Geographic Variation in Cardiovascular Disease Burden
Clues and Questions

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In October 1978, a conference was convened by the National Institutes of Health to discuss the decline in coronary heart disease (CHD) mortality rates in the United States during the previous decade.[1] The purpose of the conference was to consider whether the decline was real, discuss the possible causes, and recommend further studies to elucidate these causes. The conference was a watershed event that launched several major population-based, observational studies in the United States

and internationally, including the Atherosclerosis Risk in Communities Study[2] in the United States and the World Health Organization–Monitoring Trends and Determinants in Cardiovascular Disease Project[3] in 21 countries in the mid-1980s. A focus of studies prompted by the conference was to better understand the abrupt decrease in CHD mortality rates as well as investigating geographic variation in CHD trends. In 1986, Wing et al[4] reported that the onset of the decline in CHD mortality in the United States began in metropolitan areas before nonmetropolitan areas. They also reported that the timing of the onset of the decline was independent of a region's absolute CHD morality rate; mid-Atlantic regions (with high rates) and Pacific regions (with low rates) experienced early onset of the decline, while much of the south (with high rates) and mountain regions (with low rates) had later onset of the decline.[4]

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Studies of the geographic variation and trends in cardiovascular disease (CVD) are as relevant now as they were then. However, today, we have shifted our focus toward investigating the reasons for the possible end of the 5-decade–long decline in CVD burden. This research priority is explored by the Global Burden of Cardiovascular Diseases Collaboration[5] in their article published in this issue of *JAMA Cardiology*. They examined state-by-state differences in the burden of CVD, and their findings suggest that the long-term decline in CVD may be ending and that new interventions delivered earlier in the life course may be required to alter this new trajectory.[5] As acknowledged by Wing et al[4] more than 30 years ago, clues to what those interventions should look like may lie within information encoded in geographic variation of health. The Global Burden of Cardiovascular Diseases Collaboration[5] provides several key additions to our current understanding of the role of location in cardiovascular health and generates important new questions.

First, comparisons between areas with later onset of the decline in CHD in the 1960s and those experiencing a slowing decline in total CVD burden in recent decades is striking. The Global Burden of Cardiovascular Diseases Collaboration[5] reported that although the mean age-standardized rate of CVD disability-adjusted life-years (DALYs) decreased from 1990 to 2016 in the United States, the states with the slowest decline were Oklahoma, Arkansas, Alabama, Indiana, Kentucky, Michigan, Mississippi, Missouri, New Mexico, and South Dakota. All of these states except South Dakota also had a later onset of the decline in CHD mortality 50 years ago[4]; in the most recent years (2010-2016) reported by the Global Burden of Cardiovascular Diseases Collaboration,[5] the total CVD burden actually increased in these states. States with a later onset of a decline in CHD mortality 5 decades ago are now more likely to have a slowing down in the decline in CVD burden or even an increase in CVD burden in recent years.

Similar to maps reported by Wing et al,[4] the map of the percentage change in DALY rates between 1990 and 2016 in the study by the Global Burden of Cardiovascular Diseases Collaboration[5] shows a band of states extending from the Gulf Coast to West Virginia (plus New Mexico) as areas of particular concern. Notably, both maps show New Mexico as slow to join in the decline in the 1960s and increasing in CVD burden in recent years. These maps are similar to those reported by Fang et al[6] in 2012 depicting state-level cardiovascular health as defined by the American Heart Association's Life's Simple 7 metrics of cardiovascular health. Not surprisingly, many of these same states have the lowest percentage of the population reporting cardiovascular health metrics within an ideal range. Simple state-by-state comparisons are of interest in their own right; assessing the drivers of the geographic variation and potential projections into the future are critical for creating positive change. As discussed by the Global Burden of Cardiovascular Diseases Collaboration,[5] the regions that were last in joining the decline in CHD burden and first to reverse the trend may be forecasting similar trends in other states.

An important methodologic challenge addressed by the Global Burden of Cardiovascular Diseases Collaboration[5] is the underlying validity of combining various data sources to estimate the total burden of CVD. The work by the Global Burden of Cardiovascular Diseases Collaboration[5] goes far beyond single measures such as mortality rates or hospital discharges by pooling together death certificate data; structured review of published and unpublished data on incidence, prevalence, case fatality, inpatient and outpatient claims; and exposure assessment from the National Health and Nutrition Examination Survey, the Behavioral Risk Factor Surveillance System, and satellite and air sampling data. This multifaceted approach of data-pooling provides a broader picture of dynamic change in CVD. By taking what others have done historically in documenting geographic variation of mortality and hospital claims data and translating them into the more global DALY metric, the Global Burden of Cardiovascular Diseases Collaboration[5] use a powerful tool with which to forecast trends in CVD in the United States. Of course, the ultimate strength of this tool depends on the quality of each of its component data sources.

Another key finding by the Global Burden of Cardiovascular Diseases Collaboration[5] is that since 1990, the decline in CVD burden was slower for women than men in all 50 states. The higher baseline CVD burden among men—twice as high as that of women—may contribute to the slower decline among women. Although the Global Burden of Cardiovascular Diseases Collaboration[5] does not speculate on what this disparity portends for future trends, their finding highlights the importance of exploring the causes of this disparity in future research.

Yet another important contribution by the Global Burden of Cardiovascular Diseases Collaboration[5] is the striking geographic analysis of attributable risk of DALYs. The authors report that 80% of CVD burden could be attributed to known modifiable risk factors, a potentially encouraging finding if we are to prevent the reversal of the decline in CVD burden across the United States. How to implement change in these risk factors at the population level remains a challenge.

Also of note, while age-standardized DALYs vary widely by state, with Minnesota with the lowest, Mississippi with the highest, and Iowa in the middle, the relative contribution of each of 12 key CVD risk factors to overall CVD burden was found

to be similar in each state. Thus, although factors such as high blood pressure, low physical activity, and air pollution exert similar relative influence on CVD burden whether one lives in Minnesota, Iowa, or Mississippi, geographic disparities remain in overall CVD burden and trajectories. As noted by Wing et al,[4] social and economic changes within and between states are key factors in epidemics such as CVD as well as the underlying risk factors driving the overall burden and trends. The article by the Global Burden of Cardiovascular Diseases Collaboration[5] is a major step forward in the study and measurement of the burden and trends of CVD and may indeed provide benchmarks for regions committed to creating positive change and preventing a reversal of decades of favorable trends in CVD burden across the United States.

ARTICLE INFORMATION

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