RESEARCH LETTER

Rising burden of cardiac arrest– and heart failure–related mortality in the United States from 1999 to 2020

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Cardiac arrest (CA) remains the leading cause of death in patients with heart failure (HF). Adverse remodeling and myocardial fibrosis form an ideal substrate for the generation and propagation of fatal ventricular arrythmias. Consequently, antiremodeling guideline-directed medical therapies (GDMT) and widespread utilization of implantable cardioverter-defibrillators (ICDs) have helped decreased the burden of CA in this population beginning in the early 2000s.[1] However, relatively little is known about more recent trends in CA associated with HF. Updated epidemiological trends can help inform decisions surrounding the utility of ICDs in the era of newer pharmacotherapies.

We used the Centers for Disease Control and Prevention WONDER (Wide-Ranging OnLine Data for Epidemiologic Research) database to identify adults ≥25 years of age in which CA (International Classification of Diseases–Tenth Revision code I46.x), HF (codes I11.0, I13.0, I13.2, and I50.x), and ventricular tachycardia and ventricular fibrillation (code I149.0) were listed as an underlying or contributing cause of death between 1999 and 2020 (ie. all of these conditions were listed as an underlying or contributing cause of death on the death certificate).[2] Age-adjusted mortality rates (AAMRs) per 100,000 population were determined. The Joinpoint Regression Program (Joinpoint V 4.9.0.0; National Cancer Institute) was used to determine trends in mortality within the study period. Annual percentage change (APC) and 95% confidence interval (CI) were calculated using the Monte Carlo permutation test among intervals identified by the Joinpoint regression.

Between 1999 and 2020, there were 1,031,071 deaths attributed to the combined effects of CA and HF. The overall AAMR decreased from 27.7 in 1999 to 22.8 in 2020. After an initial period of decline in AAMR between 1999 and 2011 (APC –3.26, 95% CI –2.56 to –3.01), there was a steady rise from 2011 to 2020 (APC +1.88, 95% CI 1.38 to 2.45). Across the entire study period, the AAMR was higher for males compared with females; however, the pattern of falling AAMR from 1999 to 2011 and the rise from 2011 to 2020 was similar between sexes (Figure 1A). The AAMR was highest for non-Hispanic Black adults followed by Hispanic and non-Hispanic White adults across all time periods, and the rise in AAMR since 2011 was noted similarly across races (Figure 1B). There were significant geographical disparities, such that states in the 90th percentile of mortality (New York, Mississippi, Georgia, California) had AAMRs that were ∼5-fold higher than those in the bottom 10th percentile of mortality (Delaware, Maryland, Maine) (Figure 1C).

These data demonstrate that after an initial decline in HF- and CA-related mortality for a decade, this trend has reversed, with increasing mortality rates noted starting ∼2011. Although similar trends were noted across sexes and races, significant geographic and demographic disparities persist, such that Black adults fared worse than individuals of other races. While it is encouraging to note the significant decline in overall AAMRs, the reversal of the

KEY FINDINGS

- Using administrative data from death certificates, we report a rise in cardiac arrest mortality associated with heart failure starting around 2011, after an initial period of decline between 1999 and 2011.
- The rise in heart failure–associated cardiac arrest has been consistent across demographic subgroups. However, significant geographical differences were noted.
- Ensuring equitable access to newer pharmacotherapies for heart failure and access to implantable cardioverter-defibrillators may curb the increase in cardiac arrest mortality.

