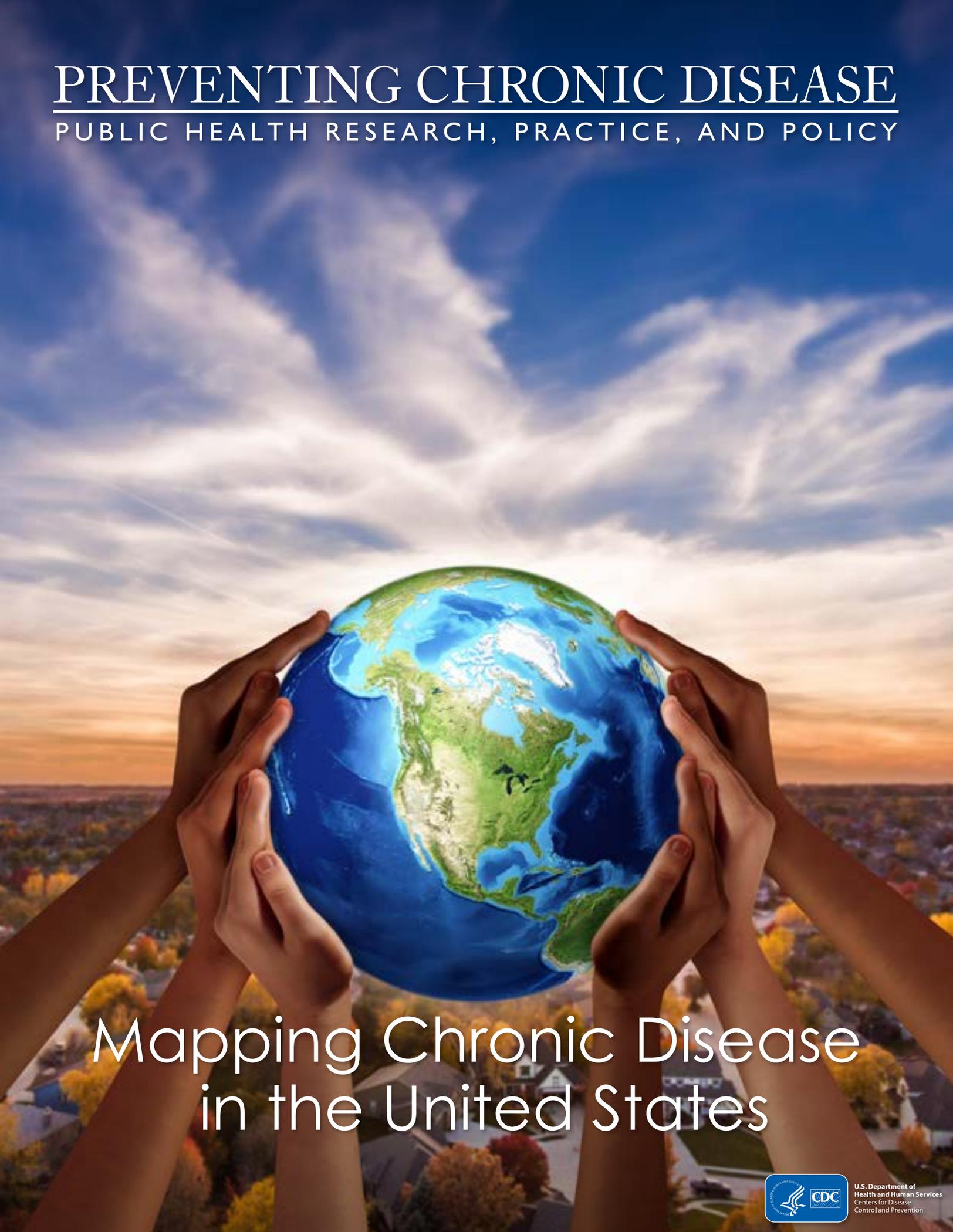


# PREVENTING CHRONIC DISEASE

PUBLIC HEALTH RESEARCH, PRACTICE, AND POLICY



## Mapping Chronic Disease in the United States



U.S. Department of  
Health and Human Services  
Centers for Disease  
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# About the Journal

*Preventing Chronic Disease* (PCD) is a peer-reviewed public health journal sponsored by the Centers for Disease Control and Prevention and authored by experts worldwide. PCD was established in 2004 by the National Center for Chronic Disease Prevention and Health Promotion with a mission to promote dialogue among researchers, practitioners, and policy makers worldwide on the integration and application of research findings and practical experience to improve population health.

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## GUEST EDITORIAL

# Chronic Disease Mapping, an Important Strategy and Tool for Health Promotion

Karen Hacker, MD, MPH<sup>1</sup>; Rachel Kaufmann, PhD, MPH<sup>1</sup>

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## PEER REVIEWED

Loss of life from the COVID-19 pandemic has been tremendous over the past several years (1); however, chronic diseases like heart disease and cancer still account for the largest numbers of deaths in the US. Stroke and Alzheimer disease are also among the leading causes of death (2). Chronic disease overall continues to drive national mortality and morbidity (2). Its annual national medical cost exceeds \$1 trillion, which doesn't include the cost to the economy of workdays lost to illness and disability (3). Having a chronic disease like diabetes or cancer is a risk factor for severe morbidity and mortality from COVID-19 (4). We know that many chronic diseases can be prevented (5) and that risk behaviors such as tobacco use, alcohol consumption, poor nutrition, and lack of physical activity are the leading contributors to preventable chronic disease (6). As we move forward, our country's ability to remain resilient is dependent on chronic disease prevention and management (7).

The Centers for Disease Control and Prevention's (CDC's) National Center for Chronic Disease Prevention and Health Promotion (NCCDPHP) is dedicated to preventing chronic disease and promoting health and wellness for all. Our 9 divisions work in major areas related to both risk factors such as smoking and physical inactivity and diseases such as cancer, diabetes, and cardiovascular disorders (7). Strategies fall into 4 domains: epidemiology and surveillance to understand the prevalence and incidence of conditions and behaviors over time, environmental approaches aimed at shifting behaviors and offering opportunities for healthy living to all, health care interventions that identify disease early and help manage chronic conditions, and connecting people to the clinical care and resources they need to thrive (8). NCCDPHP relies on various types of public health surveillance data, such as individual

interviews about health behaviors, clinical and laboratory data, tracking cancer survivors' medical journeys, sales data documenting Americans' use of tobacco and food, and vital statistics from birth and death certificates (9). These are used to understand the population's health status and trends, identify emerging issues, and evaluate whether interventions aimed at improving health have been successful.

Helping communities, state and local partners, and all interested parties understand the prevalence of chronic disease is always a challenge. Over the last few decades, visualization has become enormously helpful (10). Mapping information that helps people literally see where conditions disproportionately affect specific areas and groups has proved enlightening. Maps created by using geographic information systems — GIS — provide the public with clear, easy-to-understand information on patterns, relationships, and levels of disease or behavior within specific geographic areas (11). For example, a study of life expectancy at birth showed disparities as large as 20.1 years across US counties, with the lowest life expectancies clustered in the Southeast and Appalachia and the highest clustered in Colorado and the California coast (12).

Animated maps can also depict changes over time. Take for example maps of the obesity epidemic, which provided a stark understanding of the epidemic's expansion (13). Or maps of opioid overdoses, which demonstrated the severe loss of life that occurred from 2011 through 2017 (14). More recently, maps of COVID-19 morbidity linked with maps of chronic disease helped local communities direct vaccination and other mitigation efforts (15). The value of the "Aha!" moment that occurs when you see the public health surveillance data in a GIS visualization cannot be overestimated. For example, in 1995, a map of blood lead testing results for young children attending WIC (Special Supplemental Nutrition Program for Women, Infants, and Children) clinics in Salt Lake County, Utah, showed that 76% of children with elevated blood lead levels resided in a contiguous area comprising 10% of the county (16). Consequently, the Salt Lake city and county health departments reached out to parents and physicians to encourage screening of young children living in that area. Screenings increased significantly, and additional children with elevated



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levels were identified. This early mapping application was uncomplicated yet revealing, providing the exact information local health departments needed to take appropriate action.

Although mapping for public health action may have begun with John Snow's famous demonstration in 1854 of a cholera-contaminated water source (17), use of GIS in public health has proliferated over the past several decades. Today's digital maps can involve multiple layers integrating disparate types and sources of information. GIS allows users to create maps that can examine health-related factors by location, elevation, and time. Users can integrate relevant information about population density, air quality, neighborhood wealth index, transportation routes, and food availability, as just a few examples. These "geospatial determinants of health" (18) need to be identified and shared with the people who set policy, plan interventions, treat patients, and organize communities.

In recent years, NCCDPHP has used GIS extensively to identify areas of high and low disease prevalence, and environments that dispose populations to high and low risk of chronic disease. These locations might benefit from directed interventions, producing changes over time. NCCDPHP has also sponsored efforts to increase the use of GIS by health departments. From 2018 through 2020, NCCDPHP's Division of Heart Disease and Stroke Prevention published *GIS Express for Chronic Disease*, a newsletter for public health professionals to share GIS-related information (19). NCCDPHP has also supported the National Association of Chronic Disease Directors' GIS Capacity Building Project, which provides GIS training for state and local health departments and established the Chronic Disease GIS Network to connect, support, and highlight public health professionals using GIS to address chronic disease priorities (20,21).

This *Preventing Chronic Disease* collection features 6 peer-reviewed articles that highlight examples of NCCDPHP's uses of GIS in preventing and addressing chronic diseases. Most were submitted in 2023 in response to a call for papers in the journal's article category, "GIS Snapshots," and one essay featuring GIS maps was published before the journal's call for papers. GIS Snapshots are intended to highlight the public health application of maps in a brief format, demonstrate how GIS informs chronic disease prevention and treatment, and inspire others to use GIS in their work (22). The articles in this collection document how GIS can be used to identify populations at greatest risk, locations for public health interventions, and sometimes-surprising relationships requiring more in-depth research.

The essay by Petersen et al (23) includes maps illustrating how obesity prevalence varies startlingly across the United States — not just by region, but also by race and ethnicity. While the

obesity epidemic has affected the entire nation, its burden falls especially on non-Hispanic Black and Hispanic Americans. The Evans et al article (24) also examined national disparities by race and by county, this time for stroke. They found that counties with the highest number of stroke deaths were similar for Black and White Americans, but counties with the highest stroke hospitalization rates had more divergence, a finding that suggests avenues for future study in stroke care.

