The Most Distinctive Causes of Death by State, 2001–2010

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Background

Maps of the most distinctive or characteristic value of some variable at the state or country level became popular on social media in 2014. Among the most widely shared examples have been maps of state-level birth name preferences, music-listening preferences, and mortality from among the top 10 causes of death (1). This form of data presentation has a long history in economic geography, where the mapped values are known as location quotients (2). We use the International Classification of Diseases, 10th Revision (ICD-10), List of 113 Selected Causes of Death file published by the National Center for Health Statistics (3) to present a more nuanced view of mortality variation within the United States than what can be seen by using only the 10 most common causes of death.

Methods

Counts for each cause of death included on the ICD-10 List of 113 Selected Causes of Death along with population sizes were obtained for each of the 50 states and the District of Columbia for 2001 through 2010 from the Underlying Cause of Death file accessible through the Centers for Disease Control and Prevention (CDC) WONDER (Wide-ranging Online Data for Epidemiologic Research) website (4). We also included subcauses of death contained in this file, such as specific types of cancer, which brought the total number of causes of death to 136. The standardized mortality rate ratio (ie, the ratio of the age-adjusted state-specific death rate for each cause of death relative to the national age-adjusted death rate for each cause of death relative to the national age-adjusted death rate for each cause of death, equivalent to a location quotient) was then calculated, and the maximum ratio for each state was mapped. That is, we mapped

$$\text{Max}_j \text{SMR}_j = \max_i \left( \frac{\text{Age-Adjusted Mortality Rate for State}_i, \text{Cause of Death}_j}{\text{Age-Adjusted Mortality Rate for United States, Cause of Death}_j} \right)$$

where Max$_j$ is the age-adjusted mortality rate for each state $i$ and SMR$_j$ is the age-adjusted mortality rate for the United States for

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each cause of death $j$. Causes of death with fewer than 10 counts at
the state level were suppressed and therefore not available for this
analysis.

The map was produced in SAS software version 9.3 (SAS Insti-
tute, Inc) by using a single program that imported the output from
CDC WONDER, calculated the mortality rate ratios, and gener-
ated the map using PROC MAPIMPORT and PROC GMAP. The
program code is available from the authors. Minor cosmetic en-
hancements were made to the map using Adobe Illustrator
(Adobe, Inc). Both colors and numeric labels were used on the
map to facilitate black-and-white printing.

Main Findings

The resulting map depicts a variety of distinctive causes of death
based on a wide range of number of deaths, from 15,000 deaths
from HIV in Florida to 679 deaths from tuberculosis in Texas to
22 deaths from syphilis in Louisiana. The largest number of deaths
mapped were the 37,292 deaths in Michigan from “atherosclerotic
cardiovascular disease, so described”; the fewest, the 11 deaths in
Montana from “acute and rapidly progressive nephritic and neph-
rotic syndrome.” The state-specific percentage of total deaths
mapped ranged from 1.8% (Delaware; atherosclerotic cardiovas-
cular disease, so described) to 0.0005% (Illinois, other disorders of
kidney).

Some of the findings make intuitive sense (influenza in some
northern states, pneumoconioses in coal-mining states, air and wa-
ter accidents in Alaska and Idaho), while the explanations for oth-
ers are less immediately apparent (septicemia in New Jersey,
deaths by legal intervention in 3 Western states). The highly vari-
able use of codes beginning with “other” between states is also ap-
parent. For example, Oklahoma accounted for 24% of the deaths
ttributable to “other acute ischemic heart diseases” in the country
despite having only slightly more than 1% of the population, res-
ulting in a standardized mortality rate ratio of 19.4 for this cause
death, the highest on the map. The highest standardized mortal-
ity rate ratio after Oklahoma was 12.4 for pneumoconioses in
West Virginia.

A limitation of this map is that it depicts only 1 distinctive cause
of death for each state. All of these were significantly higher than
the national rate, but there were many others also significantly
higher than the national rate that were not mapped. The map is
also predisposed to showing rare causes of death — for 22 of the
states, the total number of deaths mapped was under 100. Using
broader cause-of-death categories or requiring a higher threshold
for the number of deaths would result in a different map. These
limitations are characteristic of maps generally and are why these
maps are best regarded as snapshots and not comprehensive stat-
istical summaries (5).

Action

This map has been a robust conversation starter among those who
have seen it before publication, generating hypotheses and invit-
further exploration of the underlying data set, something that
an equivalent tabular representation does not accomplish as well.
Although chronic disease prevention efforts should continue to
emphasize the most common conditions, an outlier map such as
this one should also be of interest to public health professionals,
particularly insofar as it highlights nonstandard cause-of-death
certification practices within and between states that can poten-
tially be addressed through education and training. This is espe-
cially true considering that most death certificates are completed
by community physicians who receive little or no formal training
in this area. For example, a study found that nearly half of the
death certificates certified by physicians in a suburban Florida
county contained major errors, often reflecting confusion between
the underlying cause of death and the terminal mechanism of death
(6). It would not take many systematic miscodes involving an un-
usual cause of death for it to appear on this type of map.

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