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Alcoholic cardiomyopathy mortality and social vulnerability index: A nationwide cross-sectional analysis

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ABSTRACT

Background: Social vulnerability index (SVI) plays a pivotal role in the outcomes of cardiovascular diseases and prevalence of alcohol use. We evaluated the impact of the SVI on alcoholic cardiomyopathy (ACM) mortality.
Methods: Mortality data from 1999 to 2020 and the SVI were obtained from CDC databases. Demographics such as age, sex, race/ethnicity, and geographic residence were obtained from death certificates. The SVI was divided into quartiles, with the fourth quartile (Q4) representing the highest vulnerability. Age-adjusted mortality rates across SVI quartiles were compared, and excess deaths due to higher SVI were calculated. Risk ratios were calculated using univariable Poisson regression.
Results: A total of 2779 deaths were seen in Q4 compared to 1672 deaths in Q1. Higher SVI accounted for 1107 excess-deaths in the US and 0.05 excess deaths per 100,000 person-years (RR: 1.38). Similar trends were seen for both male (RR: 1.43) and female (RR: 1.67) populations. Higher SVI accounted for 0.06 excess deaths per 100,000 person-years in Hispanic populations (RR: 2.50) and 0.06 excess deaths per 100,000 person-years in non-Hispanic populations (RR: 1.46).
Conclusion: Counties with elevated SVI experienced higher ACM mortality rates. Recognizing the impact of SVI on ACM mortality can guide targeted interventions and public health strategies, emphasizing health equity and minimizing disparities.

1. Introduction

Social vulnerability refers to the negative effects caused by external stressors on community infrastructure and individual well-being. The social vulnerability index (SVI) is a measure of social vulnerability consisting of 16 social components aggregated under one ranking system to determine a community's social vulnerability (Table 1) [1]. In the United States (US), communities that have been severely affected by social vulnerability are also characterized by higher densities of alcohol outlets, leading to higher levels of alcohol consumption [2]. The SVI has been shown to impact many aspects of the cardiovascular disease care continuum, including prevalence of cardiovascular disease (CVD) risk factors and prevalence, outcomes including morbidity and mortality, readmission rates, and access to healthcare [3–7].

Alcoholic cardiomyopathy (ACM) is a prominent cause of dilated cardiomyopathy in the US; however, no previous analyses have investigated the impact of the SVI on ACM mortality. This study aimed to evaluate the association between SVI and ACM mortality in the US.

2. Methods

We gathered US mortality data from the Centers for Disease Control and Prevention (CDC) Wide-ranging Online Data for Epidemiologic Research database and obtained the county-level 2018 release SVI rankings from the CDC Agency for Toxic Substances and Disease Registry database [1,8]. All deaths related to ACM as the underlying cause of death were queried from 1999 to 2020 in the form of International Classification of Diseases, Tenth Revision (ICD-10) code I42.6.

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Table 1
Social Vulnerability Index. Four themes and 16 social variables used to quantify the level of social vulnerability.

Household characteristics	Socioeconomic status	Housing type & transportation	Racial and ethnic minority status
aged 65 or older	unemployed	no vehicle	Hispanic or Latino (of any race)
civilian with a disability	below 150% poverty	mobile homes	American Indian and Alaska Native
aged 17 or younger	no health insurance	crowding	Black and African American
single-parent households	housing cost burden	multi-unit structures	Asian
English language proficiency	no high school diploma	group quarters	Other Races, Not Hispanic or Latino Native Hawaiian and Other Pacific Islander

Demographic information including age, sex, race/ethnicity, and area of residence were obtained. Age-adjusted mortality rates (AAMR) per 100,000 population were estimated using the direct method with the US population in 2000 as the standard population. We obtained the SVI in the form of an overall SVI percentile ranking, ranging from 0 to 1, with 1 indicating the highest level of social vulnerability. Counties in each SVI percentile ranking were divided into quartiles with the first quartile (Q1) denoting the least socially vulnerable group, while the fourth quartile (Q4) represented the most socially vulnerable group. SVI rankings were connected to mortality data using county codes and mortality data were compared across SVI quartiles. Excess deaths attributable to higher SVI were obtained by comparing AAMR between Q4 and Q1. We also utilized univariable Poisson regression to estimate the risk ratio (RR) between Q4 and Q1. Statistical significance was determined by confidence intervals that did not include 1. This study did not require Institutional Review Board approval given the publicly available and anonymized nature of the data.