Geolocating areas where resources are needed can be useful for decision makers as they consider interventions directed at patients, clinicians, and the general public. In the Wittman et al (25), Fujii et al (26), and Richardson et al (27) articles, authors sought information critical for focusing these future interventions. Wittman et al found that in Appalachia, economically distressed counties are less likely to have a diabetes self-management program, even though having to travel a long distance to participate may be an important barrier to program use in these communities. Such analyses can provide decision makers with important information about where new programs are needed to improve access. In a similar vein, Fujii et al examined locations of barber and beauty shops as potential community-based resources in fighting hypertension. Their analysis demonstrates the potential feasibility of bringing the LA Barbershop Model (28), in which blood pressure screenings are offered at community-friendly locations, to other cities. Richardson et al examined state-level improvements in colorectal cancer screening rates to elucidate patterns of use and opportunities for improvement. Although screening prevalence has increased in every state since 2012, 22 states did not meet the national target screening rate for 2020. Lastly, GIS visualizations can also prompt additional unanswered questions. For example, the analysis by Han et al (29) of chronic kidney disease and poverty at the county level showed that outcomes do not always follow predicted patterns. Poverty and chronic kidney disease were not always related as expected, and the pattern seemed to vary by region.

The articles in this collection demonstrate just a few recent uses of GIS at NCCDPHP. Mapping is used extensively by CDC programs and partners to highlight features such as prevalence and geographic distribution of risk factors, disease outcomes, and community characteristics. Geographic visualizations can be important tools during emergency responses but also play a key role in understanding relationships among disorders, risk factors, environmental context, and other factors. In 2019, *Preventing Chronic Disease* published an article collection, *Population Health, Place, and Space: Spatial Perspectives in Chronic Disease Research and Practice*. The articles in that collection provided insights on how using GIS mapping advances understanding of connections between community-level characteristics and population health

and showed innovative ways of developing and applying new spatial statistical methods and geospatial tools in public health and how maps and geospatial results can be used to guide program and policy decisions (30).

Today, GIS competency is necessary for public health departments across the nation at local, county, and state levels (31). Its use will continue to evolve, and we look forward to applying it to additional chronic disease issues. As artificial intelligence becomes more available, this too will help to drive GIS capacity, such that large datasets can be transformed into clearly visible spatial analyses (32). For further information on the work across NCCDPHP and to download state and local chronic disease data for your own GIS maps, visit the National Center for Chronic Disease Prevention and Health Promotion (NCCDPHP), Open Data Portal ([www.cdc.gov/chronicdisease/data/indicators.htm](http://www.cdc.gov/chronicdisease/data/indicators.htm)).

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### GIS SNAPSHOTS

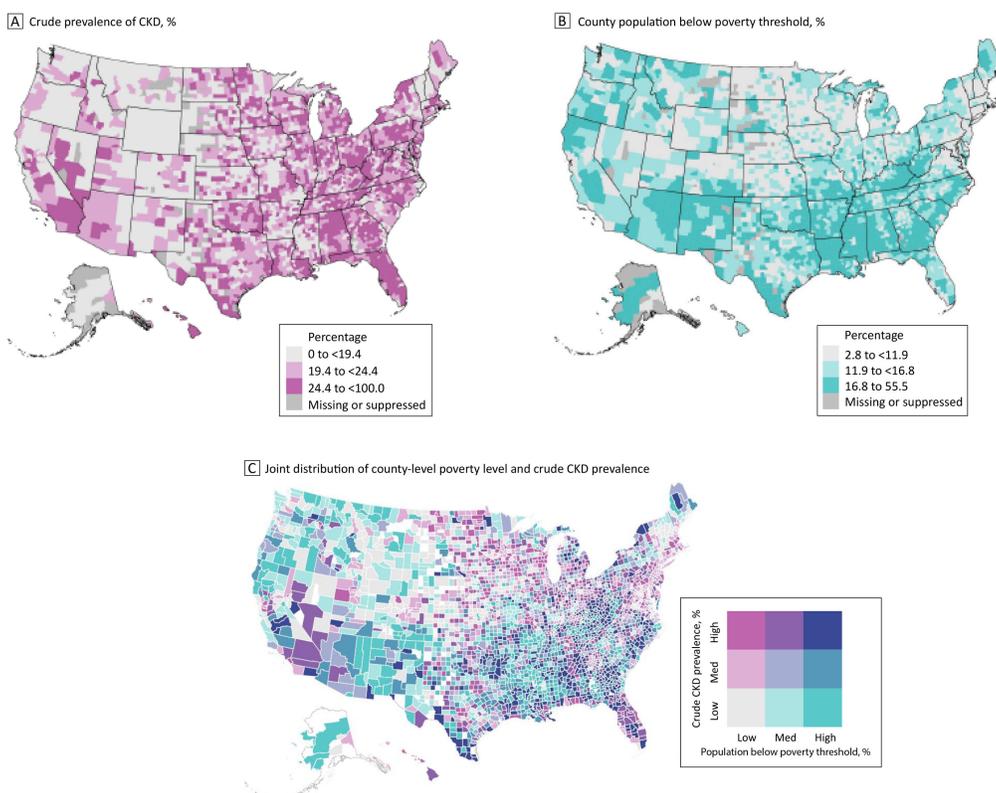
# Mapping the Overlap of Poverty Level and Prevalence of Diagnosed Chronic Kidney Disease Among Medicare Beneficiaries in the United States

Yun Han, PhD<sup>1</sup>; Fang Xu, PhD<sup>2</sup>; Hal Morgenstern, PhD<sup>3,4</sup>; Jennifer Bragg-Gresham, PhD<sup>1</sup>;  
 Brenda W. Gillespie, PhD<sup>5</sup>; Diane Steffick, PhD<sup>1</sup>; William H. Herman, MD, MPH<sup>3,6</sup>;  
 Meda E. Pavkov, MD, PhD<sup>2</sup>; Tiffany Veinot, PhD<sup>7</sup>; Rajiv Saran, MD<sup>1,3</sup>

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### PEER REVIEWED



Geographic differences by county in CKD prevalence among US Medicare beneficiaries aged  $\geq 65$  years and in poverty levels, with higher rates of CKD in Florida and Appalachia (Panel A) and higher poverty levels in the Southeast (Panel B). Many counties in the South have both high poverty levels and a high prevalence of CKD, while many counties in the Northeast and Midwest have lower poverty levels but a high prevalence of CKD (Panel C). Abbreviation: CKD, chronic kidney disease. Data sources: Centers for Disease Control and Prevention (9); US Census Bureau (11).



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## Background

Living in high-poverty neighborhoods has been identified as a contributing factor to the development and progression of chronic kidney disease (CKD) (1,2). High-poverty neighborhoods often face inequities related to social determinants of health, such as lower incomes; gaps in educational achievement; inadequate access to healthy food, health care, green space, and high-quality recreational facilities; and greater exposure to air and water pollution (3–8). A limited ability to purchase healthy food and access recreational facilities and preventive health care can delay diagnosis and timely management of CKD. Understanding the distribution of CKD at the county level in relation to poverty level is important: this knowledge can guide population-level interventions for CKD prevention and management. The objectives of this study were to examine the county-level association between poverty level and diagnosed CKD and to illustrate county-level bivariate distribution of poverty and CKD among Medicare fee-for-service beneficiaries aged 65 years or older in the US.

## Methods

We calculated the county-level prevalence of diagnosed CKD in each US county among Medicare fee-for-service beneficiaries aged 65 years or older based on 5% claims data for 2019. The study population included beneficiaries who had full-year Parts A and B enrollment and at least 1 inpatient or outpatient visit in 2019. The numerator of CKD prevalence included eligible beneficiaries with at least 1 claim in 2019 containing an ICD-10-CM (*International Classification of Diseases, Tenth Revision, Clinical Modification*) diagnosis code for CKD (9,10). We excluded beneficiaries with end-stage kidney disease because they are not at risk for CKD. We also excluded Medicare beneficiaries covered by Part C (managed care/Medicare Advantage plans) because of limited availability of data. The total study population consisted of 1,234,056 beneficiaries in 3,097 counties (98.5% of all 3,143 US counties).

Poverty level was measured as the percentage of the total county population below the poverty threshold extracted from the American Community Survey 5-year data (2015–2019) (11).

We linked measurements of CKD and poverty by using county Federal Information Processing Standards (FIPS) codes. We standardized county-level prevalence of CKD based on strata of demographic characteristics. The 5% sample of the 2019 Medicare population aged 65 years or older (ie, the study population) served as the standard population. We performed 3 analyses: 1) a crude (unstandardized) analysis; 2) standardization on age alone (age categories 65–69, 70–79, 80–89,  $\geq 90$  y); and 3) standardiza-

tion on age, sex (male, female), and race and ethnicity (White, Black, Hispanic, Asian, other [American Indian or Alaska Native, Native Hawaiian or Other Pacific Islander, other], unknown).

We then generated 2 univariate choropleth (color-coded or shaded) maps to separately depict crude county-level distributions of CKD prevalence and poverty levels across the US. In addition, we created a bivariate map (in R version 4.3.1 [R Foundation for Statistical Computing]) that combines the distributions of both variables in each county by using a 2-dimensional ( $3 \times 3$ ) key to show the tertile (high, medium, low) of CKD prevalence and poverty level. Thus, the color of each county represents the association between county poverty level and CKD prevalence, and the bivariate map shows the pattern of those associations across the US, emphasizing the clustering and geographic patterns of counties. Data were suppressed for counties with 10 or fewer beneficiaries ( $n = 108$ , 3.4% of all counties) according to the Centers for Medicare & Medicaid Services small-cell suppression rule to protect privacy (12). This suppression had only a minor effect on the map's appearance, but it may have led to underrepresentation of counties with smaller populations of older adults.

## Highlights

The mean (SD) county-level crude prevalence of CKD in the study population was 22.1% (6.5%). The mean (SD) prevalence of poverty was 15.4% (6.9%). As the poverty level increased, the crude prevalence of CKD also rose, from 20.9% to 23.4% (Table). This pattern was nearly the same when standardized measures were used (Table), suggesting that age, sex, and race and ethnicity did not confound the association between poverty-level tertile and CKD prevalence.

We observed considerable geographic variations in crude CKD prevalence (Figure A) and poverty level (Figure B). CKD prevalence was higher in Florida and the Appalachian region, which encompasses parts of Ohio, Pennsylvania, West Virginia, Kentucky, Tennessee, and Alabama (Figure A). Poverty levels were clustered, with a high concentration of counties east of the Mississippi River having higher poverty levels (Figure B).

The bivariate map (Figure C) shows the underlying joint distribution of county-level poverty and CKD prevalence. Many counties in the Southeast show high levels of both poverty and CKD, and many counties in New England show low levels of both poverty and CKD. Both patterns indicate a positive association between the 2 measures (high–high or low–low). In contrast, several counties in the mid-Atlantic coast and the upper Midwest show high CKD prevalence and low poverty level, and many counties in the West show high levels of poverty level and low CKD prevalence, indicating an inverse association between the 2 measures (high–low or low–high).

