

Beyond the Objective: Wisconsin Reaching Ischemic Heart Disease Mortality Objective Despite a Third of Counties Not Meeting the Goal

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ABSTRACT

Introduction: Ischemic heart disease is one of the leading causes of death in the United States, with some geographic groups being more affected than others. A Healthy People 2020 objective exists to reduce ischemic heart disease mortality.

Methods: This study examined ischemic heart disease mortality in Wisconsin by county and 4 county categories, based on an urban to rural spectrum, and observed progress towards the Healthy People 2020 objective.

Results: Ischemic heart disease mortality rates have been decreasing. Currently, 67% of Wisconsin counties meet the objective; however, 71% of counties not meeting the objective are more rural.

Discussion: Although further investigation is needed to better understand the factors that cause disparities, more resources should be directed towards communities at highest risk.

ity among rural communities and African American or black populations.³ Because of the impact ischemic heart disease has on the US population, reducing ischemic heart disease deaths from 129.2 as of 2007 (age-adjusted to the year 2000 standard population, per 100,000 people) to 103.4 is a Healthy People 2020 objective.⁴ The purpose of this paper is to expand on existing literature regarding ischemic heart disease mortality by describing the epidemiology of ischemic heart disease mortality in Wisconsin by county and county categories, based on an urban to rural spectrum, and observe progress towards the Healthy People 2020 objective.

INTRODUCTION

Ischemic heart disease is the cause of 1 out of every 4 deaths in the United States and is the leading cause of death for African Americans, Hispanics, and whites.¹ Although research shows that heart disease mortality has been decreasing since the mid-1960s—likely due to a reduction in the occurrence of heart disease as well as a decrease in the case-fatality rate—ischemic heart disease mortality remains a problem for the United States as a whole and for some groups more than others.² Recent studies show that health disparities related to ischemic heart disease mortality exist and are indicated by slower decreases in ischemic heart disease mortal-

METHODS

Data on ischemic heart disease mortality (ICD-10 I20-I25, the same codes used by Healthy People 2020) were collected for all people in Wisconsin (ages, races, and sex) by county for all counties from the CDC WONDER Underlying Cause of Death database for 3 equal time periods: 1999-2004, 2005-2010, and 2011-2016.⁵ Ischemic heart disease death rates were age-adjusted to the 2000 US standard population. Counties were then categorized into frontier (most rural), rural (rural, but not as remote as frontier), micropolitan (counties containing or near small urban centers), and metropolitan (counties containing or near large urban centers) based on classifications made by the University of Wisconsin Applied Population Laboratory, the Wisconsin Office of Rural Health, and the US Office of Management and Budget.^{6,7}

The US Office of Management and Budget defines a Core Based Statistical Area (CBSA) as a geographic area consisting of a core population of 10,000 or more people. The area surrounding the core is included in the CBSA if commuting patterns

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indicate high economic and social integration.⁸ CBSAs are then categorized as metropolitan statistical areas if they contain urban areas with more than 50,000 people, or micropolitan statistical areas if they contain urban areas with a population above 10,000 and below 50,000 people. Metropolitan and micropolitan statistical areas can be comprised of single or multiple counties.

For this paper, counties that are part of metropolitan or micropolitan CBSAs were classified as metropolitan and micropolitan, respectively. Counties that were not classified as part of metropolitan or micropolitan statistical areas were categorized as rural. Frontier counties were identified based on designations made by the Wisconsin Office of Rural Health and the National Center for Frontier Communities. Counties categorized as frontier had residents that lived an hour or more from a major city and at least a 15-minute drive from an area with a population of more than 2,500.⁷ For the purposes of this paper, if there was disagreement between the classifications of a county between the Office of Management and Budget and the Wisconsin Office of Rural Health, the more rural classification was used.

To compare counties and observe progress towards the Healthy People 2020 objective, age-adjusted ischemic heart disease mortality rate histograms were created for each of the 3 time periods. From these histograms, percentages of counties meeting or not meeting the Healthy People 2020 objective were calculated for each time period. For the most recent time period (2011-2016), percentages of frontier, rural, micropolitan, and metropolitan counties reaching and not reaching the Healthy People 2020 objective also were calculated. Additionally, the percent change between each time period for all counties was calculated, and then the median percent change was identified for each county category.