3. Results

There were a total of 1672 ACM deaths in Q1 compared to 2779 ACM deaths in Q4, with higher SVI accounting for 1107 excess-deaths in the US (Table S1). AAMR in Q4 (0.18) was higher compared to Q1 (0.13), with higher SVI accounting for 0.05 excess deaths per 100,000 person years (RR: 1.38 [95% CI, 1.26–1.50]) (Table 2). Higher SVI was associated with increased mortality rates among both sexes, with higher SVI accounting for 0.02 excess deaths per 100,000 person-years (RR: 1.67 [95% CI, 1.42–1.93]) in females and 0.09 excess deaths per 100,000 person-years (RR: 1.43 [95% CI, 1.31–1.58]) in males. Among all three of our included age-groups, an increase in SVI lead to higher mortality rates. Higher SVI accounted for 0.03 excess deaths per 100,000 person-years (RR: 2.5 [95% CI, 1.33–2.50]) in individuals ≤44 years, 0.10 excess deaths per 100,000 person-years (RR: 1.29 [95% CI, 1.17–1.44]) in individuals 46–64 years, and 0.11 excess deaths per 100,000 person-years (RR: 1.39 [95% CI, 1.20–1.68]) in individuals ≥65 years.

Hispanic populations had a higher AAMR in Q4 (0.10) compared to Q1 (0.04) with higher SVI accounting for 0.06 excess deaths per 100,000 person-years (RR: 2.50 [95% CI, 1.71–4.30]). Similarly, Non-Hispanic populations also had a higher AAMR in Q4 (0.19) compared to Q1 (0.13), with higher SVI accounting for 0.06 excess deaths per 100,000 person-years (RR: 1.46 [95% CI, 1.45–1.47]). Both Black and White populations were impacted by greater mortality rates in counties with the highest SVI; however, the AAMR in Q4 for Black populations (0.24) were higher compared to the AAMR in White populations (0.15) in Q4. Specifically, higher SVI accounted for 0.07 excess deaths per 100,000 person-years (RR: 1.41 [95% CI, 1.36–1.44]) in Black populations and 0.04 excess deaths per 100,000 person-years (RR: 1.36 [95% CI, 1.35–1.37]) in White populations.

Metropolitan regions had a higher AAMR in Q4 (0.17) compared to Q1 (0.10), with higher SVI accounting for 0.07 excess deaths per 100,000 person-years (RR: 1.7 [95% CI, 1.44–2.08]). In contrast, no differences in AAMR were observed among non-metropolitan regions in Q4 (0.19) compared to Q1 (0.19). Higher SVI accounted for 0.02 excess deaths per 100,000 person-years (RR: 1.15 [95% CI, 1.10–1.20]) in Northeastern regions, 0.08 excess deaths per 100,000 person-years (RR: 1.62 [95% CI, 1.45–1.79]) in Midwestern regions, 0.05 excess deaths per 100,000 person-years (RR: 1.63 [95% CI, 1.43–1.83]) in Southern regions, and 0.11 excess deaths per 100,000 person-years (RR: 1.85 [95% CI, 1.57–2.15]) in Western regions.

4. Discussion

Our study revealed greater ACM mortality among counties impacted

Table 2
Alcoholic Cardiomyopathy Age-Adjusted Mortality Rates Across SVI Quartiles. ACM age-adjusted mortality rates across each SVI quartile, cumulatively and across subpopulations (sex, race and ethnic, and geographic).