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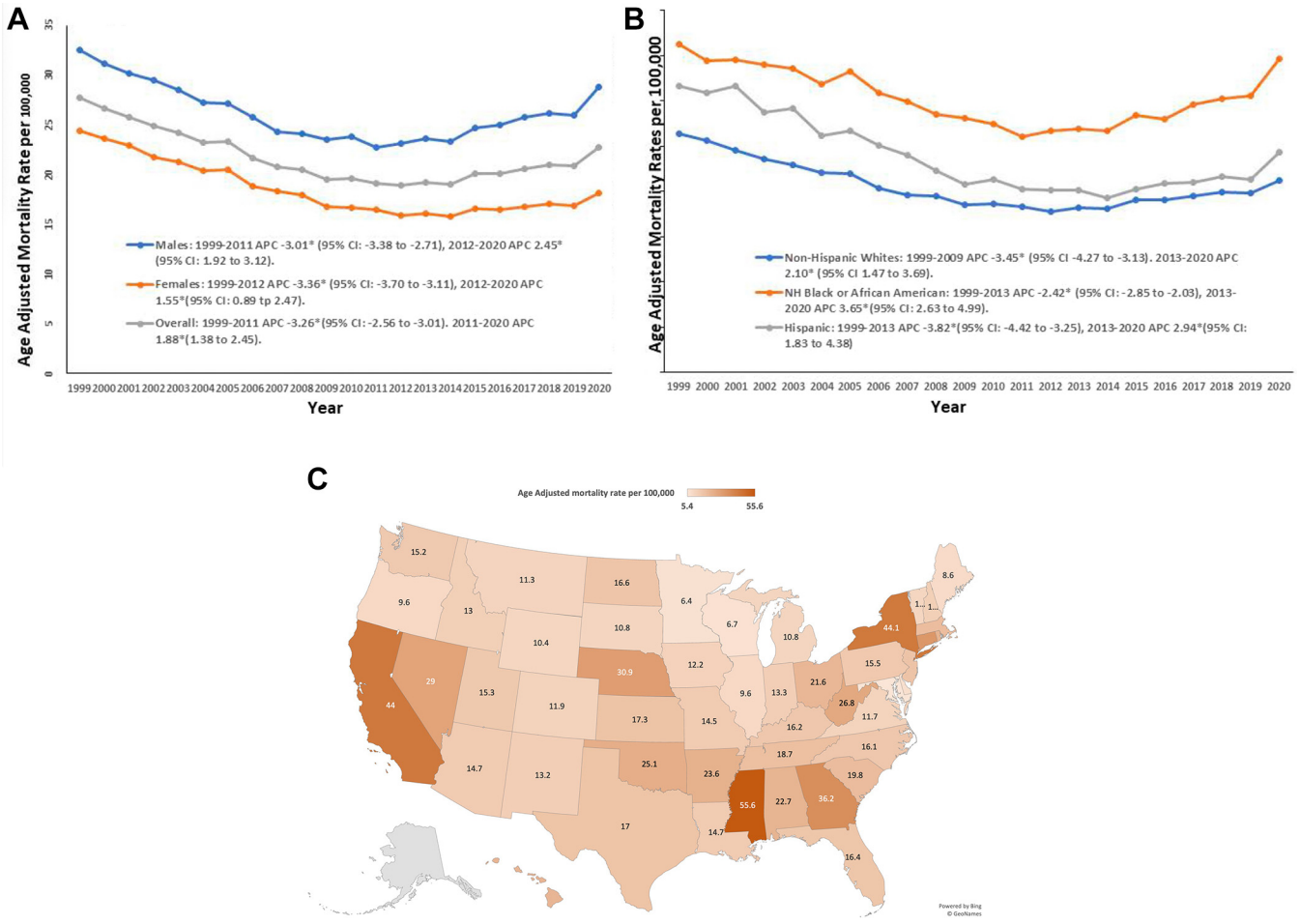

Figure 1 Age-adjusted mortality rates for the overall population (gray), males (blue), and females (orange) (A) and Hispanic (gray), Black (orange), and White (blue) individuals (B). C: State-level disparities in age-adjusted mortality rates. APC, annual percent change; CI, confidence interval.

trend in last decade is of concern. These findings are consistent with overall HF-related mortality rates over the same time period.[3] If indeed true, these trends are likely multifactorial and in part secondary to an increase in the prevalence of HF and its associated risk factors,[4] as well as underutilization of, or lack of access to, newer GDMTs and primary prevention ICDs. While ICDs have historically had the largest absolute benefit in reducing CA-related mortality in HF patients, their relative risk reduction may be blunted in the context of newer GDMTs and advancing HF symptoms.[1] While identifying the exact reasons for this concerning trend is beyond the scope of this study, ensuring equitable access to newer GDMTs, some of which can be quite costly depending on insurance coverage, and device therapies for people who need them the most will help prevent further loss of the progress noted in the decade prior.

It is important to note that these findings may be limited by the use of International Classification of Diseases codes and reliance on death certificates, which may be sources of misclassification bias. While death certificates are crucial data sources for assessing mortality trends, it is essential to acknowledge the potential for substantial heterogeneity in the accuracy of reported causes of death. Death certificates also do not provide information about ejection fraction, ICD use, medication use, and socioeconomic factors. In conclusion, after an initial decline in HF- and CA-related mortality for a decade, there has been a reversal in trend, with increasing mortality rates noted starting ~2011.

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