RESULTS

Age-adjusted mortality rates due to ischemic heart disease for all 72 Wisconsin counties (grouped by county category) for the 3 different time periods are listed in Table 1. From 1999 to 2004, age-

Table 1A. Ischemic Heart Disease Mortality By County, Frontier and Rural Counties, 1999-2016 (Frontier and Rural)

	1999-2004		2005-2010		2011-2016	
	Age Adjusted		Age Adjusted		Age Adjusted	
	Rate Per 100,000	95% CI	Rate Per 100,000	95% CI	Rate Per 100,000	95% CI
Frontier Counties (n=11)						
Bayfield	138.4	116.8 - 159.9	129.1	109.6 - 148.7	95.5	79.1 - 111.8
Iron	169.9	139.6 - 200.3	169.0	139.0 - 199.1	94.9	74.1 - 119.7
Ashland	209.9	184.8 - 235.0	139.2	118.9 - 159.5	92.5	75.9 - 109.0
Sawyer	188.2	164.3 - 212.1	141.6	121.4 - 161.7	121.9	104.0 - 139.8
Washburn	174.2	152.1 - 196.2	129.4	111.1 - 147.7	138.7	119.8 - 157.6
Burnett	104.5	87.2 - 121.7	85.3	69.7 - 100.8	63.8	50.4 - 77.3
Rusk	147.6	126.7 - 168.5	103.1	85.6 - 120.6	120.5	102.2 - 138.8
Price	163.7	142.8 - 184.7	113.5	95.7 - 131.2	111.7	94.0 - 129.5
Florence	141.5	108.7 - 181.0	132.0	99.5 - 171.9	134.4	103.5 - 171.6
Forest	177.9	149.2 - 206.7	125.0	100.8 - 149.2	125.2	101.2 - 149.2
Menominee	161.9	102.6 - 242.9	134.1	86.8 - 198.0	94.5	57.8 - 146.0
Median	163.7		129.4		111.7	
Rural Counties (n=28)						
Barron	153.1	140.4 - 165.8	123.1	112.2 - 134.0	94.9	85.5 - 104.3
Polk	142.5	129.3 - 155.7	104.0	93.2 - 114.8	85.0	75.6 - 94.3
Vilas	159.8	142.5 - 177.1	116.4	102.4 - 130.4	110.7	96.9 - 124.5
Oneida	154.2	140.4 - 168.1	118.9	107.3 - 130.5	100.2	89.7 - 110.7
Langlade	185.2	165.7 - 204.8	142.1	125.2 - 159.1	104.1	89.8 - 118.5
Oconto	122.9	109.3 - 136.5	132.2	118.5 - 145.9	122.4	109.8 - 135.0
Shawano	219.1	203.3 - 235.0	115.1	103.9 - 126.3	88.9	79.2 - 98.5
Waupaca	189.1	176.2 - 202.0	148.3	137.2 - 159.3	120.6	110.9 - 130.4
Taylor	134.8	116.3 - 153.3	109.7	93.8 - 125.7	77.4	64.7 - 90.2
Clark	152.6	137.5 - 167.6	113.7	100.9 - 126.5	105.4	93.3 - 117.5
Jackson	187.0	164.3 - 209.7	116.2	98.7 - 133.6	122.2	105.2 - 139.3
Trempealeau	167.3	150.4 - 184.2	108.1	94.5 - 121.7	95.2	82.7 - 107.6
Buffalo	126.8	105.5 - 148.0	90.6	73.2 - 107.9	86.8	70.2 - 103.3
Pepin	160.4	129.1 - 191.7	107.8	84.5 - 135.5	84.1	64.1 - 108.2
Kewaunee	109.6	93.1 - 126.1	87.3	73.2 - 101.5	76.2	63.3 - 89.1
Door	135.6	121.3 - 150.0	105.8	93.9 - 117.7	102.9	91.3 - 114.5
Monroe	187.0	171.0 - 203.0	138.6	125.4 - 151.9	104.5	93.4 - 115.6
Juneau	182.3	163.1 - 201.5	101.4	88.0 - 114.8	107.1	93.3 - 120.9
Adams	154.3	135.1 - 173.5	128.7	112.2 - 145.2	121.2	106.0 - 136.5
Waushara	205.7	186.0 - 225.3	151.1	134.6 - 167.7	153.7	137.6 - 169.8
Marquette	123.7	104.0 - 143.5	94.2	77.9 - 110.5	66.5	53.5 - 79.6
Green Lake	158.3	139.6 - 177.1	110.8	95.3 - 126.3	83.2	70.1 - 96.3
Columbia	141.7	129.7 - 153.6	97.8	88.1 - 107.5	90.7	81.6 - 99.7
Vernon	161.3	144.9 - 177.7	95.8	83.5 - 108.2	86.3	75.1 - 97.4
Richland	136.9	118.0 - 155.9	105.7	89.8 - 121.7	75.6	62.6 - 88.6
Crawford	158.5	137.3 - 179.8	110	92.7 - 127.4	89.3	73.8 - 104.8
Iowa	191.4	169.0 - 213.7	147.2	128.4 - 166.1	114.9	99.4 - 130.4
Lafayette	171.2	147.9 - 194.5	117.6	98.7 - 136.6	90.3	74.3 - 106.3
Median	158.4		112.2		95	