## Action

The observed spatial disparities in CKD and poverty suggest that a one-size-fits-all intervention may not be effective in decreasing the prevalence of CKD. Tailored interventions for older adults are necessary. In high-prevalence/high-poverty counties, interventions could focus on local challenges among older adults by improving health care access, addressing socioeconomic barriers to health, and implementing strategies such as subsidized healthy food programs and enhanced health care services. Conversely, in high-prevalence/low-poverty counties, strategies could encompass health education and disease management programs, with a focus on public awareness campaigns about CKD risk factors and promotion of regular health screenings. In these counties, factors other than economic status, including prevalence of comorbidities, health care access, environmental conditions, and lifestyle choices, may influence the prevalence of CKD.

Although our study sheds light on the correlation between county-level poverty and the prevalence of CKD, it has limitations in addressing the multifaceted nature of poverty. First, individual-level poverty, which encompasses personal financial constraints and limited access to health care, also plays a crucial role in CKD risk. Our focus on county-level data may not fully capture individual poverty experiences and their direct effect on CKD. Studies incorporating individual-level socioeconomic data could enhance the understanding of the complex interplay between poverty and CKD prevalence. Second, we identified CKD based on ICD-10-CM diagnosis codes because we lacked laboratory data (eg, estimated glomerular filtration rate). This reliance on diagnosis codes may have resulted in an underestimation of actual CKD prevalence and possible distortions in observed geographic patterns. A third limitation is the choice of geographic unit; using county-level data may mask finer-scale variations and socioeconomic disparities, particularly in urban areas. Fourth, our cross-sectional study examined the relationship between county-level poverty and CKD prevalence at a single time point. As highlighted by Lapedis et al (13), a cross-sectional approach may not fully encapsulate the complex and evolving relationship between neighborhood characteristics and the various stages of CKD, particularly the early stages. The reliance on a single time-point analysis limits our ability to understand these dynamics over the life course. Overall, further research, accounting for confounders and mediators, may be essential to delve into the underlying causes of the observed spatial disparities in CKD and poverty. This research includes identifying factors contributing to high CKD prevalence in low-poverty counties in the Northeast and Midwest. These findings may guide clinical practice and health policy aimed at mitigating CKD disparities across the US.

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Table

**Table. Crude and Standardized Prevalence of Diagnosed Chronic Kidney Disease Among Medicare Beneficiaries Aged ≥65 Years, by Tertile of County Poverty Level (N = 3,097), United States, 2019<sup>a</sup>**

Prevalence	All	Tertile of county poverty level <sup>b</sup>		
		Low	Medium	High
Crude	22.1 (6.5)	20.9 (6.0)	22.1 (6.2)	23.4 (7.0)
Standardized for age <sup>c</sup>	22.2 (6.6)	21.0 (6.2)	22.2 (6.3)	23.5 (7.1)
Standardized for age, sex, and race and ethnicity <sup>c</sup>	22.0 (6.9)	20.8 (6.4)	22.0 (6.4)	23.0 (7.6)

Abbreviation: CKD, chronic kidney disease.

<sup>a</sup> Data source: 2019 Medicare 5% Sample Data and American Community Survey data (2015–2019) (11). All values are mean (SD).

<sup>b</sup> Tertile breaks were used to create the categories for all data from the study population for poverty level (expressed as percentage of the population below the federal poverty threshold): low, <12%; medium, 12%–17%; high, >17%.

<sup>c</sup> Standardization was based on strata for age (65–70, 70–80, 80–90, >90 y), sex, and race and ethnicity (White, Black, Hispanic, Asian, other [American Indian/Alaska Native, Native Hawaiian/Other Pacific Islander, other], unknown). The standard population was Medicare fee-for-service beneficiaries aged ≥65 years in 2019.

### GIS SNAPSHOTS

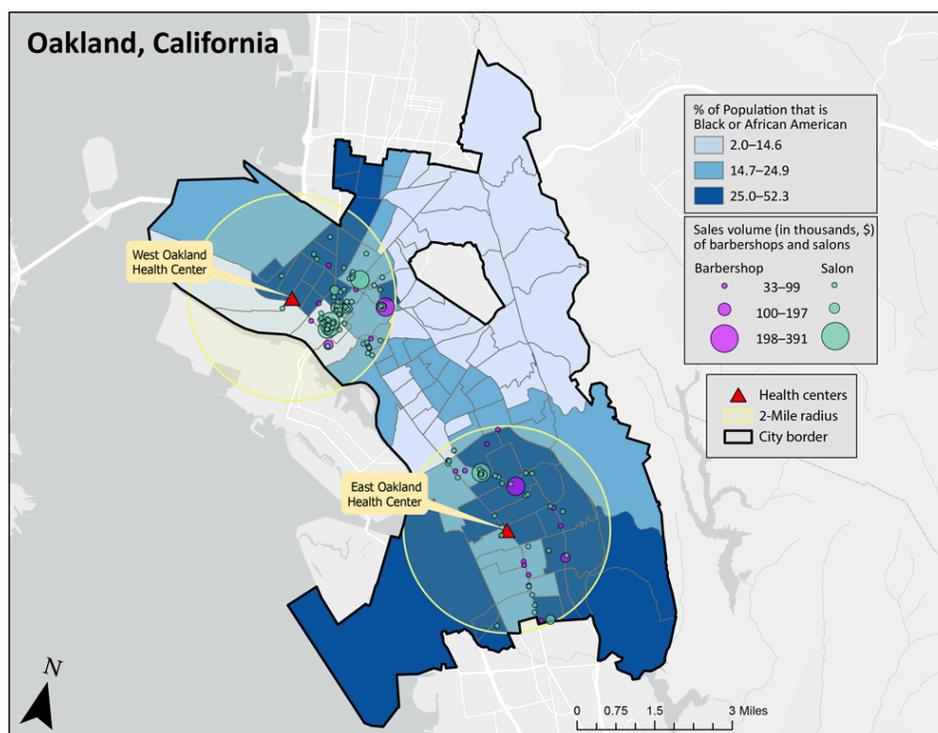
# Finding Optimal Locations for Implementing Innovative Hypertension Management Approaches Among African American Populations: Mapping Barbershops, Hair Salons, and Community Health Centers

Yui Fujii, MPH<sup>1,2</sup>; Taylor E. Streeter, MPH<sup>1</sup>; Linda Schieb, MPH<sup>1</sup>; Michele Casper, PhD<sup>1</sup>; Hilary K. Wall, MPH<sup>1</sup>

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### PEER REVIEWED



Within a 2-mile radius of the East Oakland Health Center and the West Oakland Health Center, in Oakland, California, numerous barbershops and hair salons are located in census tracts where more than 14.7% of the population is Black or African American. This map provides information for implementing innovative blood pressure management approaches that extend the evidence-based LA barbershop model in African American communities. Sources: US Census Bureau (1), Esri Business Analyst (2).



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## Background

An estimated 120 million US adults have hypertension, a leading cause of heart disease, stroke, and kidney disease, and about 93 million of those adults have uncontrolled hypertension (3,4). Black or African American (hereinafter, African American) populations have a disproportionate burden of hypertension and hypertension-related mortality compared with White populations (5,6). The Los Angeles Barbershop Blood Pressure Study, a novel approach to improve hypertension control among African American adults, involved partnerships between local barbershops and pharmacists. Barbers screened African American men for hypertension, and pharmacists provided hypertension medication management. This intervention significantly reduced systolic blood pressure by an average of 21.6 mm Hg among African American men enrolled in the study (7).

The LA barbershop model demonstrated that trusted spaces, like barbershops, can facilitate evidence-based care and contribute to reductions in blood pressure in African American communities (8,9). Although recognized for its impact on hypertension control, this model has not been scaled to real-world settings, nor has it been expanded to include other trusted spaces. Million Hearts, a national initiative to prevent myocardial infarctions, strokes, and other cardiovascular events, is mapping selected communities as part of a feasibility demonstration project to identify patterns of 3 core components needed for large-scale implementation of the LA barbershop model: 1) percentage of the population that is African American, 2) location of community health centers, and 3) location of barbershops and hair salons within a 2-mile radius of community health centers. In this GIS Snapshot, we expand on the LA barbershop model by including hair salons as trusted spaces and focus on these 3 core components in Oakland, California.

## Data and Methods

We obtained data on the percentage of the population that is African American in each census tract in Oakland, California, from the US Census Bureau American Community Survey (2016–2020) (1). We selected the East Oakland Health Center and the West Oakland Health Center because of their interest in partnering in Million Hearts. We used the North American Industry Classification System codes 812111 (barber shops) and 812112 (hair salons) from Esri Business Analyst to obtain geocoded data on barbershops and hair salons, along with their sales volumes (2). We categorized barbershops and hair salons according to tertiles of sales volume.

We created a choropleth map that shows tertiles of the percentage of population that is African American in Oakland (N = 116 census tracts) and drew a 2-mile radius around each health center to capture core components nearby. We included in the map all

barbershops (N = 25) and hair salons (N = 112) within a 2-mile radius of each health center; the map also shows these businesses by tertile of sales volume. We used ArcGIS Pro 2.9.2 (Esri) to create the map.

## Highlights

Within a 2-mile radius of both the East Oakland Health Center and the West Oakland Health Center, numerous barbershops and hair salons are located in census tracts in the middle tertile (14.7%–24.9%) and top tertile (25.0%–52.3%) of percentage African American population. More barbershops and hair salons are within a 2-mile radius of the West Oakland Health Center (n = 88) than the East Oakland Health Center (n = 49). However, the East Oakland Health Center has a greater percentage (43%) of shops and salons located in the top tertile of percentage of African American population, compared with those near the West Oakland Health Center (16%). In both locations, there are barbershops and salons in all 3 categories of sales volume. These locations are potential settings for implementing the LA barbershop model of hypertension medication management in real-world settings.

## Action

Million Hearts addresses inequities in health care among racial and ethnic minority populations, including hypertension medication management in trusted spaces for African American people with hypertension. Our map provides valuable information for implementing innovative hypertension management approaches that extend the evidence-based LA barbershop model. Community health centers in Oakland can use this map to identify barbershops and hair salons — trusted spaces in African American communities — to initiate discussions for enhancing community–clinical linkages for hypertension management that are tailored to the needs of African American communities. This asset mapping of 3 core components (percentage African American population, presence of health centers, and nearby barbershops and hair salons) can serve as a model for other communities interested in extending the LA barbershop model of hypertension medication management.

A recent statement from the American Heart Association/American Medical Association (AHA/AMA) indicates that “large-scale implementation and dissemination [of high blood pressure management and control strategies] would help accelerate the translation of evidence-based best practices into care” (10). The AHA/AMA statement is an urgent call for multipronged approaches to optimize blood pressure management in light of the recent national declines in blood pressure control (10). These organizations also

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recognized the need to increase access to care for populations that have been historically excluded from traditional health care settings and have a disproportionately high burden of hypertension.

