

# Increasing Educational Disparities in Premature Adult Mortality, Wisconsin, 1990-2000

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## ABSTRACT

*Context:* Public health agencies have identified the elimination of health disparities as a major policy objective.

*Objective:* The primary objective of this study is to assess changes in the association between education and premature adult mortality in Wisconsin, 1990-2000.

*Design, Setting, and Subjects:* Wisconsin death records (numerators) and US Census data (denominators) were compiled to estimate mortality rates among adults (25-64 years) in 1990 and 2000. Information on the educational status, sex, racial identification, and age of subjects was gathered from these sources.

*Main Outcome Measure:* The effect of education on mortality rate ratios in 1990 and 2000 was assessed while adjusting for age, sex, and racial identification.

*Results:* Education exhibited a graded effect on mortality rates, which declined most among college graduates from 1990 to 2000. The relative rate of mortality among persons with less than a high school education compared to persons with a college degree increased from 2.4 to 3.1 from 1990-2000—an increase of 29%. Mortality disparities also increased, although to a lesser extent, among other educational groups.

*Conclusion:* Despite renewed calls for the elimination of health disparities, evidence suggests that educational disparities in mortality increased from 1990 to 2000.

## INTRODUCTION

In *Healthy People 2010*, the US Department of Health and Human Services identified the elimination of health disparities as a major policy objective.<sup>1</sup> A large body of research has determined the importance of socioeconomic determinants as a critical component in the production of health outcomes and disparities.<sup>2-3</sup> While it is often difficult to determine the relative contribution of factors such as income, education, and occupation, education has been shown to have important independent associations with health outcomes; because of this, House and colleagues have concluded that “a causal impact of education on health is highly plausible.”<sup>4</sup> Education is also important as a proxy for socioeconomic status (SES) because it tends to remain fixed after young adulthood and this, unlike income or occupation, makes education less vulnerable to critiques that cite declining health as the cause of low SES. In addition, improving educational opportunity or outcomes is a widely shared cultural value while redistributing income is less so. Unfortunately, previous research suggests that adult mortality disparities by SES in general<sup>5,6</sup> and education in particular<sup>7-8</sup> have widened since the 1960s. Our study updates this body of knowledge by using recent death certificate and census data from the state of Wisconsin to examine changes in educational disparities in premature mortality over the period 1990-2000.

## METHODS

We calculated annual premature adult (25-65 years) mortality rates and rate ratios using full count Wisconsin (i.e., non-sampled) death certificate data for rate numerators. Wisconsin death certificates include information on the highest level of educational attainment (typically provided by family of the decedent). US Census population data for Wisconsin provided death rate denominators. To maximize the stability of our estimates, Wisconsin death records were compiled over 3-year periods centered

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around 1990 and 2000 (i.e., 1989-1991 and 1999-2001). Data were obtained from the Wisconsin Department of Health and Family Services, Division of Public Health, Bureau of Health Information and Policy. Death counts by age, race, sex, and education subgroups comprised the numerators of the mortality rates.

Denominators for the mortality rates were obtained from Wisconsin-specific 1990 and 2000 US Census tables for sex by race by age by educational attainment population counts. The Census data were multiplied by a factor of 3 to estimate Wisconsin's population from 1989-1991 and 1999-2001. The subgroup population counts were taken as estimates of person-years of exposure to risk of death for the calculation of rates.<sup>9</sup>

We examined premature mortality rates for 4 levels of educational attainment (less than high school, high school completion, some college experience, and a college degree or more), 3 age groups (25-34, 35-44, and 45-64) and 2 racial groups (whites and blacks). Younger adults (ages 18-24) were omitted since many in this age range have yet to complete formal education. We also limited analyses to white and black race groups since those racial classifications were the only groups in Wisconsin with sufficient numbers for comparative mortality analyses. Since the 2000 Census permitted multiracial classifications, we adopted the fractional approach outlined by Allen and Turner<sup>10</sup> to apportion multiracial individuals to black and white racial categories for the 2000 population counts.

SAS 8.02<sup>11</sup> was used for analyses of disparities in mortality rates by levels of educational attainment. Because mortality odds ratios approximate rate ratios in large samples with rare outcomes (highest mortality rate among the examined subgroups <2/100 persons per year),<sup>12</sup> we used logistic regression techniques to estimate ratios in the rates of death for the various groups in our study. Race group was used as an adjustment variable.

## RESULTS

Race-adjusted age, gender, and education specific mortality rates are presented for 1990 and 2000 in Table 1. For both men and women, mortality rates tended to decline sharply with increasing education, indicating that education has a strong, graded effect on mortality. Although mortality rates fell between 1990 and 2000 for most groups shown in Table 1, in every instance they fell most sharply among those with a college degree.

Figure 1 depicts the mortality rates of less educated persons relative to the referent population of persons with a college degree in the 1990 and 2000 time periods.