adjusted mortality rates due to ischemic heart disease ranged from 104.5 to 219.1 per 100,000 people. During 2005 to 2010, rates ranged from 78.9 to 169 per 100,000 people. And, during 2011 to 2016, rates ranged from 63.8 to 153.7 per 100,000 people. With few exceptions, mortality rates consistently decreased for all counties over time and, on average, rates were lower in metropolitan counties and higher in frontier counties for all 3 time periods.

Histograms created to see trends in the number of counties meeting and not meeting the Healthy People 2020 objective revealed a steady increase in the number of counties meeting the objective as well as a potential urban-rural disparity (Figure 1). For

Table 1B. Ischemic Heart Disease Mortality By County, Frontier and Rural Counties, 1999-2016 (Micropolitan and Metropolitan)

	1999-2004		2005-2010		2011-2016	
	Age Adjusted		Age Adjusted		Age Adjusted	
	Rate Per 100,000	95% CI	Rate Per 100,000	95% CI	Rate Per 100,000	95% CI
Micropolitan Counties (n=11)						
Marinette	199.3	184.9 - 213.8	158.3	145.6 - 171.0	129.9	118.7 - 141.1
Lincoln	158.7	142.7 - 174.7	101.2	88.8 - 113.6	113.8	101.0 - 126.6
Dunn	130.9	116.0 - 145.8	82.5	71.5 - 93.4	78.7	68.7 - 88.7
Wood	120.3	111.3 - 129.2	100.9	93.0 - 108.7	86.4	79.3 - 93.5
Portage	135.9	124.2 - 147.6	96.5	87.2 - 105.8	86.0	77.7 - 94.2
Manitowoc	140.2	131.0 - 149.5	111.8	103.9 - 119.7	86.6	79.7 - 93.4
Dodge	192.6	181.6 - 203.6	137.1	128.2 - 146.0	97.0	89.7 - 104.2
Jefferson	163.3	151.7 - 174.8	128.3	118.5 - 138.0	92.8	85.0 - 100.7
Walworth	162.2	152.0 - 172.4	107.8	99.9 - 115.7	95.3	88.2 - 102.4
Grant	172.9	159.5 - 186.3	130.8	119.4 - 142.3	94.8	85.3 - 104.3
Sauk	160.7	148.3 - 173.2	112.1	102.3 - 121.8	110.1	100.8 - 119.3
Median	160.7		111.8		94.8	
Metropolitan Counties (n=22)						
Douglas	154.6	140.7 - 168.5	110	98.3 - 121.8	85.1	75.1 - 95.1
Chippewa	160.7	148.2 - 173.2	98.7	89.5 - 108.0	106.5	97.3 - 115.8
Eau Claire	118	109.1 - 126.9	91.2	83.6 - 98.7	73.3	66.8 - 79.8
St. Croix	144.4	131.5 - 157.3	94.3	84.8 - 103.8	71.5	64.0 - 79.1
Pierce	151.3	133.4 - 169.1	87.9	75.1 - 100.7	79.9	68.6 - 91.2
Marathon	107.3	100.3 - 114.4	86.6	80.7 - 92.6	73	67.8 - 78.2
Outagamie	137.2	129.5 - 144.8	95.7	89.7 - 101.7	83.3	78.0 - 88.5
Brown	160.1	153.0 - 167.2	111.9	106.4 - 117.4	110.2	105.0 - 115.3
Winnebago	117	110.3 - 123.7	84.8	79.4 - 90.2	69.6	64.9 - 74.2
Calumet	112.3	98.2 - 126.3	95.3	83.5 - 107.0	93.4	82.7 - 104.1
Fond Du Lac	148.5	139.5 - 157.5	109.3	101.9 - 116.8	92.1	85.5 - 98.6
Sheboygan	141.2	132.9 - 149.5	106.7	99.7 - 113.7	93	86.7 - 99.3
Washington	135.1	126.4 - 143.9	93	86.5 - 99.6	80.3	74.7 - 85.9
Ozaukee	132.2	122.3 - 142.1	99.1	91.4 - 106.9	79.3	72.8 - 85.8
Milwaukee	170.8	167.4 - 174.2	129.9	127.0 - 132.9	110.3	107.6 - 113.0
