

# The Economic Value of Improving the Health of Disadvantaged Americans

Robert F. Schoeni, PhD, William H. Dow, PhD,  
Wilhelmine D. Miller, PhD, MS, Elsie R. Pamuk, PhD

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**Background:** Higher educational attainment is associated with better health status and longer life.

**Purpose:** This analysis estimates the annual dollar value of the benefits that would accrue to less-educated American adults if they experienced the lower mortality rates and better health of those with a college education.

**Methods:** Using estimates of differences in mortality among adults aged  $\geq 25$  years by educational attainment from the National Longitudinal Mortality Survey and of education-based differentials in health status from published studies based on the Medical Expenditure Panel Survey, combined with existing estimates of the economic value of a healthy life year, the economic value of raising the health of individuals with less than a college education to the health of the college educated is estimated.

**Results:** The annual economic value that would accrue to disadvantaged (less-educated) Americans if their health and longevity improved to that of college-educated Americans is \$1.02 trillion.

**Conclusions:** This modeling exercise does not fully account for the social costs and benefits of particular policies and programs to reduce health disparities; rather, it provides a sense of the magnitude of the economic value lost in health disparities to compare with other social issues vying for attention. The aggregate economic gains from interventions that improve the health of disadvantaged Americans are potentially large.

(Am J Prev Med 2011;40(1S1):S67–S72) © 2011 American Journal of Preventive Medicine

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## Introduction

Large health disparities across SES groups in the U.S. have received increasing attention in recent years from researchers, the health policy community, and the general public.<sup>1–4</sup> For example, adults aged 25–50 years who have a college degree will on average live 5 years longer than those with less than a high school education.<sup>1</sup> At every age, health is better among the more highly educated: 75% of college-educated adults report being in very good or excellent health, compared to 40% of those with less than a high school education.<sup>1</sup>

The Robert Wood Johnson Foundation commissioned this analysis in 2007 to inform the deliberations of the Commission to Build a Healthier America.<sup>2</sup> The eco-

nomical model estimates the foregone value associated with worse health among lower-SES groups compared to the health of high-SES groups (with educational attainment serving as the indicator of SES). Specifically, it calculates the annual dollar value of the gains in health and longevity that would accrue to American adults with less than a college education if they experienced the lower mortality rates and better health of their counterparts with a college education. Considering the economic implications of a scenario in which all American adults enjoy the health status and longevity of those with a college education can inform policy discussions about investments to address disparities in health status. By expressing the health disparities in monetized form, the magnitude of the disparities can be more easily compared with other policy priorities.

## Methods

Two components account for the estimate of foregone benefits: the greater number of years lived and the higher health status for any given year of life lived by more educated individuals. Estimates are restricted to the population aged  $\geq 25$  years because a substantial share of the population aged  $< 25$  years has not completed their education.

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From the Institute of Social Research, University of Michigan (Schoeni), Ann Arbor, Michigan; School of Public Health, University of California, Berkeley (Dow), Berkeley, California; NORC at the University of Chicago (Miller), Bethesda; National Center for Health Statistics, CDC (Pamuk), Hyattsville, Maryland

Address correspondence to: Robert F. Schoeni, PhD, Institute for Social Research, University of Michigan, 426 Thompson Street, Ann Arbor MI 48109. E-mail: bschoeni@umich.edu.

0749-3797/\$17.00

doi: 10.1016/j.amepre.2010.09.032

**Table 1.** Population estimates for people aged  $\geq 25$  years, March 2006 CPS<sup>a</sup>

Age (years)	<High school	High school	Some college	College degree	Total
25–29	2,733	5,768	5,916	5,719	20,136
30–34	2,409	5,533	5,311	6,087	19,340
35–39	2,497	6,055	5,457	6,762	20,771
40–44	2,619	7,081	6,025	6,626	22,351
45–49	2,524	7,339	6,236	6,418	22,517
50–54	2,366	6,159	5,600	6,152	20,277
55–59	1,966	5,414	4,905	5,512	17,797
60–64	1,938	4,511	3,182	3,523	13,154
65–69	1,994	3,752	2,215	2,269	10,230
70–74	1,912	3,160	1,569	1,683	8,324
75–79	2,006	2,824	1,403	1,417	7,650
80–84	1,533	1,905	980	899	5,317
85+	1,367	1,395	570	658	3,990
25+	27,864	60,896	49,369	53,725	191,854