	SVI-Q1 (95% CI)	SVI-Q2 (95% CI)	SVI-Q3 (95% CI)	SVI-Q4 (95% CI)	Risk Ratio (95% CI)
All	0.13 (0.12–0.13)	0.15 (0.14–0.16)	0.14 (0.14–0.15)	0.18 (0.17–0.19)	1.38 (1.26–1.50)
Sex					
Female	0.03 (0.03–0.04)	0.03 (0.03–0.04)	0.03 (0.03–0.04)	0.05 (0.05–0.06)	1.67 (1.42–1.93)
Male	0.21 (0.20–0.22)	0.30 (0.29–0.31)	0.27 (0.26–0.28)	0.30 (0.29–0.31)	1.43 (1.31–1.58)
Age Groups					
≤44 years	0.02 (0.02–0.03)	0.02 (0.02–0.03)	0.02 (0.02–0.03)	0.05 (0.04–0.05)	2.5 (1.33–2.5)
46–64 years	0.34 (0.32–0.36)	0.38 (0.36–0.40)	0.38 (0.36–0.40)	0.44 (0.42–0.46)	1.29 (1.17–1.44)
≥65 years	0.28 (0.25–0.30)	0.39 (0.37–0.42)	0.34 (0.32–0.36)	0.39 (0.36–0.42)	1.39 (1.20–1.68)
Ethnicity					
Hispanic	0.04 (0.02–0.07)	0.11 (0.09–0.13)	0.07 (0.06–0.08)	0.10 (0.09–0.11)	2.50 (1.71–4.30)
Non-Hispanic	0.13 (0.12–0.13)	0.16 (0.16–0.17)	0.14 (0.14–0.15)	0.19 (0.19–0.20)	1.46 (1.45–1.47)
Race					
Black	0.17 (0.14–0.21)	0.25 (0.22–0.27)	0.22 (0.21–0.24)	0.24 (0.23–0.26)	1.41 (1.36–1.44)
White	0.11 (0.11–0.12)	0.14 (0.14–0.15)	0.13 (0.13–0.14)	0.15 (0.14–0.16)	1.36 (1.35–1.37)
US Census Region					
Northeast	0.13 (0.12–0.15)	0.16 (0.14–0.17)	0.13 (0.12–0.14)	0.15 (0.13–0.17)	1.15 (1.10–1.20)
Midwest	0.13 (0.12–0.14)	0.13 (0.12–0.14)	0.15 (0.14–0.16)	0.21 (0.18–0.23)	1.62 (1.45–1.79)
South	0.08 (0.07–0.10)	0.13 (0.12–0.14)	0.13 (0.12–0.14)	0.13 (0.12–0.14)	1.63 (1.43–1.83)
West	0.13 (0.11–0.15)	0.24 (0.23–0.25)	0.21 (0.19–0.22)	0.24 (0.23–0.26)	1.85 (1.57–2.15)
Urbanization					
Metro	0.10 (0.09–0.11)	0.15 (0.14–0.16)	0.14 (0.14–0.15)	0.17 (0.17–0.18)	1.7 (1.44–2.08)
Non-metropolitan	0.19 (0.17–0.21)	0.15 (0.14–0.17)	0.16 (0.15–0.18)	0.19 (0.18–0.21)	1.0 (0.94–1.06)

Abbreviations: ACM = alcoholic cardiomyopathy, CI = confidence interval, SVI = social vulnerability index.

by higher SVI rankings, cumulatively and across demographic subpopulations. Specifically, greater social vulnerability accounted for 0.05 excess ACM related deaths per 100,000 person-years in the US. For a populous nation like the US, this may lead to thousands of excess deaths over a decade, resulting in ripple effects on communities and healthcare systems. Although the SVI has been explored across multiple components within the cardiovascular disease care continuum, no previous analysis has explored its relationship with ACM. Given that ACM is a leading cause of non-ischemic cardiomyopathy in the US, it is imperative to understand this entity and subgroups that are more likely to be impacted in efforts to promote health equity and minimize disparities [9].

Greater SVI confers greater mortality rates from ACM due to a confluence of socioeconomic and healthcare access factors. Communities with higher SVI are ones with greater economic inequality, increased environmental exposures, lack of education, and limited access to healthcare [10]. The SVI has been correlated with poor healthcare access to individuals with CVD, increased readmission rates related to heart failure, and greater burden of cardiovascular mortality and risk factors [3–7]. Individuals with lower health literacy are also more likely to have a higher prevalence of CVD [11,12]. Additionally, communities facing financial stressors who also lack other recreational activities, given disadvantaged neighborhood structures, are more likely to use alcohol as a coping mechanism [12].

Our findings revealed that ACM mortality in Q4 were higher for males compared to females, aligning with the results of other studies [9]. This is likely related to more frequent alcohol consumption in males as compared to females [13]. However, this gender gap in alcohol use has been closing as women's drinking habits have been on the rise [14]. Additionally, both Black and White populations were impacted by higher ACM mortality in regions with higher SVI rankings. However, Black populations had a higher AAMR in Q4 compared to White populations that may relate to poorer access to primary care providers and health insurance coverage leading to advanced stages of disease and higher mortality rates amongst Black communities [15–17]. Black populations are more likely to undergo dire consequences associated with alcohol use including dependency symptoms, alcohol use disorder, and social and financial repercussions in the setting of residential segregation, unemployment, and educational disparities [18–20].

Metropolitan regions were impacted by higher ACM rates in regions with higher SVI; however, this finding was not seen in non-metropolitan regions. This is possibly due socioeconomic differences seen in rural areas that are not accounted for by the SVI. Moreover, one study found that overall cardiovascular death were higher in non-metropolitan regions; however, this observed discrepancy likely underscores the rates of alcohol consumption in metropolitan regions leading to increased rates of ACM mortality [21,22].

There are limitations to this study. Given the use of ICD-10 codes, misclassification bias may contribute to our findings. However, this is unlikely to explain the disparities observed. Given the cross-sectional design of our analysis, we are unable to establish causality. Lastly, we are unable to account for alcohol intake in our analyses, which may contribute to the sociodemographic differences in ACM mortality that we describe amongst different groups of patients.