Waukesha	143.2	138.2 - 148.2	95	91.3 - 98.7	73.4	70.4 - 76.4
Racine	140.9	134.0 - 147.9	110.2	104.4 - 116.0	88.6	83.6 - 93.6
Kenosha	170.1	161.3 - 178.9	142.6	135.0 - 150.3	120.5	113.8 - 127.3
Rock	146.8	139.1 - 154.5	104	98.1 - 110.6	95	89.1 - 100.4
Green	117.4	103.9 - 131.0	80.1	69.4 - 90.9	71.8	62.1 - 81.5
Dane	115.1	110.5 - 119.7	78.9	75.4 - 82.4	70.6	67.5 - 73.6
La Crosse	126	117.5 - 134.6	87.6	80.9 - 94.3	77.5	71.5 - 83.4
Median	141		95.5		81.8	

the first time period (1999-2004), no counties had age-adjusted ischemic heart disease mortality rates lower than 103.4; thus, no Wisconsin counties met the Healthy People 2020 objective. For the 2005-2010 period, 36% (26) of counties had age-adjusted ischemic heart disease mortality rates lower than 103.4, and 64% (46) had rates that were higher. And from 2011 to 2016, 67% (48) of counties met the Healthy People 2020 goal of rates lower than 103.4, while 33% (24) had higher rates. More specifically, 45% (5 of 11) of frontier counties, 60% (17 of 28) of rural counties, 73% (8 of 11) of micropolitan counties, and 82% (18 of 22) of metropolitan counties met the goal during this time period (Figure 2). Of the 33% of counties that did not meet the Healthy People 2020 objective, 71% were either rural or frontier. Additionally, the statewide age-adjusted rate for this time period was 92.4 (95% CI, 91.5-93.4).

In terms of trends over time, percent change between each

time period and overall illustrates that ischemic heart disease mortality is decreasing and that the decrease has been slowing over time. Between 1999 to 2004 and 2005 to 2010, age-adjusted mortality rates decreased between 25% and 29% for all county categories—or about 4% to 5% per year. Between 2005 to 2010 and 2011 to 2016, rates decreased between 14% and 17% for all county categories—or about 2% to 3% per year. And between 1999 to 2004 and 2011 to 2016, rates decreased around 40% across all county categories.

DISCUSSION

This study finds that the state of Wisconsin is currently meeting the Healthy People 2020 objective of an age-adjusted ischemic heart disease mortality rate of less than 103.4 per 100,000 people, despite 33% of counties not meeting this goal. The majority of counties not meeting the objective (71%) were categorized as either rural or frontier. Ischemic heart disease mortality decreased for each county category, on average, over the time period studied. Furthermore, percent change in ischemic heart disease mortality was larger from the first time period (1999-2004) to the second time period (2005-2010) than it was from the second time period to the third time period (2011-2016), indicating that the rate of decrease is slowing.