<sup>a</sup>Values given in 1000s  
CPS, Current Population Survey

The model uses estimates of SES differentials in mortality from the National Longitudinal Mortality Study (NLMS) and also relies on published estimates of SES differentials in health as measured by a multi-attribute health-related quality of life (HRQL) index. The primary measure of advantage/disadvantage is educational attainment, which is strongly related to economic status, closely associated with health and mortality, and the causal effect of which has been widely studied.<sup>5</sup> The quality-adjusted life year (QALY) is the unit of measurement and its value is taken from existing literature. The resultant simulation model estimates the potential benefits of improving the health of low-SES groups in the U.S.

### Estimating the Value of Longer Life

Estimates are derived for 2006, the most recent year mortality data were available from the National Center for Health Statistics at the time of the original analysis (2007). The procedure consists of five major steps. First, age-specific mortality rates by education for four education groups: less than a high school education, high school education, some college but less than a bachelor's degree, and bachelor's degree or higher, were calculated for 5-year age groups (25–29, 30–34, and so on, up through  $\geq 85$  years) using the NLMS.

The most recent NLMS data to construct estimates by socioeconomic group covered the 1988–1998 period. Because mortality has declined since 1998, the estimated mortality rates from the NLMS were adjusted downward. Specifically, the change in mortality between 1993 (the midpoint of the 1988–1998 NLMS estimates) and 2006 were calculated for each of the age groups. The estimated age-specific percentage decline in mortality between 1993 and 2006 was assumed to apply to each of the education groups equally (SES-specific mortality data after 1998 are not currently available). Because the NLMS calculations for the two periods 1979–1989 and

1988–1998 revealed somewhat larger declines in mortality for the more advantaged groups, assuming identical declines across education groups from 1993 to 2006 is likely conservative, understating the value of raising health for all American adults to the level experienced by the college educated.

The baseline survey of the NLMS does not include the institutionalized population, a substantial limitation. As a result, the number of deaths and the death rates estimated in the NLMS are low. For 2006, the National Center for Health Statistics (NCHS) vital statistics reports 39% more deaths than the simulated number of deaths based on the NLMS. To account for this fact, the NLMS death rates were scaled up by an age-specific factor, with that factor derived so as to equate the predicted number of deaths to the actual number of deaths reported by NCHS in 2006. The death rates for all education groups were scaled up by the same factor within 10-year age groups. Because disadvantaged populations are more likely to be in institutions (primarily correctional facilities and nursing homes), this assumption is conservative. The true death rates among the disadvantaged populations are likely to be higher than estimated.

The second step in the calculation, to estimate the 2006 U.S. population by age and educational attainment, was based on the 2006 March Current Population Survey (CPS), the best source of information on educational attainment of Americans. Like the NLMS, the CPS does not include the institutionalized population; thus it understates the number of disadvantaged people in the U.S. who would benefit from increased health.

Third, the mortality rates generated in Step 1 were multiplied by the population totals generated in Step 2 to estimate the number of deaths in 2006 by 5-year age group for each of the educational groups. Tables 1 and 2 report the population estimates, by age and education group, along with the estimated number of deaths.