5. Conclusion

Our findings revealed that populations impacted by greater SVI have a higher ACM mortality. Future areas of research should focus on alcohol use amongst the populations that we have identified to determine whether the excess mortality relates to greater alcohol consumption, or differences in clinical services in managing the medical and psychosocial complications of alcohol once established.

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Data availability statement

All data are available in publicly available repositories.

Declaration of competing interest

Authors have no conflict of interest.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ijcrp.2023.200224.

References

[1] Agency for Toxic Substances and Disease Registry. CDC/ATSDR social vulnerability index.Accessed December 6, 2020. https://www.atsdr.cdc.gov/placeandhealth/svi/index.html..
[2] N.K. Shortt, et al., Alcohol risk environments, vulnerability and social inequalities in alcohol consumption, Ann. Assoc. Am. Geogr. 108 (5) (2018) 1210–1227.
[3] G. Bevan, et al., Neighborhood-level social vulnerability and prevalence of cardiovascular risk factors and coronary heart disease, Curr. Probl. Cardiol. (2022), 101182.
[4] S. Ganatra, et al., Impact of social vulnerability on comorbid cancer and cardiovascular disease mortality in the United States, JACC CardioOncol. 4 (3) (2022) 326–337.
[5] V. Jain, et al., Association between social vulnerability index and cardiovascular disease: a behavioral risk factor surveillance system study, J. Am. Heart Assoc. 11 (15) (2022), e024414.
[6] Z.M. Thompson, et al., State-level social vulnerability index and healthcare access in patients with atherosclerotic cardiovascular disease (from the BRFSS survey), Am. J. Cardiol. 178 (2022) 149–153.
[7] M.R. Regmi, et al., Social vulnerability indices as a risk factor for heart failure readmissions, Clin. Med. Res. 19 (3) (2021) 116–122.
[8] Center for Disease Control and Prevention National Center for Health Statistics. CDC Wonder: Multiple Cause of Death 1999–2018. Center for Disease Control and Prevention..
[9] A. Shaaban, G M, V.S. Pendela, et al., Alcoholic Cardiomyopathy. [Updated 2022 Aug 8], in: StatPearls [Internet], StatPearls Publishing, Treasure Island (FL), 2023. https://www.ncbi.nlm.nih.gov/books/NBK513322/.
[10] T. Elfassy, et al., Associations of income volatility with incident cardiovascular disease and all-cause mortality in a US cohort, Circulation 139 (7) (2019) 850–859.
[11] K.J. Lindley, et al., Socioeconomic determinants of health and cardiovascular outcomes in women: JACC Review topic of the week, J. Am. Coll. Cardiol. 78 (19) (2021) 1919–1929.
[12] W.M. Schultz, et al., Socioeconomic status and cardiovascular outcomes: challenges and interventions, Circulation 137 (20) (2018) 2166–2178.
[13] A.F. Ceylan-Isik, S.M. McBride, J. Ren, Sex difference in alcoholism: who is at a greater risk for development of alcoholic complication? Life Sci. 87 (5-6) (2010) 133–138.
[14] K.M. Keyes, et al., Is there a recent epidemic of women's drinking? A critical Review of national studies, Alcohol Clin. Exp. Res. 43 (7) (2019) 1344–1359.
[15] D.C. Lee, H. Liang, L. Shi, The convergence of racial and income disparities in health insurance coverage in the United States, Int. J. Equity Health 20 (1) (2021) 96.
[16] W.J. Riley, Health disparities: gaps in access, quality and affordability of medical care, Trans. Am. Clin. Climatol. Assoc. 123 (2012) 167–172, discussion 172-4.
[17] L.D. Richardson, M. Norris, Access to health and health care: how race and ethnicity matter, Mt. Sinai J. Med. 77 (2) (2010) 166–177.
[18] J.C. Harris, et al., Racial differences in the association between alcohol drinking and cigarette smoking: preliminary findings from an alcohol research program, Alcohol Alcohol 57 (3) (2022) 330–339.
[19] Y. Ransome, et al., Racial disparities in the association between alcohol use disorders and health in Black and white women, Biodemogr. Soc. Biol. 63 (3) (2017) 236–252.
[20] T.C. Zapolski, et al., Less drinking, yet more problems: understanding African American drinking and related problems, Psychol. Bull. 140 (1) (2014) 188–223.
[21] S.H. Cross, et al., Rural-urban differences in cardiovascular mortality in the US, 1999-2017, JAMA 323 (18) (2020) 1852–1854.
[22] M.A. Dixon, K.G. Chartier, Alcohol use patterns among urban and rural residents: demographic and social influences, Alcohol Res 38 (1) (2016) 69–77.