The findings of this study in terms of an urban-rural health disparity and a consistent, yet slowing decrease in ischemic heart disease mortality, echo what existing literature reports.^{2,3,9,10} Like other studies have shown, location matters for health. Rural communities tend to be worse off than more urban settings in terms of ischemic heart disease mortality and some other health indicators. However, urban communities do not always fair better than rural communities, especially on measures of water and air quality, mental health issues due to limited green space, and higher rates of poverty, among other issues.¹⁰⁻¹³

Likewise, existing literature supports this study's findings that ischemic heart disease mortality rates are consistently decreasing and that the rate of decrease is slowing for some groups. In the mid-1960s, death due to ischemic heart disease peaked and has been declining since. The increase in ischemic heart disease mortality from the early 20th century into the mid-20th century is thought to be related to increases in negative health behaviors,

such as poor diet and smoking, and the decrease in mortality since the mid-20th century is thought to be attributed to improvements in primary, secondary, and tertiary prevention.^{2,3} This investigation did not explore why rates of ischemic heart disease mortality are decreasing more slowly now than in previous years, but further study into how increasing obesity rates relate to ischemic heart disease mortality may be an appropriate next step.

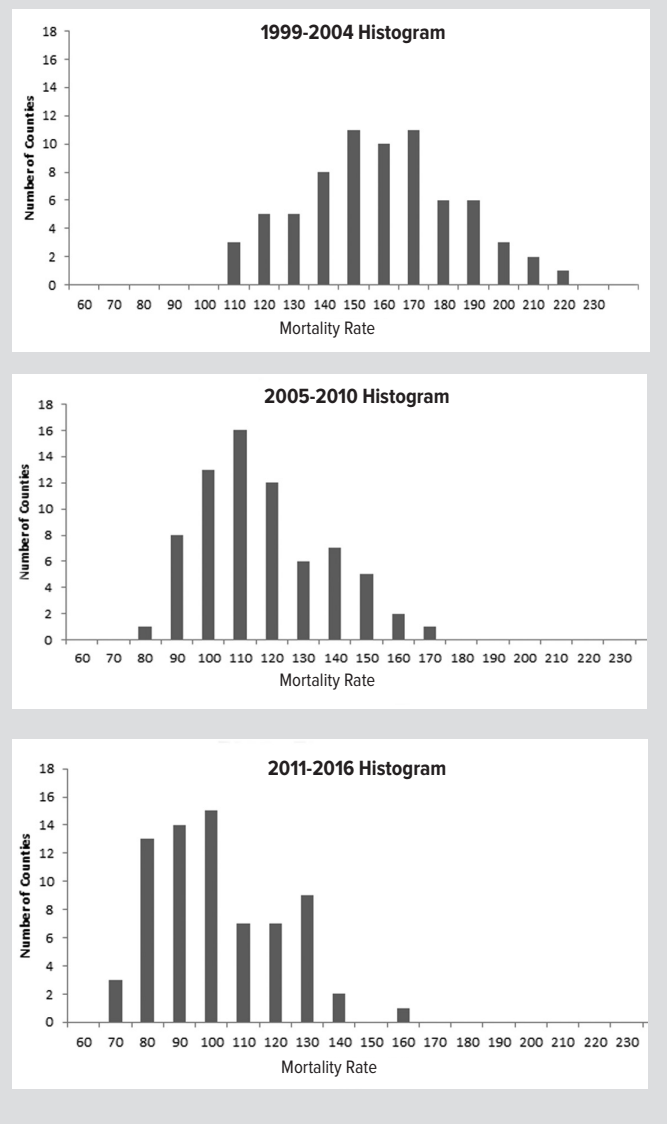
Similarly, while this paper does not examine the underlying causes for ischemic heart disease mortality disparities, existing literature creates a solid foundation for further study. Rural communities may experience higher ischemic heart disease mortality than urban and suburban communities due to issues in access to care as well as health behaviors. Access to care may be limited for rural residents due to higher uninsured rates and longer travel times to health care providers, which can make health care unreachable.^{14,15} Lifestyle also may play a role as leisure time spent physically active is lower; the prevalence of obesity is higher—even after adjusting for age, sex, race/ethnicity, and education level; and smoking rates tend to be higher in rural adults as compared to urban and suburban populations.¹⁶⁻¹⁸ Understanding the unique barriers faced by rural communities and adapting a systems-thinking approach to addressing those barriers will be invaluable when trying to reduce ischemic heart disease mortality.

