.

Geographic Disparities:
- Rural populations have higher mortality rates than urban populations.
- Regional variations indicate uneven healthcare access and outcomes.

Implications of Medical Advances:
- Despite advancements in leukemia treatments, sepsis-related deaths remain inadequately addressed.
- Medical progress alone is insufficient to reduce mortality in vulnerable populations.

Structural Gaps in Healthcare:
- Limited healthcare access, suboptimal care delivery, and gaps in prevention contribute to persistent disparities.
- Rural and racial populations are disproportionately affected by these systemic barriers.

Need for Equity-Focused Interventions:
- Enhance healthcare access in rural areas.
- Address racial health disparities through targeted programs.
- Ensure medical advancements benefit all populations equitably.

Future Research Directions:
- Investigate underlying factors contributing to mortality disparities.
- Develop effective strategies to reduce the combined burden of sepsis and leukemia nationally.

References

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