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RESEARCH LETTER

Social Vulnerability and Potentially Preventable Cardiovascular Deaths Among Younger Adults in the U.S. Counties, 2014-2018

The social vulnerability index (SVI) integrates key social attributes (socioeconomic, household composition and disability, minority status and language barriers, and housing type and transportation vulnerabilities) to assess a community's resilience to a natural disaster.[1] United States counties with social vulnerabilities exhibited higher cardiovascular disease (CVD) mortality among non-elderly adults (<65 years).[1] Among those, younger adults (<45 years) living in the counties with more vulnerabilities experienced 2-fold higher deaths than those residing in the least vulnerable counties.[1] While prior studies focused on non-elderly adults, it is crucial to estimate the scope of the issue to guide health policy actions given the possible economic impact resulting from the lost productive years due to CVD mortality in young adults. Therefore, in this focused report, we aimed to estimate the association of social vulnerability and its components with potentially preventable deaths (PPD) from CVD among younger adults, stratified by demographic characteristics.

We used the Centers for Disease Control and Prevention SVI database from 2014 to 2018, which ranks every US census tract on 15 social variables and groups them into 4 related themes (Table 1).[2] First, we calculated percentile ranking for SVI within the county, across counties within a particular state, and the country. We then classified percentile rankings into quartiles from least vulnerable (first: 0-0.25) to most vulnerable (fourth: 0.75-1.00). Next, we used the databases of the National Center for Health Statistics death certificates and US Census Bureau from 2014 to 2018 to abstract deaths among younger adults (18-44 years) from CVD and its subtypes: ischemic heart disease (IHD) (International Classification of Diseases (ICD)-10: I20-I25), stroke (I60-I69), and heart failure (HF) (I50).[3] Following the Centers for Disease Control and Prevention methods, we estimated PPD (the number of deaths above the number that would be anticipated if the death rates in all states were equivalent to those in the average of the 3 states with the lowest death rates [benchmark states], by age group and cause of death).[4] The same benchmarks were applied to metropolitan (large, medium/small metros) and nonmetropolitan (micropolitan and noncore) counties. Finally, we linked county-level SVI and National Center for Health Statistics mortality data to compare PPD across the SVI quartiles (SVI-Q). Demographic subgroups included sex, race (non-Hispanic [NH] White and Black adults), and counties. We excluded NH American Indian or Alaska Native and Asian/Pacific Islander since mortality data were small and unreliable. We assumed *quasi*-Poisson distribution for PPD, and data were reported as median (Q1-Q3). The data were de-identified and publicly available; therefore, informed consent was not applicable per United States Department of Health and Human Services regulation 45 Code of Federal Regulations 46.101(c).

Between 2014 and 2018, the average annual observed CVD deaths were 94,407 (IHD: 28,842; stroke: 12,272; and HF: 2,967). The average annual PPD from CVD were 38,004 (IHD: 9,480; stroke: 3,746; and HF: 1,900). Overall, PPD from CVD were higher in men vs women (51% vs 16%), NH Black vs NH White adults (66% vs 26%), and nonmetropolitan vs metropolitan counties (51% vs 32%). There was a stepwise increase in PPD from least to most vulnerable counties (Table 1), consistent across demographic groups. There was a 35% (95% confidence interval [CI]: 23%-48%) absolute increase in PPD from CVD (IHD: 32% [95% CI: 20%-44%]; stroke: 45% [95% CI: 35%-54%]; and HF: 4% [95% CI: −10% to 17%]) between fourth vs first SVI-Q. Vulnerabilities related to socioeconomic and household composition and disability were significantly associated with PPD. Decedents from IHD and residents of micropolitan counties exhibited a substantial rise from first to fourth SVI-Qs. While both sexes and races showed a significant increase in PPD from first to fourth SVI-Q, women and NH Black adults showed a substantially higher rise across SVI-Qs. For instance, NH White men and women showed an 8- and a 55-fold increase in

TABLE 1 Number of Potentially Preventable Deaths Among Younger Adults Aged <45 Years According to Quartiles of the Social Vulnerability Index, 2014 to 2018