**Table 2.** Predicted number of deaths for people aged  $\geq 25$  years, NLMS 2006

<High school	High school	Some college	College degree	Total
5,094	7,150	4,439	3,073	19,757
5,148	8,585	5,352	4,110	23,195
6,483	11,202	8,044	6,269	31,998
10,909	18,068	11,650	10,417	51,045
14,424	31,922	22,345	13,741	82,431
20,926	36,659	23,080	21,934	102,600
24,491	42,072	35,377	28,832	130,772
32,642	54,137	36,387	27,462	150,629
46,728	64,837	34,584	30,133	176,281
63,582	79,469	34,482	36,279	213,812
103,375	111,539	54,933	53,828	323,675
114,310	119,960	59,012	50,382	343,663
256,715	240,027	92,512	112,738	701,992
704,827	825,627	422,196	399,200	2,351,850

NLMS, National Longitudinal Mortality Study

**Table 3.** Predicted number of deaths if less-educated people experienced mortality of people with college degree

<High school	High school	Some college
1,469	3,100	3,179
1,627	3,736	3,586
2,315	5,614	5,059
4,117	11,132	9,472
5,404	15,713	13,351
8,436	21,959	19,966
10,284	28,320	25,657
15,107	35,164	24,804
26,481	49,828	29,416
41,215	68,117	33,821
76,203	107,277	53,296
85,912	106,760	54,921
234,215	239,012	97,661
512,784	695,731	374,191

In the fourth step, the number of life years that would be gained if people with less than a college degree experienced the lower mortality rates of those with at least a college degree were simulated. The number of deaths by age for mortality rates at current education levels were projected and then compared to the number of deaths simulated using the mortality rates experienced by people with a college degree. Table 3 reports these estimates. Because those individuals whose lives would be saved in 2006 would be expected, on average, to live many more years beyond 2006, age-specific life expectancies were calculated. Specifically, life expectancies at age  $\geq 25$  years for gender and education groups were calculated by 5-year age groups based on abridged life tables. These were constructed using mortality rates estimated using the NLMS analyses previously described. The total number of life years saved equals the number of lives saved in 2006, multiplied by remaining life expectancy, for each age and education group.

The final step estimated the average health state in which the additional life years gained would be lived and ascribed a monetary value to those quality-adjusted life years (QALYs). Nyman and colleagues<sup>6</sup> estimated the HRQL for various U.S. population subgroups from data collected in the national Medical Expenditure Panel Survey (MEPS), and their estimates were applied in this simulation. MEPS collected health-related quality of life information using the EuroQoL 5D (EQ-5D), a multi-attribute index with five dimensions: mobility, self-care, usual activities, pain/discomfort, and anxiety/depression ([www.euroqol.org](http://www.euroqol.org)). The index assigns weights to different health states on a scale of 0 to 1, where 0 represents the state of being dead and 1 the state of optimal health. The EQ-5D has been valued for the U.S. general, non-institutionalized population, and is widely used internationally in estimating population HRQL.<sup>7</sup>

Nyman et al.'s estimates were used to calculate the health-related quality of life for individuals with at least a college degree. For example, the average HRQL index value for a person aged 25–34

years with at least a bachelor's degree is 0.94 on the 0-to-1 scale.<sup>6</sup> Age- and education-specific valuations were based on their Table 4, Column 4 (evaluating all other control variables at their means). The scale calculated from this model was multiplied by a \$100,000 valuation for each life year in optimal health to estimate the HRQL-adjusted monetary value of a life year at a given age for people with at least a bachelor's degree. The benchmark was \$100,000 because it is a common, arguably conservative, value of a healthy life year<sup>8</sup> (see Table 4).

Note that the Nyman study's education categories were collapsed in order to map them into three categories available in the March CPS and the NLMS.<sup>6</sup> Specifically, GED, high school degree, and "other degree" categories are collapsed into "high school or some college," and bachelor's degree and graduate degree are collapsed into "at least a bachelor's degree." Individuals with less than a high school education remain a single group.

To express future amounts in present-value terms, a discount of 3% is used, consistent with the recommendation of the U.S. Panel on Cost-Effectiveness in Health and Medicine<sup>11</sup> and the U.S. Office of Management and Budget guidelines for economic evaluations.<sup>12</sup>

### Estimating the Value of Improved Health Status

In addition to mortality differences, the less-educated groups also suffer from worse health than more highly educated groups every year before they die. Estimates of the value of foregone benefits arising from the poorer health status among disadvantaged populations were again based on estimates of HRQL for various education groups as described above.<sup>6</sup> On average, HRQL for individuals with at least a bachelor's degree differs from that of individuals with less than a high school education by 0.062 points on the 0 to 1 EQ-5D scale; the gap between individuals with at least a bachelor's degree and individuals with a high school education or some college (but not a bachelor's degree) is 0.032. Again, assuming that a year lived in optimal health is valued at \$100,000, the discrepant QALY weights imply health differences valued at \$6200 and \$3200, respectively, per year per person.