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### GIS SNAPSHOTS

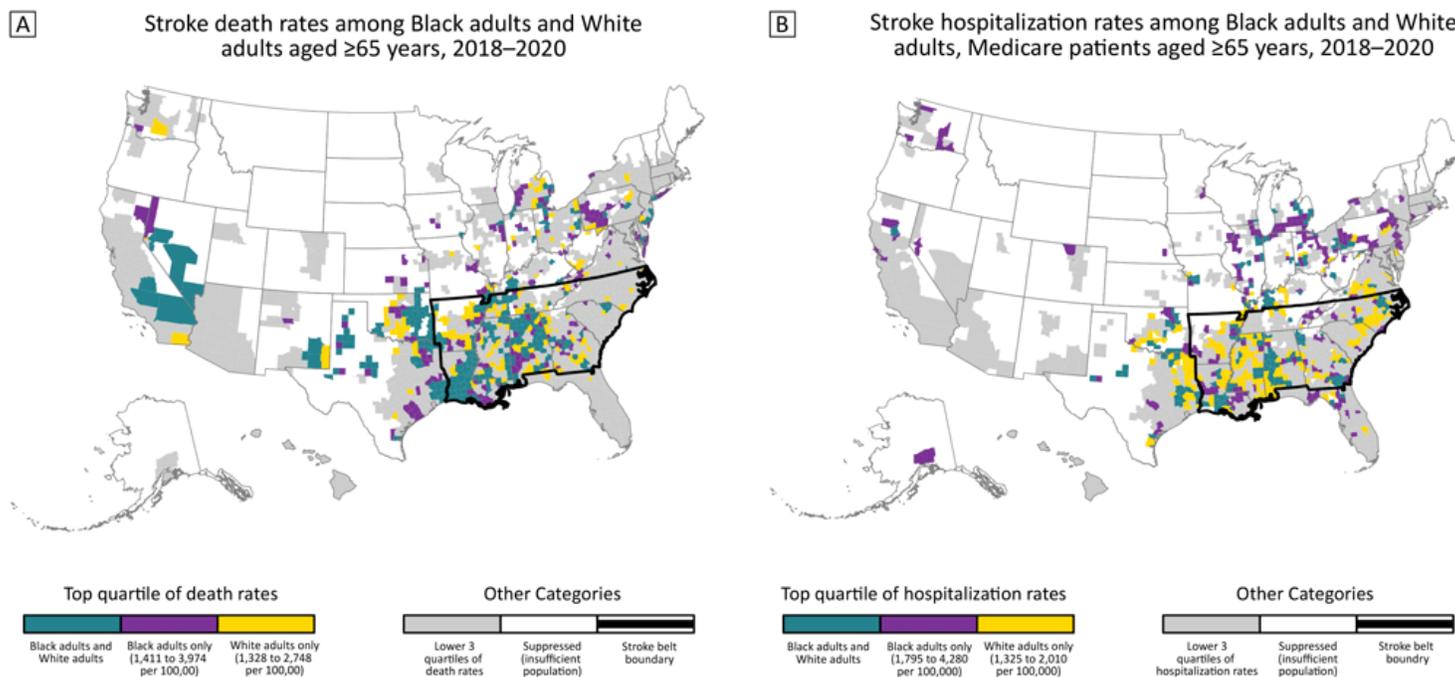
# Stroke Mortality and Stroke Hospitalizations: Racial Differences and Similarities in the Geographic Patterns of High Burden Communities Among Older Adults

Kirsten Evans, ScM<sup>1</sup>; Michele Casper, PhD<sup>1</sup>; Linda Schieb, MSPH<sup>1</sup>;  
David DeLara, MS<sup>1</sup>; Adam S. Vaughan, PhD, MPH, MS<sup>1</sup>

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### PEER REVIEWED



Source: CDC Interactive Atlas of Heart Disease and Stroke

The 2 maps show the top quartiles of county-level race-specific stroke death rates (Map A) and hospitalization rates (Map B) among Black and White adults aged ≥65 years during 2018–2020. Source: The Interactive Atlas of Heart Disease and Stroke (4).



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## Background

Geographic patterns of stroke deaths in the US are well documented for Black adults and White adults. Both populations have concentrations of high stroke death rates in the South, commonly known as the Stroke Belt, but geographic patterns of stroke morbidity rates are undocumented (1,2). US stroke incidence data are available only through cohort studies (3). However, county-level stroke hospitalization data can be examined nationally among Medicare beneficiaries, providing a measure of stroke morbidity among older US adults.

Documenting geographic patterns by race for both stroke mortality and hospitalization rates provides a more comprehensive understanding of stroke among Black older adults and White older adults. Additionally, these results provide information for tailoring stroke prevention and treatment programs and policies to communities' needs. In this study, we compared county-level patterns of stroke death rates (Map A) and stroke hospitalization rates (Map B) for 2018–2020 for Black adults and White adults aged 65 years or older.

## Data and Methods

Three-year average stroke hospitalization and death rates per 100,000 population for 2018–2020 among US non-Hispanic Black adults and non-Hispanic White adults aged 65 years or older were acquired from the Interactive Atlas of Heart Disease and Stroke (hereinafter, Atlas) (4). The Atlas obtains stroke hospitalization data from the Centers for Medicare and Medicaid Services Medicare Provider Analysis and Review file, Part A, and stroke death counts and total population sizes from the National Center for Health Statistics' National Vital Statistics System. Stroke is defined by *International Classification of Diseases, 10th revision*, codes I60–I69, as the underlying cause of death and principal diagnosis for hospitalizations (5). Rates were age-standardized (using the 2000 US standard population) and spatially smoothed using a local empirical Bayes algorithm (6). Race-specific county rates that did not meet the data suppression criteria for reliability for the Atlas were not included (7).

We calculated quartiles of stroke death rates and hospitalization rates for Black older adults and White older adults separately and created maps comparing geographic patterns of counties in the top quartile for each race. For each county, we also calculated absolute and relative Black–White disparities in stroke death and hospitalization rates. To facilitate comparison between races, we restricted the analysis to counties with reliable stroke death rates ( $N = 1,679$ ) or hospitalization rates ( $N = 1,453$ ) for both races (7).

Maps showing stroke death and hospitalization rates for all counties are available online (8). We used R version 4.3.1 (R Foundation) (9).

## Highlights

Stroke death rates in the top quartile for both Black adults and White adults aged 65 years or older overlapped considerably: 63% of counties were in the top quartile for both Black older adults and White older adults (teal counties, Map A). Counties in the top quartile of stroke death rates for both populations were concentrated in the western Stroke Belt, Oklahoma, and Texas. Median county-level stroke death rates were 1,214 and 1,155 deaths per 100,000 for older Black and White adults, respectively. The median county-level absolute Black–White disparity in stroke death rates was 61.5 deaths per 100,000 population; the median relative disparity was 1.1.

For stroke hospitalization rates, 44% of counties in the top quartile for Black older adults and White older adults overlapped (teal counties, Map B). In contrast to stroke death rates, counties in the top quartile of stroke hospitalization rates for Black older adults were in the Midwest, Northeast, and South. Counties in the top quartile for White older adults were concentrated in the Stroke Belt — specifically the Mississippi Delta region and into Oklahoma and Texas. The supplemental maps show the full distributions of rates by race (Appendix). Median county-level stroke hospitalization rates were 1,590 and 1,120 hospitalizations per 100,000 for older Black and White adults, respectively. The median county-level absolute Black–White disparity in stroke hospitalization rates was 410 hospitalizations per 100,000, and the median relative disparity was 1.4.

## Action

Examining geographic patterns of morbidity and mortality rates improves our understanding of the disproportionate burden of stroke across race and geography. Comparing these geographic patterns by race shows notable differences. The historically dominant pattern for the Stroke Belt prevails for stroke mortality rates among Black and White older adults and for stroke hospitalization among White older adults. However, concentration of the highest stroke hospitalization rates in the Midwest and Northeast for Black older adults raises questions about contributors to racial differences in these geographic areas.

Stroke hospitalization rates represent underlying stroke incidence and hospital utilization (10). Understanding factors contributing to concentrations of high stroke hospitalization rates in the Midwest and Northeast for Black older adults requires more closely studying racial patterns in incidence and stroke hospitalization in these

communities. Stroke incidence is higher among Black older adults than White older adults, and the magnitude of difference decreases with age (3). Additionally, stroke hospitalization is influenced by stroke literacy and health beliefs of individuals and medical professionals, which affect patients' trust in the health care system, likelihood to seek care, and likelihood of being admitted to the hospital, many of which are affected by racial discrimination (10,11). Thus, counties with high hospitalization rates and low mortality rates may suggest a health care system with high-quality stroke care. However, low hospitalization rates and high mortality rates suggest that some stroke patients die outside of hospitals. Geographic differences in stroke hospitalizations may also be shaped by state-level policies establishing stroke systems of care and hospital protocols (12,13).

These findings highlight the patterns of counties where stroke burden is greatest for both Black older adults and White older adults. Public health professionals and partners can use these maps to explore and address local conditions driving stroke burden in those communities. Other resources provide valuable information, including the Atlas, materials from the Paul Coverdell National Acute Stroke Program, and the American Heart Association Get With the Guidelines (4,14,15). Meaningfully reducing the burden of stroke in the US may advance by 1) focusing on counties where stroke death rates and hospitalization rates are high for Black older adults and White older adults, and 2) tailoring programs and policies to the needs of those communities.