	First Quartile	Second Quartile	Third Quartile	Fourth Quartile
Social vulnerability index	59 (15-104)	349 (80-1,102)	1,180 (156-1,999)	1,246 (388-1,482)
Components of social vulnerability index				
Socioeconomic vulnerability index	82 (37-173)	234 (101-1,102)	1,279 (466-2,024)	1,301 (709-1,740)
Household composition and disability vulnerability index	92 (19-176)	154 (76-1,102)	1,331 (388-2,024)	1,076 (611-1,184)
Minority status/language vulnerability index	85 (59-1,180)	294 (85-1,265)	1,031 (100-1,456)	191 (105-926)
Housing type/transportation vulnerability index	144 (55-234)	137 (76-1,260)	802 (166-1,316)	388 (101-1,246)
Cardiovascular disease subtypes				
Ischemic heart disease	9 (1-37)	63 (15-236)	340 (17-484)	386 (72-421)
Stroke	1 (0-4)	30 (3-76)	91 (6-189)	150 (21-161)
Heart failure	6 (5-8)	11 (4-45)	48 (6-88)	75 (3-113)
Sex and race				
Non-Hispanic White men	48 (40-133)	222 (82-533)	484 (220-811)	399 (203-482)
Non-Hispanic White women	0 (0-0)	2 (1-3)	122 (0-233)	111 (0-144)
Non-Hispanic Black men	16 (0-50)	153 (8-473)	153 (62-621)	511 (64-613)
Non-Hispanic Black women	2 (0-11)	69.5 (0-168)	78 (20-298)	294 (33-376)
County type				
Metropolitan	18 (1-44)	300 (79-931)	651 (101-1,394)	581 (317-1,172)
Nonmetropolitan	41 (7-79)	45 (18-191)	215 (49-569)	368 (103-590)

Values are median (Q1-Q3). Social vulnerability quartiles: first: 0.00 to 0.25; second: 0.26 to 0.49; third: 0.50 to 0.75; fourth: 0.75 to 1.00. We averaged the death rates of the 3 states during 2014 to 2018 (benchmark states) to produce benchmark rates. The age and cause of death stratified average death rates per 100,000 for benchmark states were overall cardiovascular disease [3.6 (Utah, New Mexico and Washington) for 18-29 years; 11 (Vermont, New Hampshire, and Oregon) for 30-39 years; 24.9 (New Hampshire, Minnesota, and Colorado) for 40-44 years], ischemic heart disease [2 (California, Utah and New Mexico) for 18-39 years; 10.8 (Colorado, Washington and Connecticut) for 40-44 years], heart failure [0.2 (Colorado, Washington and New York) for 18-44 years], and stroke [1.6 (Oregon, Nebraska and Minnesota) for 18-44 years]. The same benchmarks were applied to demographic groups, cause of death within the counties, and county type. We calculated the expected number of casualties for each demographic group by multiplying population estimates for age, sex, ethnicity/race, cause, and urban-rural county classification by the benchmark death rates. The expected deaths were subtracted from the observed to yield potentially preventable deaths. We then linked social vulnerability index and mortality data and aggregated potentially excess deaths across study groups.

PPD from first to fourth SVI-Qs, respectively. In comparison, NH Black men and women showed a 32- and 147-fold increase in PPD across SVI-Qs. This gradient effect across sexes and races was consistent across the socioeconomic and household composition and disability vulnerability indices.

In this analysis, ~3 in 10 PPD from CVD among young adults were associated with greater social vulnerabilities in U.S. counties. The social stratification of the younger women and NH Black population places them at a higher risk of premature CVD mortality.[5] We noted no association between the proportion of minorities and those who are less proficient in the English language within a county with CVD mortality; however, the health of young minorities was instead influenced by vulnerabilities connected to socioeconomic status, household structure, and disability. These findings suggest that racism, but "not the race," which is linked to unequal resource distribution, is thus a crucial social determinant of health that generates a disproportionate impact on the cardiovascular survival of young minorities. Overall, communities with susceptible household compositions, such as elderly (65+ years) or very young (17 years) people, lone parents, or people with disabilities, may face socioeconomic obstacles that disproportionately affect the CVD survival of young adults.

Our analysis was limited by relying on unadjudicated mortality data, coding inaccuracies, and modeling assumptions to calculate excess deaths. In addition, small and unreliable mortality estimates precluded us from analyzing NH American Indian/Alaska Native, Asian/Pacific Islander, and Hispanic data. This analysis demonstrates the influence of county-level SVI on the cardiovascular health of individuals, endorsing the integration of social determinants of health into cardiovascular risk assessment frameworks. Identifying underserved populations and prioritizing public health actions in counties with significant social vulnerabilities may help reverse the CVD burden among younger adults.

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REFERENCES

1. Khan SU, Javed Z, Lone AN, et al. Social vulnerability and premature cardiovascular mortality among US counties, 2014 to 2018. *Circulation*. 2021;144:1272–1279.

2. CDC/ATSDR social vulnerability index. Accessed October 10, 2021. https://www.atsdr.cdc.gov/placeandhealth/svi/index.html

3. National Center for Health Statistics. Accessed December 25, 2022. https://www.cdc.gov/nchs/nhis/about_nhis.htm

4. Garcia MC. Potentially excess deaths from the five leading causes of death in metropolitan and nonmetropolitan counties—United States, 2010–2017. *MMWR Surveill Summ*. 2019;68:1–11.

5. Gangavelli A, Morris AA. Premature cardiovascular mortality in the United States: who will protect the most vulnerable among us? *Circulation*. 2021;144:1280–1283.