This study has some notable limitations. First, the data used for this study are based on death records. Death record documentation and underlying cause of death determinations may vary based on who is collecting and recording the data. Second, although this study examined data from 1999 to 2016, the data was summarized in 3 data points each representing 6 years; thus, some variability within the 6-year periods was lost. Third, some of the county categories were small and consequently made it difficult to meaningfully compare between county categories. Fourth, classifying counties into frontier, rural, micropolitan, and metropolitan may hide variability that exists within a geographic region by factors such as race or ethnicity.¹⁹ Finally, this is a single study in 1 state. Although results are echoed in similar studies from other regions, further research into ischemic heart disease mortality in other frontier, rural, micropolitan, and metropolitan counties is needed to generalize the results.³

CONCLUSION

This study's findings make it clear that ischemic heart disease mortality is decreasing and that recognizable progress is being made. However, this study also reveals that more rural communities are not reaching ischemic heart disease mortality goals at the same rates as more urban counties. As time to evaluate the Healthy People 2020 objectives approaches and passes, it will be important that policies and programs acknowledge progress, but that equal acknowledgment is given to the existence of health disparities in a state that will likely meet the Healthy People 2020 objective.

Figure 1. Ischemic Heart Disease Mortality Histograms 1999-2004, 2005-2010, and 2011-2016



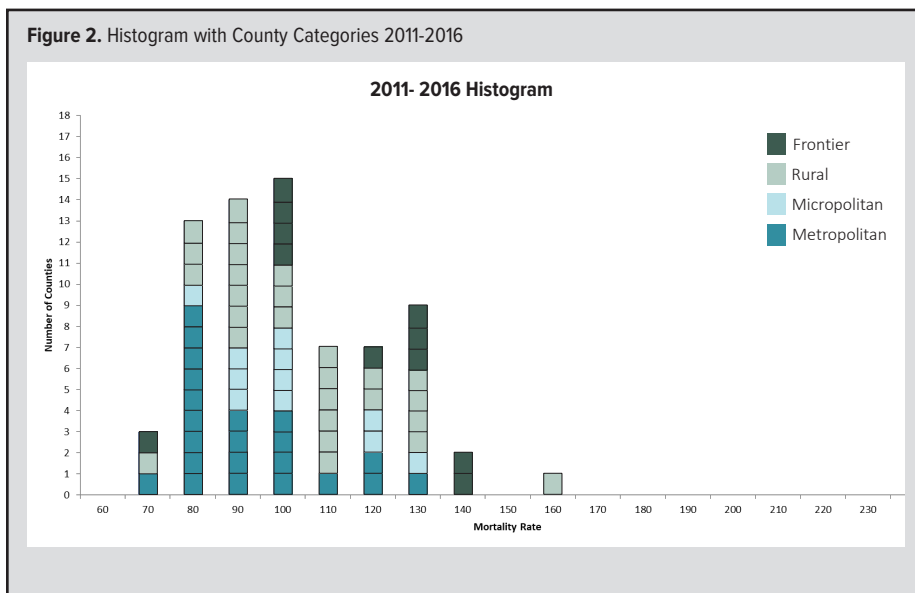
Like other current public health problems, the underlying cause of disparities in ischemic heart disease mortality between urban and rural geographic areas are likely the result of differences in primary, secondary, and tertiary prevention. Effective and equitable policy is needed to dedicate resources to investigate underlying causes of mortality rate differences across geographic locations and to subsequently distribute available resources so that rural communities struggling to meet Healthy People 2020 objectives are supported with public health programs.

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Figure 2. Histogram with County Categories 2011-2016



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