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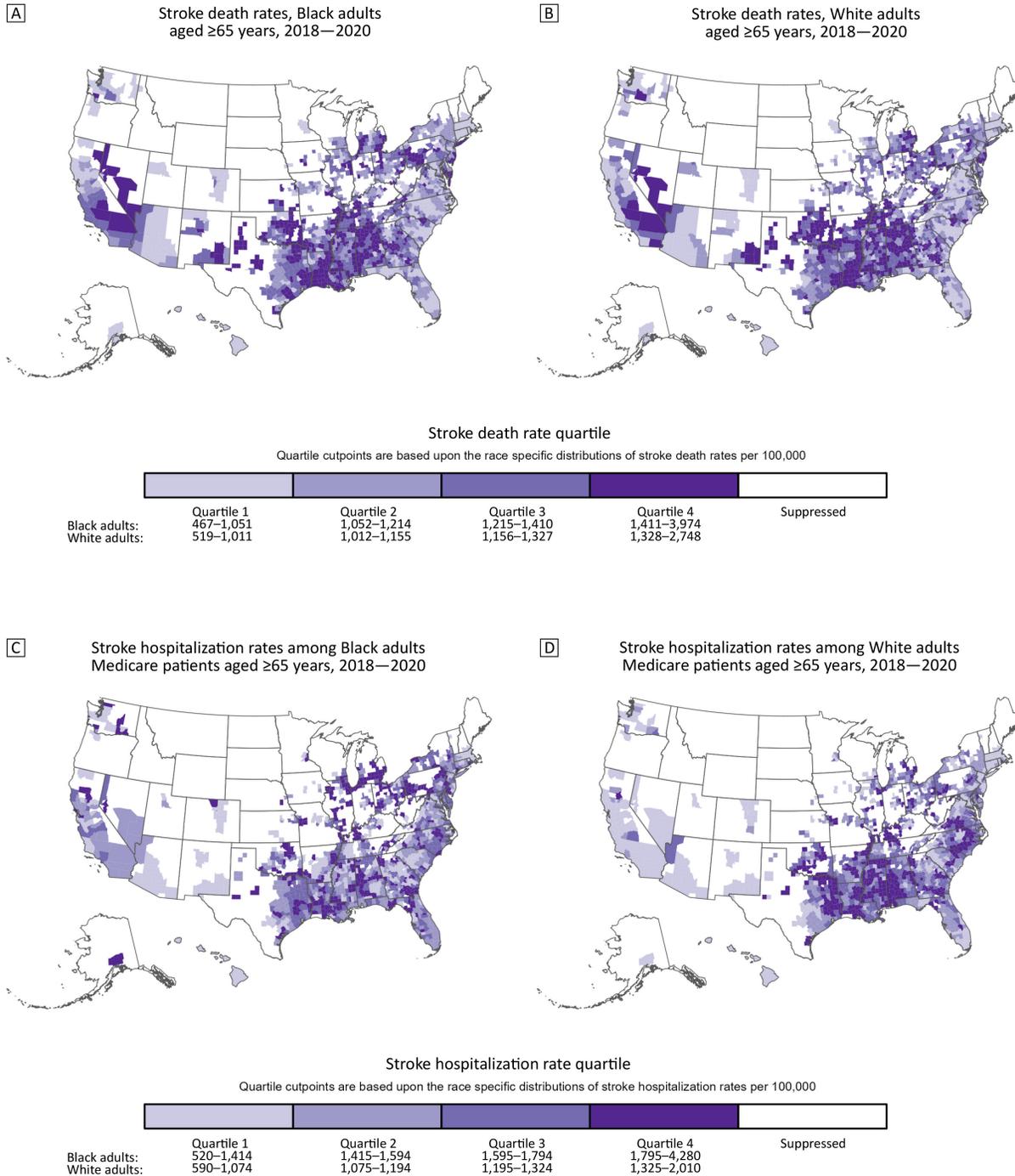
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**Appendix . County-level race-specific stroke death rates and stroke hospitalization rates per 100,000 for Black adults and White adults aged ≥65 years, 2018–2020**



The top maps show county-level stroke death rates for Black adults (Map A) and White adults (Map B) aged ≥65 years, and the bottom maps show county-level stroke hospitalization rates for Black (Map C) and White (Map D) Medicare beneficiaries aged ≥65 years. Quartile cut points are based on the race-specific distributions of stroke death rates or hospitalization rates (respectively) per 100,000 population. Counties had to meet the inclusion criteria to be included on the maps. Source: The Interactive Atlas of Heart Disease and Stroke (4).

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### GIS SNAPSHOTS

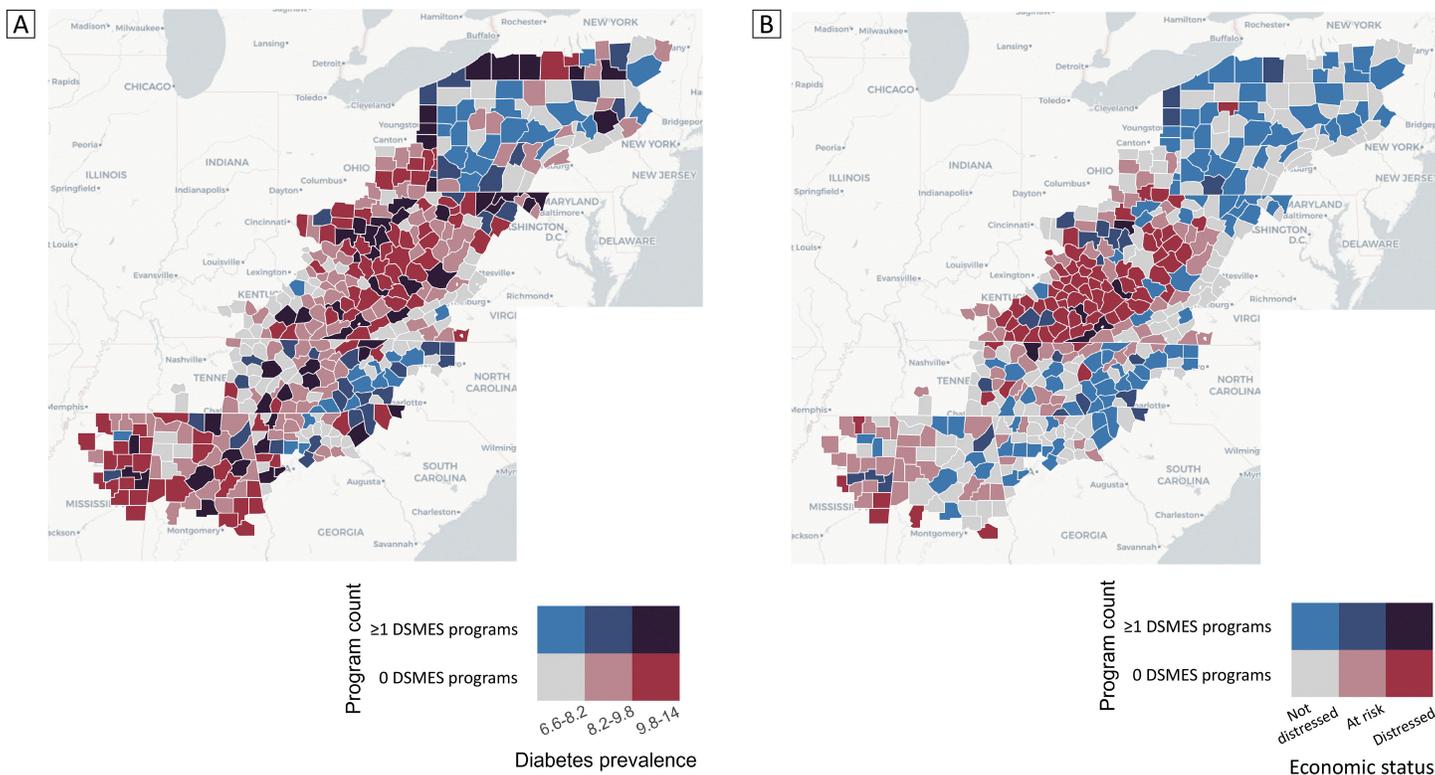
# Identifying Priority Geographic Locations for Diabetes Self-Management Education and Support Services in the Appalachian Region

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### PEER REVIEWED



Sources: Appalachian Regional Commission, American Diabetes Association, Association of Diabetes Care and Educational Specialists, Centers for Disease Control and Prevention

Bivariate choropleth maps of counties in the Appalachian region in 2021 showing the number of accredited or recognized programs offering diabetes self-management education and support (DSMES) services, by diabetes prevalence (Map A) and by county economic status of not distressed, at-risk, and distressed, as defined by the Appalachian Regional Commission (ARC) (Map B). Sources: ARC county data (14), American Diabetes Association or accredited by the Association of Diabetes Care and Education Specialists (DSMES program data); and diabetes prevalence (13).



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## Introduction

Diabetes self-management education and support (DSMES) services provide information and skills for people to manage diabetes (1), as they reduce average hemoglobin A1c levels (2), improve quality of life (3), and improve the psychosocial aspects of managing diabetes (4). These services could empower people to set goals, develop self-care strategies, and adopt positive lifestyle changes, which contribute to improved diabetes management, enhanced overall health, lower health care costs, and reduced odds of hospitalization (5).

However, DSMES services are underused. Participation rates are 6.8% for people with private insurance in the first year of diagnosis, and those without insurance have 13% lower odds of participating (6,7). Barriers to use include limited access to services, distance from services, underdeveloped telehealth programs, lack of awareness about the benefits of DSMES, financial constraints, and limited health care provider referrals (8,9). Such barriers may be more pronounced in rural areas, such as much of the Appalachian region, which has higher rates of type 2 diabetes and worse health outcomes when compared with the US as a whole (10). Addressing these barriers and promoting use of DSMES services is crucial for comprehensive diabetes care and self-management.

This article focuses on economic equity in the Appalachian region and access to DSMES services in 2021. We describe the geographic association between diagnosed diabetes prevalence, economic distress, and number of programs recognized by the American Diabetes Association (ADA) or accredited by the Association of Diabetes Care and Education Specialists (ADCES) providing DSMES. Identifying areas with higher diabetes prevalence and a lower number of recognized programs in economically distressed counties may present an opportunity for enhanced clinical–community linkages.

## Data and Methods

We obtained addresses for programs recognized by the ADA or accredited by ADCES providing DSMES as of 2021. We geocoded these addresses using the `prettymapr` package (version 0.2.4) in R (version 4.2.1, R Foundation) to identify the county location for each program (11,12). For addresses that failed to geocode, we manually looked up the address to determine the county location. We summed the number of programs within each county and merged these data with county economic status data from the Appalachian Regional Commission (ARC). Data on diabetes prevalence in Appalachian counties were provided by the Centers for Disease Control and Prevention US Diabetes Surveillance System (13).

We used economic status and distressed areas data from the ARC for 2021 (14). Of the 423 counties that comprise the Appalachian region, 420 were included in the data set. We restricted our analysis to those 420 counties, of which 63.8% would be considered rural based on having a Rural–Urban Continuum code of 5 or more (15). The ARC groups counties into 5 categories: distressed, at-risk, transitional, competitive, and attainment. These categories are based on an index calculated for all counties nationally from 3 economic variables: 5-year estimated poverty rate (2014–2018), per capita market income (2018), and 3-year average unemployment rate (2016–2018). Distressed counties fall in the bottom 10% on this index, at-risk between 10% and 25%, transitional counties between 25% and 75%, competitive between 75% and 90%, and attainment counties are the top 10%. We collapsed counties initially categorized as transitional, competitive, and attainment into “not distressed.”

To describe the geographic association between diagnosed diabetes prevalence, economic distress, and number of accredited programs providing DSMES, we produced 2 maps. We also evaluated the association between program counts by county and economic status with a 2-part hurdle model due to excessive “zero” counts. This model uses a binomial model to first model absence versus presence (the “hurdle” component to be “cleared” before modeling the count) and a truncated negative binomial model to model counts for counties with 1 or more programs. We included economic status and diabetes prevalence as covariates and county population as an offset.

