Regional Trends in Mortality from Alcohol-Induced Causes in the United States, 2000–2017

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Bureau.⁴ The study period was divided into two periods, 2000–2009 and 2010–2017, and the relative percent change was calculated between these periods.

INTRODUCTION

In the United States (US), alcohol use disorder remains a major contributor to all-cause morbidity with a persistent uptrend in deaths from alcohol-induced causes.^{1, 2} While recent guidelines from the US Preventative Services Task Force have recommended screening for all adults in the primary care setting,³ understanding the regional disparities and associated sociodemographic factors that may impact the mortality from alcohol-induced causes can aid in prioritizing allocation of resources to at-risk subpopulations.

METHODS

Using data obtained from the National Center for Health Statistics, we performed a cross-sectional study analyzing all deaths attributable to alcohol-induced causes as defined by the Center of Disease Control by US Census region (Northeast, Midwest, South, and West) and state from 2000 through 2017.⁴ Age-adjusted death rates (per 100,000 persons) for overall and population-specific cohorts were calculated for each US region and state using annual data from US Census

RESULTS

Overall, the age-adjusted mortality from alcohol-induced causes increased within all four US regions from 2000–2009 to 2010–2017, with similar rising trends in mortality from alcoholic liver disease (Table 1). The West region had the highest overall mortality from alcohol-induced causes; over a 75% higher rate compared with all other US regions. From 2000 to 2009, the South had the second highest overall mortality but was surpassed by the Midwest in 2010–2017, with similar regional patterns noted in middle-aged adults between 45 and 64 years as well as both men and women.

Middle-aged adults (45–64 years) had the highest population-specific mortality and experienced at least a 20% relative increase across all 4 regions from 2000–2009 to 2010–2017. Although men and women also experienced increases in mortality, these death rates remained more than twofold higher in men in each region. Based on race/ethnicity, non-Hispanic Whites experienced the largest relative change in mortality in all four regions from 2000–2009 to 2010–2017 and surpassed mortality in non-Hispanic Blacks in the Northeast, Midwest, and South from 2000–2009 to 2010–2017. Non-Hispanic Blacks were the only sociodemographic subgroup that experienced a decline in mortality. Although mortality among Hispanics remained relatively unchanged, mortality among Hispanics in the West surpassed that of all other race/ethnicities in any region.

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Table 1 Age- and Population-Specific Adjusted Death Rates (Per 100,000 Persons) Attributed to Alcohol-Induced Causes Within the 4 United States Regions from 2000 to 2017

Sociodemographic characteristic	Northeast (95% CI)	Midwest (95% CI)	South (95% CI)	West (95% CI)
Total	5.8 (5.8–5.9)	6.9 (6.9–7.0)	6.9 (6.9–6.9)	11.9 (11.8–12.0)
2000–2009	5.7 (5.6–5.7)	6.3 (6.2–6.3)	6.7 (6.6–6.7)	10.9 (10.9–11.0)
2010–2017	7.5 (7.4–7.6)	8.9 (8.8–9.0)	8.3 (8.2–8.4)	13.9 (13.8–14.0)
% change	31.5	41.2	23.8	12.9
Age groups (years)				
45–64	15.3 (15.1–15.4)	18.3 (18.1–18.4)	18.9 (18.8–19.0)	30.6 (30.4–30.8)
2000–2009	13.5 (13.3–13.7)	15.3 (15.1–15.5)	17.1 (16.9–17.2)	27.6 (27.3–27.8)
2010–2017	17.2 (17.0–17.5)	21.5 (21.3–21.8)	20.9 (20.7–21.0)	33.8 (33.5–34.0)
% change	27.4	40.5	22.2	22.5
≥ 65	9.3 (9.2–9.5)	10.5 (10.3–10.6)	11.2 (11.1–11.3)	22.0 (21.8–22.3)
2000–2009	8.4 (8.2–8.7)	9.4 (9.2–9.6)	10.3 (10.2–10.5)	20.8 (20.5–21.1)
2010–2017	10.3 (10.1–10.6)	11.6 (11.4–11.9)	12.0 (11.8–12.2)	23.2 (22.9–23.6)
% change	22.6	23.4	16.5	11.5
Gender				
Women	2.9 (2.8–2.9)	3.6 (3.5–3.6)	3.3 (3.3–3.3)	6.5 (6.4–6.5)
2000–2009	2.3 (2.1–2.5)	2.6 (2.4–2.7)	3.0 (2.9–3.2)	5.0 (4.8–5.3)
2010–2017	3.3 (3.2–3.4)	4.3 (4.2–4.3)	3.7 (3.7–3.8)	7.3 (7.3–7.4)
% change	43.4	65.4	23.3	46.0
Men	9.1 (9.0–9.2)	10.6 (10.5–10.6)	10.9 (10.9–11.0)	17.7 (17.6–17.8)
2000–2009	8.4 (8.3–8.5)	9.4 (9.3–9.5)	10.4 (10.3–10.5)	16.7 (16.6–16.9)
2010–2017	9.9 (9.8–10.0)	11.8 (11.7–11.9)	11.4 (11.3–11.5)	18.7 (18.5–18.8)
% change	17.9	25.5	9.6	12.0
Race/ethnicity				
Non-Hispanic White	5.9 (5.8–5.9)	6.8 (6.8–6.9)	7.5 (7.4–7.5)	12.0 (11.9–12.1)
2000–2009	5.1 (5.0–5.2)	5.8 (5.8–5.9)	6.6 (6.5–6.6)	10.8 (10.7–10.9)
2010–2017	6.7 (6.7–6.8)	8.0 (7.9–8.1)	8.4 (8.4–8.5)	13.3 (13.2–13.4)
% change	31.3	37.9	27.3	23.1
Non-Hispanic Black	6.2 (6.0–6.3)	7.4 (7.2–7.5)	6.3 (6.2–6.4)	10.2 (10.0–10.5)
2000–2009	6.3 (6.1–6.5)	7.3 (7.1–7.5)	6.9 (6.8–7.0)	10.3 (9.9–10.7)
2010–2017	6.0 (5.8–6.2)	7.5 (7.2–7.7)	5.6 (5.5–5.7)	10.2 (9.8–10.5)
% change	– 4.8	2.7	– 18.8	– 0.1
Hispanic or Latino	7.0 (6.8–7.2)	6.6 (6.4–6.9)	5.8 (5.7–5.9)	14.2 (14.0–14.4)
2000–2009	7.0 (6.7–7.2)	5.7 (5.4–6.1)	5.7 (5.6–5.9)	14.1 (13.9–14.4)
2010–2017	7.0 (6.8–7.3)	7.3 (7.0–7.7)	5.9 (5.8–6.1)	14.2 (14.0–14.4)
% change	–	28.1	3.5	0.7
Alcoholic liver disease	3.2 (3.1–3.2)	4.1 (4.0–4.1)	4.2 (4.1–4.2)	7.9 (7.9–8.0)
2000–2009	2.9 (2.8–2.9)	3.5 (3.5–3.6)	3.8 (3.7–3.8)	7.2 (7.2–7.3)
2010–2017	3.5 (3.4–3.5)	4.7 (4.7–4.8)	4.6 (4.5–4.6)	8.6 (8.6–8.7)
% change	15.4	34.3	21.1	19.4