**Table 1.** Mortality Rates\* by Sex, Age, and Educational Attainment in Wisconsin, 1990-2000

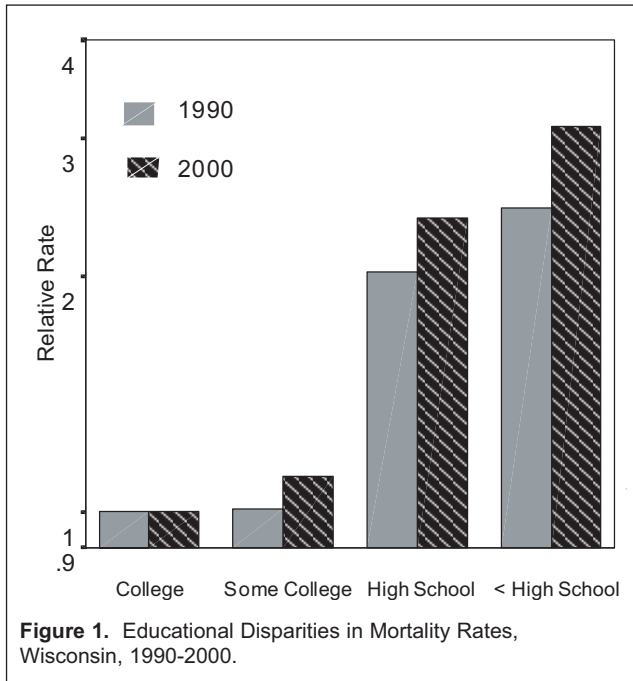
	1990	2000	Percent Change
<b>Males</b>			
Age 25-34			
Less than High School	234	209	-11
High School	168	160	-5
Some College	72	63	-13
College Degree	55	42	-24
Age 35-44			
Less than High School	343	385	+12
High School	253	259	+2
Some College	117	110	-6
College Degree	116	94	-19
Age 45-54			
Less than High School	1204	1216	+1
High School	951	876	-8
Some College	493	412	-16
College Degree	460	373	-19
<b>Females</b>			
Age 25-34			
Less than High School	103	93	-10
High School	67	92	+37
Some College	29	34	+17
College Degree	31	24	-23
Age 35-44			
Less than High School	180	224	+24
High School	122	150	+23
Some College	71	76	+7
College Degree	70	61	-13
Age 45-54			
Less than High School	641	751	+17
High School	542	525	-3
Some College	291	260	-11
College Degree	319	245	-23

\* Mortality rates expressed per 100,000 persons.

Controlling for age, gender, and race, in 2000, persons with less than a high school education died at 3.1 (95% confidence interval: 3.0 to 3.2) times the rate of college educated persons. By comparison, persons with less than a high school education died at 2.4 times the rate (95% confidence interval: 2.3 to 2.6) of college educated persons in 1990. This shows that mortality disparities between the least and most educated groups increased by 29% in this single decade. Similarly, the figure shows that mortality disparities among persons who completed high school or some college (but no college degree) relative to persons who hold a college degree increased by 20% and 10%, respectively, from 1990 to 2000.

## COMMENT

At the turn of the millennium, both federal<sup>1</sup> and state<sup>13</sup>



agencies issued calls to eliminate socioeconomic disparities in health and mortality by 2010. Because our findings suggest that educational disparities in mortality continued to increase in Wisconsin over the period 1990-2000, these calls to reform were both timely and necessary. The good news is that educational attainment has steadily improved in the United States since the late 1940s,<sup>14</sup> thereby making associated health benefits available to an increasing proportion of Americans. However, it is troubling to observe that trends toward higher educational attainment are leveling off and growing educational disparities in mortality are exacerbating existing inequalities in health outcomes.

To our knowledge, this study is the first to use data from the 2000 Census and state death records to examine educational disparities in mortality. Importantly, comprehensive data sources like the Census and state death records are probably less vulnerable to selection biases than studies of mortality based on samples. Additionally, it is advantageous to examine state databases since they provide relevant information for public health and educational programs, which are generally implemented on a local level.

Limitations of our study include the use of Wisconsin-specific data. Results from a single state may not represent trends in the entire United States. However, it is encouraging to note that previous research on mortality disparities has shown that trends in Wisconsin are typically consistent with national data.<sup>15</sup> Attribution of disparities in mortality rates to differences in edu-

cational attainment may be confounded by important, unmeasured characteristics, or by residual confounding within, for example, age groups. Additionally, there are likely to be circumstances where educational attainment or race-classification measured by Census surveys do not directly correspond to how those variables are recorded on individuals' death certificates. These limitations, while important, seem unlikely to explain the increasing mortality disparities between more and less educated persons that we observed over the 1990-2000 time period.

Future research should attempt to replicate our findings with data from death registries in other states. Researchers should also continue to examine trends in socioeconomic disparities in health and mortality using nationally representative samples (e.g., the National Health Interview Study) that include mortality data. Continued monitoring of these trends will provide progress reports for stated policy objectives and guideposts for future policy reforms.

Furthermore, an understanding of why educational disparities in mortality have increased over time should be sought. The actions of mechanisms through which education affects mortality, such as health behaviors (e.g., diet, physical activity, and care seeking) and access to vital goods (e.g., the information and resources necessary to secure quality medical care), are likely to vary over time. Understanding why such variations appear to be leading to a net increase in education-related mortality disparities should be a research priority. Clearly, objectives for eliminating disparities—related to education, race, or other demographic characteristics—are unlikely to be met without studies that examine not only the extent of disparity, but also the underlying reasons for changes in disparity levels.

Nevertheless, as researchers pursue answers to these questions, clinicians and public health workers should be alert that health problems faced by clients with low levels of education are ultimately manifesting themselves as widening mortality disparities in Wisconsin. Although reducing educational disparities in mortality will likely require broad societal change, clinicians can contribute to this effort by developing and implementing best practices for clients with low educational attainment. For instance, research has shown that poorly educated persons are less likely than well-educated persons to initiate and maintain regimens of physical activity.<sup>16</sup> Clinical and public health interventions might be especially tailored to persons with lower educational attainment and opportunities. At the least, medical or public health interventions should take into consider-

ation educational level of targeted patients or populations by, for example, including an educational component (e.g., the several health benefits of physical activity, or major health risks associated with tobacco use) to increase health awareness that might otherwise be assumed in more educated persons. In this way, clinical and public health programs that accommodate variations in educational backgrounds may help reverse the trend of widening education-related health disparities in Wisconsin and set Wisconsin on a path to the abolishment of such disparities as targeted (if optimistically) by *Healthiest People 2010*.<sup>13</sup>

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