## Highlights

Of the 420 counties evaluated in the Appalachian region, 56.7% ( $n = 238$ ) were not distressed, 24.8% ( $n = 104$ ) were at-risk, and 18.6% ( $n = 78$ ) were distressed. Of the 78 distressed counties, 48.7% (38 counties) were in Kentucky and 23.1% (18 counties) were in West Virginia. Diabetes prevalence in the Appalachian region was not significantly different between county economic status types. Prevalence ranged from 6.6% to 13.0%, with an average of 9.1% (95% CI, 9.0%–9.3%).

Of the 189 recognized or accredited programs providing DSMES in Appalachia, 154 (81.5%) were found in not-distressed counties, 28 (14.8%) in at-risk counties, and 7 (3.7%) in distressed counties. A total of 296 (70.5%) counties in Appalachia did not have any programs. Stratifying by economic distress category, we found that 60.0% (143 of 238) of not-distressed counties, 77.9% (81 of 104) of at-risk counties, and 92.3% (72 of 78) of distressed counties had no programs providing DSMES.

The binomial submodel from the hurdle model showed that distressed counties had 170.1% higher odds (adjusted odds ratio = 2.7; 95% CI, 1.1–6.7) of having no programs compared with not-distressed counties. Neither economic status nor diabetes prevalence in the truncated count model was significant.

## Actions

Economically distressed counties were least likely to have programs providing DSMES. Additionally, a substantial gap in programs providing DSMES existed between at-risk counties and not-distressed counties. These findings highlight a possible need for more equitable availability of DSMES services in the Appalachian region. Tailoring delivery modality, content, and frequency to the demographics and needs of the population may improve equitable access to these programs.

Despite the possibility of crossing county boundaries to access DSMES services, distance to available programs is a barrier to use (8,10). Because 70.5% of counties in the Appalachian region do not have DSMES programs, unless programs provide services in multiple counties, substantial lack of coverage is possible in this region. Future work could evaluate how use of DSMES services in Appalachia is affected by accredited program availability and other barriers to use, such as transportation availability, telehealth offerings, or cost. Public health organizations may facilitate increased clinical–community linkages with local clinics and community centers or help organize umbrella hub arrangements to increase the availability of DSMES services (16). Addressing disparities in availability of DSMES services could improve diabetes management outcomes and overall population health in Appalachia.

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### GIS SNAPSHOTS

# Adults Who Have Never Been Screened for Colorectal Cancer, Behavioral Risk Factor Surveillance System, 2012 and 2020

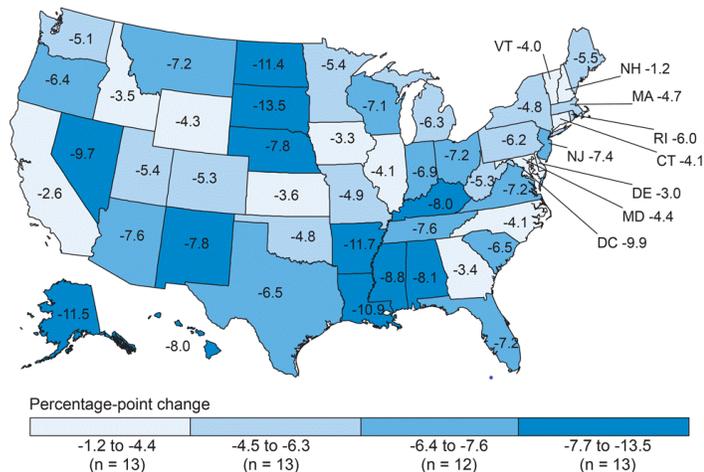
Lisa C. Richardson, MD, MPH<sup>1</sup>; Jessica B. King, MPH<sup>1</sup>; Cheryl C. Thomas, MSPH<sup>1</sup>; Thomas B. Richards, MD<sup>1</sup>; Nicole F. Dowling, PhD<sup>1</sup>; Sallyann Coleman King, MD, MSc<sup>1</sup>

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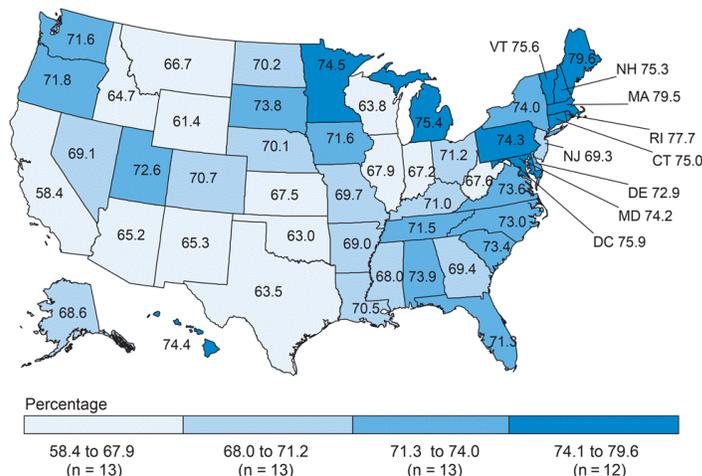
Suggested citation for this article: Richardson LC, King JB, Thomas CC, Richards TB, Dowling NF, Coleman King S. Adults Who Have Never Been Screened for Colorectal Cancer, Behavioral Risk Factor Surveillance System, 2012 and 2020. *Prev Chronic Dis* 2022; 19:220001. DOI: <https://doi.org/10.5888/pcd19.220001>.

### PEER REVIEWED

**A** Change in percentage of respondents aged 50–75 years who reported they were never screened for colorectal cancer, 2012 to 2020



**B** Percentage of respondents aged 50–75 years who reported being up to date with colorectal cancer screening, 2020



Colorectal cancer screening among US adults aged 50–75 years, Behavioral Risk Factor Surveillance System, 2012 and 2020. A, Change in percentage of US adults aged 50–75 years who reported they were never screened for colorectal cancer, 2012 to 2020. The overall decrease in never screened in the US was –5.8 percentage points. B, Percentage of US adults aged 50–75 years who reported being up to date with colorectal cancer screening in 2020. The percentage up to date in the US overall was 69.4%. Percentages were age-standardized to the 2000 US standard million population. Data source: Centers for Disease Control and Prevention, Behavioral Risk Factor Surveillance System (1,2).



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## Background

In 2018, colorectal cancer (CRC) was the second most diagnosed cancer and the second leading cause of cancer death among cancers that affect both men and women (3). Screening for CRC can lead to fewer cases of cancer through the removal of polyps before they become cancer, the detection of cancers at their earliest stages, and the prevention of cancer deaths (4).

Studies from the UK of screening by sigmoidoscopy and from the US of screening by colonoscopy showed that even 1-time or infrequent screening has long-term benefits (5,6). Another study showed that 83% of people who were not up to date with CRC screening had never been screened and outlined multiple barriers to getting tested (7).

We measured the change in prevalence of adults who reported no CRC screening from 2012 to 2020. We also used data on the use of CRC screening tests in 2020 to update a previous report on up-to-date screening (8).

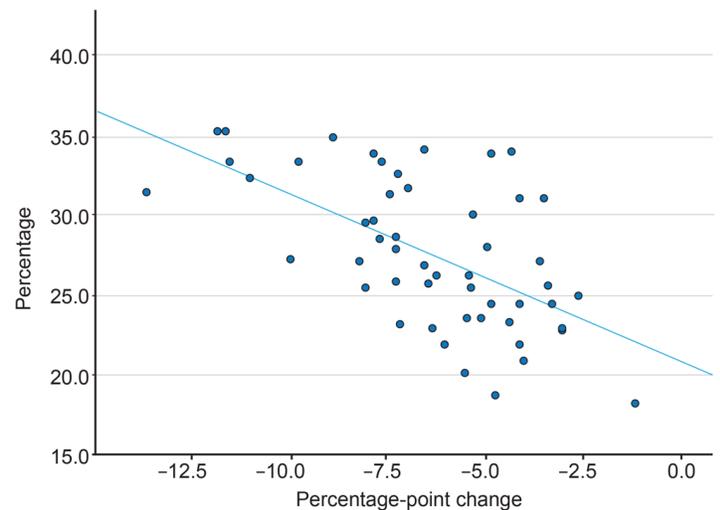
## Data and Methods

The Behavioral Risk Factor Surveillance System (BRFSS) is an annual, state-based, random-digit-dialed landline and cell phone survey of the civilian, noninstitutionalized US adult population aged 18 years or older. BRFSS collects information on demographic characteristics, health risk behaviors, preventive health practices, and health care access. We retrieved data on CRC screening from the 2012 and 2020 BRFSS (1,2). For consistency over time, we limited our analysis to respondents aged 50 to 75 years and applied the 2008 US Preventive Services Task Force (USPSTF) recommendations (9). We defined “up to date” as one of the following: 1) a home stool blood test (fecal occult blood test [FOBT] or fecal immunochemical test [FIT]) within 1 year, 2) sigmoidoscopy within 5 years with FOBT or FIT within 3 years, or 3) colonoscopy within 10 years. We analyzed the prevalence of respondents who responded yes when asked if they had ever had one of these tests and if yes, when they had the test. We defined “never screened” as respondents who answered no to being screened and respondents who had been screened but were not up to date per USPSTF 2008 recommendations. We excluded respondents who declined to answer or who reported “don’t know” or “not sure.” We used SAS-callable SUDAAN statistical software, version 9.4 (RTI International) for analysis. Results were age-standardized to the 2000 US standard million population to facilitate comparison with the Healthy People 2020 objective of 70.5% screened for CRC (10). We used ArcGIS Desktop version 10.8.1 (Esri) to create maps to show the absolute change in the percentage never screened between 2012 and 2020 and the percentage up

to date in 2020. We used a 2-tailed Spearman rank correlation test to compare 1) the proportion of respondents by state reporting no CRC screening in 2012 with 2) the absolute difference by state in the proportion reporting no CRC screening in 2020 versus the proportion reporting no CRC screening in 2012.

## Highlights

The percentage of US adults never screened for CRC decreased from 27.4% in 2012 to 21.6% in 2020, a 5.8 percentage-point reduction representing 3,917,775 fewer people screened in 2012 than in 2020. Decreases ranged from 1.2 percentage points (New Hampshire) to 13.5 percentage points (South Dakota). Decreases were 8.0 percentage points or more in 10 states and the District of Columbia (Map A). The percentage of adults never screened was higher in the northern Great Plains and the Deep South. States with the largest improvements in the proportion never screened were those with the largest proportion never screened in 2012 (Figure).