Causes of death attributable to alcohol-induced mortality included the following ICD-10 codes: E24.4, alcohol-induced pseudo-Cushing's syndrome; F10, mental and behavioral disorders due to alcohol use; G31.2, degeneration of the nervous system due to alcohol; G62.1, alcoholic polyneuropathy; G72.1, alcoholic myopathy; I42.6, alcoholic cardiomyopathy; K29.2, alcoholic gastritis; K70, alcoholic liver disease; K85.2, alcohol-induced acute pancreatitis; K86.0, alcohol-induced chronic pancreatitis; R78.0, finding of alcohol in blood; X45, accidental poisoning by and exposure to alcohol; X65, intentional self-poisoning by and exposure to alcohol; and Y15, poisoning by and exposure to alcohol, undetermined intent. Alcohol-induced causes excluded unintentional injuries, homicides, and other causes indirectly

State-specific mortality from alcohol-induced causes in 2000–2009 and 2010–2017 is depicted in Fig. 1. All states except Alaska and Maryland experienced an increase in mortality. From 2000 to 2009, only two states, Alaska (19.7) and New Mexico (18.6), had a mortality surpassing 15 deaths per 100,000 persons. However, from 2010 to 2017, this number increased to seven states, all from the Southwest and Northwest sections of the West region including New Mexico (25.2), Alaska (18.7), Wyoming (18.3), Arizona (16.0), Oregon (16.0), South Dakota (15.9), and Montana (15.5). Moreover, 32% (16) of US states had mortality surpassing 10 deaths per 100,000 persons from 2010 to 2017.

DISCUSSION

Mortality from alcohol-induced causes increased in all four regions of the US with highest rates in the West—largely attributed to states in the Southwest (Arizona and New Mexico) and Northwest (Wyoming, Oregon, and Montana). More importantly, while these data highlight the ongoing regional increase in mortality in nearly all sociodemographic groups; middle-aged adults, men, and non-Hispanic Whites in all regions as well as Hispanics in the West were seemingly at highest risk. These ominous trends warrant a comprehensive plan by the policy makers in the federal government in conjunction with a targeted approach by stake holders at the state level. These data may help health care providers on a regional/state level to focus on preemptive screening, counselling, and

Figure 1 Comparison of state-specific mortality rates from alcohol-induced causes in the United States from 2000 through 2009 and 2010 through 2017. **a** Age-adjusted mortality rate from alcohol-induced causes in the United States by state from 2000 through 2009. **b** Age-adjusted mortality rate from alcohol-induced causes in the United States by state from 2010 through 2017.

intervention in the primary care setting among at-risk subpopulations.

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Author Contributions Dr. Cholankeril was involved in study concept and design, analysis and interpretation of data, drafting of the manuscript, critical revision of the manuscript for important intellectual content, and study supervision. Dr. Dennis, Dr. Kim, and Dr. Ahmed were involved in interpretation of data, drafting of the manuscript, and critical revision of the manuscript for important intellectual content.

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Data Availability All data including statistical code used to generate results and the dataset from which the results were derived will be made available upon request to the corresponding author.

Compliance with Ethical Standards:

Conflict of Interest: The authors declare that they do not have a conflict of interest.

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