**Figure.** Correlation between 1) the percentage never screened for colorectal cancer in 2012 and 2) the absolute difference in the percentage never screened in 2020 minus the percentage never screened in 2012, by state. Each dot represents a state or the District of Columbia. Spearman  $r = -0.58$ ;  $P = .01$  (2-tailed). Data source: Centers for Disease Control and Prevention, Behavioral Risk Factor Surveillance System (1,2).

The percentage of adults aged 50 to 75 years who reported being up to date with CRC screening in 2020 was 69.4%, representing 62.3 million age-eligible adults, ranging from 58.4% in California to 79.6% in Maine (Map B). The percentage of up-to-date screening tended to be higher in New England. Twenty-two states did not meet the Healthy People 2020 objective of 70.5% screened for CRC.

## Action

The proportion of US adults never screened for CRC decreased from 2012 to 2020 in all states and the District of Columbia. The greatest increases were in states with the highest prevalence of never screened in 2012. Even with differences in the definition of never being screened, we found improvements in the percentage screened from the approximately 29% of respondents aged 50 to 75 years never screened according to 2010 BRFSS data (5). Nevertheless, CRC screening prevalence remains lower than desired. Given the challenges of the ongoing COVID-19 pandemic, the new Healthy People 2030 target of 74.4% will likely be hard to reach.

USPSTF recommendations were updated in 2016 to include more types of screening tests (2). In 2020 for the first time, BRFSS included questions on stool DNA testing and computerized tomographic colonography (11). When we included all 5 CRC testing methods, 71.6% of respondents aged 50 to 75 years reported being up to date with CRC screening in 2020.

The National Colorectal Cancer Roundtable, in collaboration with the Centers for Disease Control and Prevention (CDC), renewed a call to action to increase CRC screening to 80% (12). This call to action must address persons aged 45 to 49 years who are now eligible for screening (2) in addition to persons aged 50 to 75 years who have never been screened. The latter group comprises most people who are not up to date.

Financial and nonfinancial barriers might explain differences in screening by state. Fedewa and colleagues noted that states that expanded Medicaid soonest after the Affordable Care Act was enacted in 2010 had the largest increases in CRC screening (13). We found a correlation between the states with the largest proportion of people never screened and improvements in screening among people never screened. States with the smallest decreases in people never screened were concentrated in the South, where Medicaid expansion still has not occurred. In contrast, South Dakota has not expanded Medicaid, but it had the largest improvement (–13.5 percentage points) among people never screened. One possible explanation is that South Dakota has been a part of CDC’s Colorectal Cancer Control Program for over a decade. This program focuses on using evidence-based strategies to increase CRC screening (14). In a study that examined reasons for not being screened, people with low educational attainment, no health insurance, and no usual source of care had the highest prevalence of never being screened (5).

Nonfinancial factors also affect CRC screening. Jones and colleagues published a report of patient-reported barriers to CRC screening in 2010 (15). In their mixed-methods study, which in-

cluded African American people and people with low income, barriers identified were lack of understanding about what to do when being screened and what screening involved, lack of motivation to get tested because of reservations about getting the test, and not having the means to pay for initial testing and possible follow-up testing. No similar studies have been conducted among people who reported never being screened for CRC. Reducing these barriers will require developing educational resources designed to meet the needs of people who experience these barriers

Our study has several limitations. First, CRC screening prevalence may be underestimated or overestimated because of recall bias. Second, we were unable to differentiate between a screening test and a diagnostic test, and respondents may not have been able to differentiate between types of stool tests and endoscopies. Third, social desirability bias could have affected responses to survey questions. Fourth, our analysis did not account for any sampling error. Fifth, the response rate for BRFSS was about 45%, and some respondents did not answer all the questions. Lastly, National Health Interview Survey data are used to determine Healthy People national objectives, whereas BRFSS data are used to measure state-level progress toward improving health behaviors that affect chronic diseases (16). Estimates from BRFSS tend to be higher than estimates from the National Health Interview Survey, possibly because of the survey methods (17).

If we are to reach the Healthy People 2030 objective of 74.4% of the population screened for CRC or the goal of 80% screened in every community (12), we should intensify outreach to people who have never been screened, because most of those not up to date have never been screened (5). During the COVID-19 pandemic, the backlog in CRC screening has grown to nearly 4 million people (18). We have a lot of work ahead of us. The President’s Cancer Panel released new recommendations in early 2022 that will inform this work (19).

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The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of CDC. No copyrighted materials or tools were used in this article.

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## ESSAY

# Racial and Ethnic Disparities in Adult Obesity in the United States: CDC's Tracking to Inform State and Local Action

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Accessible Version: [www.cdc.gov/pcd/issues/2019/18\\_0579.htm](http://www.cdc.gov/pcd/issues/2019/18_0579.htm)

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## PEER REVIEWED

The Centers for Disease Control and Prevention (CDC) plays a key role in tracking data on the burden of obesity and its related racial and ethnic disparities to provide information that can highlight areas where state and local actions are most needed. Until further innovations allow for measured data on height and weight to be available for all states, self-reported data are the best source for understanding where the burden of obesity is highest among different populations. This understanding is critical given that the prevalence of obesity is increasing among adults in the United States (1). As such, obesity continues to put a strain on overall health status, health care costs, productivity, and the capacity for deployment and readiness of military personnel. Adults with obesity often have multiple-organ system complications from the condition and, as a result, are more at risk for heart disease, stroke, type 2 diabetes, and multiple types of cancers (2). The estimated annual medical cost of obesity in the United States was \$147 billion in 2008 (3). Compared with spending for someone of normal weight, medical spending for a person with obesity was \$1,429 higher (42% higher) per year (3). Adult obesity decreases productivity, and the cost of lost productivity is between \$3.4 and \$6.4 billion per year (4). Adult obesity also increases the risk of workplace injuries (2). Obesity among young adults limits the eligibility for many to serve in our military, given the weight standards for recruitment that nearly 1 in 4 young adults are not able to meet (5).

Among many other factors, the risk of adult obesity is greater among adults who had obesity as children, and racial and ethnic

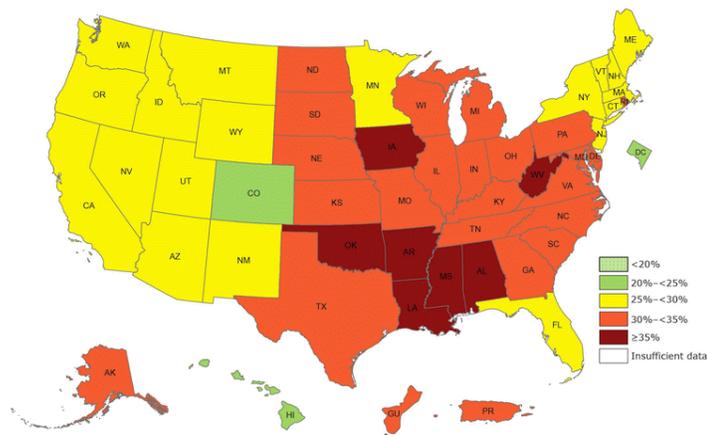
disparities exist by the age of 2 (6). If nothing else is done in the United States beyond what is being done now, simulated growth trajectories that model today's children show that over half (59% of today's toddlers and 57% of children aged 2 to 19) will have obesity at age 35 (7). Early feeding patterns, including how babies are fed and how caregivers use food in response to an infant's mood, affect acute growth, future eating patterns, and the risk of obesity (8). Similarly, family and caregiver modeling of healthy behaviors, food offerings, and active playtime, as well as characteristics of neighborhoods such as walkability and traffic volume, may affect children's nutrition and physical activity habits (9,10).

As sectors come together to reduce the obesity epidemic, we are aware how challenging success will be due to factors such as 1) the contributing risk factors of genetic and biological attributes; 2) individual behaviors (parenting styles, dietary patterns, physical activity levels, medication use, sleep, stress management); and 3) community and societal factors that influence individual, family, and collective access to healthy, affordable foods and beverages; access to safe and convenient places for physical activity; and exposure to the marketing of unhealthy products (2).

By using self-reported data of height and weight from the Behavioral Risk Factor Surveillance System, CDC's Division of Nutrition, Physical Activity, and Obesity (DNPAO) has published state-specific obesity maps since 1999. Obesity is defined as a body mass index (a person's weight in kilograms divided by the square of height in meters) of 30.0 or higher. These maps have shown the growing epidemic that has affected our nation from coast to coast. Although the data collection methods changed in 2011, which somewhat limits our ability to assess trends, the 2017 data continue to show that obesity prevalence among adults remains high across the country (Figure 1). The state-specific prevalence ranges from a low of 22.6% in Colorado to a high of 38.1% in West Virginia (11).

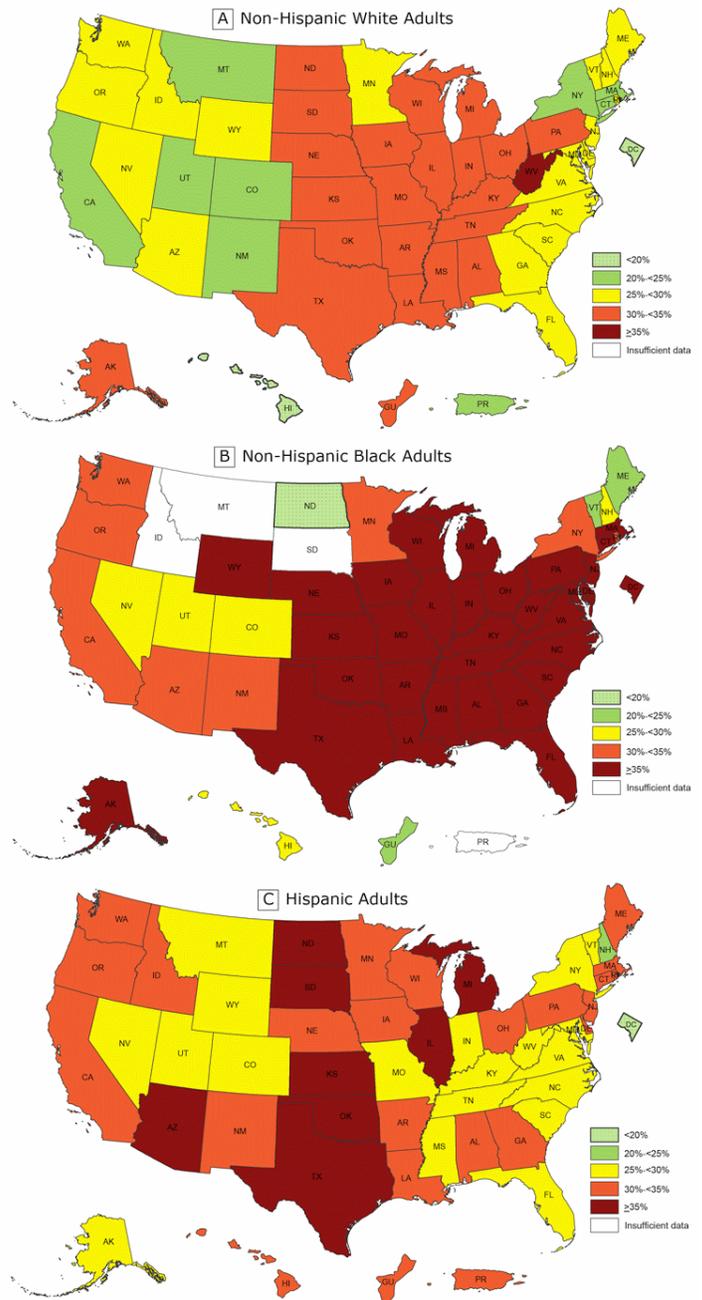


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**Figure 1.** Prevalence of self-reported obesity among US adults, by state and territory, Behavioral Risk Factor Surveillance System (BRFSS), 2017. Obesity was defined as a body mass index of 30 or higher based on self-reported weight in kilograms divided by the square of the height in meters. Prevalence estimates reflect changes in BRFSS methods that started in 2011. These estimates should not be compared to prevalence estimates before 2011. No area had a prevalence of <20%, and all had sufficient data to determine prevalence.

For the past 4 years, CDC has published more detailed state and territorial maps that combine 3 years of data to create stable estimates of self-reported adult obesity by race/ethnicity. These maps help demonstrate the geographic and racial/ethnic disparities in obesity burden. Although the previously released overall state-specific maps demonstrate where obesity may be influencing health, health care costs, well-being, and productivity across states and regions, the racial and ethnic maps for 2015 through 2017 illustrate that the negative effects are disproportionately burdensome for particular populations. Combined data for 2015 through 2017 allowed for assessment by major racial/ethnic categories and found that non-Hispanic black adults had the highest prevalence of obesity (38.4%) overall, followed by Hispanic adults (32.6%) and non-Hispanic white adults (28.6%). To identify areas of highest burden, we used a cut point of 35%. We chose this cut point because it was a somewhat natural breaking point in the data and roughly reflected areas with the highest burden. By using this cut point, we found that overall, 31 states and the District of Columbia had an obesity prevalence of 35% or higher among non-Hispanic black adults; 8 states had an obesity prevalence of 35% or higher among Hispanic adults; and only 1 state had an obesity prevalence of 35% or higher among non-Hispanic white adults (Figure 2).



**Figure 2.** Prevalence of self-reported obesity among non-Hispanic white, non-Hispanic black, and Hispanic adults, by state and territory, Behavioral Risk Factor Surveillance System, 2015–2017. Obesity was defined as a body mass index of 30 or higher based on self-reported weight in kilograms divided by the square of the height in meters. Prevalence estimates reflect changes in BRFSS methods that started in 2011. These estimates should not be compared to prevalence estimates before 2011. Areas are indicated as having insufficient data if they had a sample size of less than 50 or a relative standard error (dividing the standard error by the prevalence) of 30% or more.

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## What Causes These Disparities?

Although the exact causes of these differences in obesity are not all known, they likely in part reflect differences in social and economic advantage related to race or ethnicity (12). This concept aligns with other, more general statements about health disparities explaining that disparities are “closely linked with social, economic, and/or environmental disadvantage” and show the effect where groups of people “have systematically experienced greater social and/or economic obstacles to health . . . based on their racial or ethnic group” (13). Underlying risks that may help explain disparities in obesity prevalence among non-Hispanic black and the Hispanic populations could include lower high school graduation rates, higher rates of unemployment, higher levels of food insecurity, greater access to poor quality foods, less access to convenient places for physical activity, targeted marketing of unhealthy foods, and poor access to health care or referrals to convenient community organizations that aid family-management or self-management resources (14–17).

## What Is DNPAO Doing to Address These Disparities?

From a large number of high-quality applicants, in 2018 DNPAO competitively funded 16 state health departments (or a similar entity), 15 land grant colleges and universities, and 31 community-focused grantees to work over the course of 5 years with multiple sectors and coalitions to prioritize and implement best practices to increase healthy eating and active living to prevent obesity and other chronic diseases. With technical assistance from DNPAO public health specialists and subject matter experts, grantees use a menu of evidence-based strategies and performance metrics to develop their implementation plan, work plan, and evaluation process. To obtain the largest public health impact from limited resources, grantees are asked to focus their work on populations that have the greatest disparities and needs. Strategies for DNPAO grantees include establishing healthy nutrition standards in settings such as workplaces, hospitals, early care and education (ECE), after-school and recreational programs, and faith-based organizations; working with food vendors, distributors, and producers to increase procurement and sales of healthier foods; improving programs and systems at the state and local level to increase access to healthier food; and implementing community planning and transportation plans that support safe and accessible physical activity by connecting sidewalks, paths, bike routes, public transit with homes, ECE, schools, parks and recreation centers, and other everyday destinations.

As an example of reaching vulnerable individuals, state health department grantees may focus obesity prevention efforts at a state

level by targeting early obesity risk through system changes in the ECE setting through state licensing, state subsidy, or state quality rating systems. States may pair these efforts with promoting the use of food reimbursement programs for meals that meet minimum nutritional standards among centers serving low-income children. In addition, state health departments may work to set a standard for implementation of food service guidelines so other government entities, work sites, park and recreation centers, and hospitals can follow that example and obtain the needed technical assistance for spreading implementation. State health department grantees may also work across sectors (such as the transportation and community planners) to improve environmental supports for physical activity through the implementation of master plans and land-use interventions. These efforts to increase access to safe and convenient places for physical activity are generally targeted to geographical areas with the highest burden of obesity and chronic disease. Such efforts can include connecting neighborhoods with sidewalks, paths, bike routes, and public transit that lead to local schools, parks and recreation centers, and local businesses.

DNPAO manages 2 additional public health practice programs that have had success in reducing the risk factors for obesity in populations with the greatest disparities. These programs include the Racial and Ethnic Approaches to Community Health (REACH) program and the High Obesity Program (HOP). The REACH program focuses on improving health for racial and ethnic groups with the highest disease burden. Obesity reduction among the black population is often a key goal for REACH recipients. For example, from 2008 through 2012, 14 REACH grantees implemented strategies to address disparities in obesity among black populations. These strategies included expanding healthy food choices in grocery stores, creating neighborhood farmers markets, implementing Complete Street policies, and improving walkability and safety of neighborhood streets. The prevalence of obesity decreased about 1 percentage point in these REACH communities, but not in the comparison populations during the same time (18).

Land grant universities in states where counties have more than a 40% prevalence of adult obesity are eligible to apply for HOP. These grantees work in predominantly rural areas where residents may have less access to healthy foods and fewer opportunities to be physically active, which may increase their risk of obesity (19–21). HOP grantees use the same menu of DNPAO evidence-based strategies to improve nutrition and physical activity to reduce obesity and other chronic diseases; however, they might tailor their implementation plan given the rural nature of their target population with the highest risk of obesity. Examples include work at the Texas AgriLife Extension (Texas A&M University), which established a farmers market at a local community center to

help increase access to fresh produce. Since the creation of this market, more than 800 community members purchased over 12,000 pounds of fresh fruits and vegetables. Another example is the work of the extension staff in Ouachita County (University of Arkansas) at a low-income housing complex to improve access to physical activity for residents with limited mobility. They identified a walking path and developed signs to indicate how many laps equaled a half-mile. Eighty-four percent of residents now walk regularly and use the path at least 1 or 2 times a week (22).

## What's Next?

Implementing approaches that take into account racial and ethnic disparities is critical to addressing the high burden of obesity and its many negative consequences. Although a population-based approach is needed to increase availability and access to healthy foods and beverages and safe and convenient places for physical activity for all Americans, targeted approaches are needed to address the risks that drive the disparities. Such an approach will mean taking into account food insecurity, safe drinking water, and cultural nutrition and physical activity patterns as well as environmental and policy contexts that influence the risk. Efforts may need to include more attention to upstream determinants of health or attributes of the communities where the populations with the highest burden live. The findings linking neighborhood features to one's health status illustrate how a community can influence risk of many chronic health conditions, including obesity. For example, a study of neighborhoods in 3 US metropolitan regions (San Diego, Seattle, and Baltimore) from 2009 to 2010 assessed pedestrian environment features for walkability factors (eg, density). The study found that "across all three regions, low-income neighborhoods and neighborhoods with a high proportion of racial/ethnic minorities had poorer aesthetics and social elements (eg, graffiti, broken windows, litter) than neighborhoods with higher median income or fewer racial/ethnic minorities" (20). Likewise, if marketing of unhealthy products and/or fast-food establishments are unequally distributed across a community or are clustered near schools, communities may consider addressing this issue paired with improving healthy offerings (16,23,24). For individuals from the groups with the largest disparities, it is also important to focus attention on enhancing access to and reimbursement for quality health care services for growth assessment and obesity screening, and for persons with obesity and disease risk, appropriate referral to evidence-based healthy weight or prediabetes management programs and other treatment modalities (25,26).

In isolation, DNPAO resources, equivalent to \$0.31 investment per American per year, will not be able to prevent obesity among at-risk Americans nor reduce the racial and ethnic disparities in the

national burden of obesity. In addition to public health, many partners are needed, including policy makers, state and local organizations, business and community leaders, ECE, schools, industry, federal agencies, health care systems and providers, payers, faith-based organizations, community planners, food growers and distributors, families, and individuals. Using combined approaches, these partners should strive to best improve the ability to prevent obesity and its consequences for those with the burden. Such multisector partnerships can create positive changes at the community level to promote healthy eating and active living in areas where individuals may be at risk for obesity because of where they live and work. These focus areas could include making it easier for families with children to buy healthy, affordable foods and beverages near their homes; helping to provide access to safe, free drinking water in places such as community parks, recreation areas, child care centers, and schools; helping local schools open up gyms, playgrounds, and sports fields during nonschool hours so more children can safely play; increasing the number of safe and accessible sidewalks and bike paths to schools, parks and everyday destinations; and helping schools and ECE providers use best practices for improving nutrition and increasing physical activity. Demonstrated success in these approaches would be reductions in the disparities in upstream indicators (ie, improved community and behavioral determinants of health) and reductions in the obesity burden that is evident in CDC's childhood obesity data and the maps above.

DNPAO is committed to supporting efforts to reduce racial and ethnic disparities in obesity by continuing to share what is working through partners and grantees, to develop tools that aid community engagement and the implementation of evidenced-based interventions, and to track obesity and its risk factors. Each sector and organization has a role to play in being part of the solution. To reduce the current disparities that exist in the burden of obesity, all parts of society need to relentlessly and intentionally work to address the causes of these disparities to help give all a fair chance at health.

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