These monetary differentials are then multiplied by the number of adults aged  $\geq 25$  years with less than a high school education (27,864,000 in Table 1) and the number with a high school education or some college (60,896,000 plus 49,369,000 in Table 1), respectively, and then added together.

**Table 4.** Sensitivity analysis: alternative values of a QALY

**Varying the Value of a QALY.** Assessing sensitivity to the \$100,000/QALY assumption is straightforward. Using a lower measure of \$50,000/QALY (commonly used dating back to the early 1980s, when nominal prices were half of today's level) would cut the current dollar estimates in half. Using a higher measure such as \$200,000/QALY would double the estimates. Evidence suggests that even \$200,000 may be conservative. A literature review by Hirth and colleagues<sup>9</sup> finds a median estimate of \$265,000 per QALY in 1997 dollars using willingness-to-pay methods. Furthermore, arguably, QALY estimates should be adjusted for inflation, implying an even higher threshold when expressed in today's dollars.<sup>10</sup>

QALY, quality-adjusted life-year

**Table 5.** Foregone benefits associated with health disparities by education, 2006

Education group	Mortality effect (\$)	Morbidity/health status effect (\$)	Total (\$)
<High school	221 billion	173 billion	393 billion
High school and some college	272 billion	354 billion	627 billion
Total	493 billion	527 billion	1,020 billion

## Results

The model estimates imply substantial foregone benefits associated with disparities in both mortality and HRQL between less-educated American adults and those with at least a college education. First, bringing the mortality rates of people with less than a high school education in line with the lower prevalence of individuals with at least a bachelor's degree would lead to benefits in 2006 of \$221 billion. The benefits that would accrue to improving the mortality of people with a high school or some college amount to \$272 billion. Summing the gain from mortality reduction across all groups with less than a bachelor's degree amounts to \$493 billion per year (Table 5). Second, bringing the HRQL or health status of all adults with less than a bachelor's degree up to that of those who have at least a bachelor's degree would create gross benefits of \$527 billion. Adding this value to the foregone benefits due to the mortality effect (\$493 billion) leads to an estimated annual foregone benefit of \$1.02 trillion.

## Discussion

This simulation model suggests that, expressed in monetary terms, the foregone benefits associated with the worse health of less-educated populations are quite large. Specifically, the annual economic value that would accrue to disadvantaged (less-educated) Americans if their health and longevity improved to that of college-educated Americans is \$1.02 trillion.

Despite the challenges inherent in calculating foregone benefits, other studies using different assumptions and analyzing different populations and dimensions of SES also estimate large economic impacts.<sup>13–15</sup> Mackenbach et al.<sup>16</sup> concluded that, in the European Union (EU), education-based health disparities resulted in very large foregone economic benefits. Specifically, they estimated that foregone benefits associated with differences in mortality and health status between the top and bottom halves of the education distribution totaled roughly €1 trillion per year, or 9.5% of the EU GDP. The analogous calculation for the U.S., using this study's estimate of foregone benefits, is 7.7% of GDP (which was \$13.195 trillion in

2006). While the approach in this study and the approach in the EU study are not strictly comparable, both estimates imply that the economic impact of educational disparities is very large.

Lost earnings represent a key component of foregone benefits. Some additional years of life would have been spent working and earning income. In addition, healthier people are likely to have higher earnings. The value of lost earnings is, theoretically, subsumed in the \$100,000/QALY figure, although this study did not directly estimate the lost earnings and reduction in GDP, and controversy persists as to whether or not lost earnings are captured in the QALY valuation.<sup>17</sup> The EU study, however, did attempt to quantify lost earnings (which the authors term “capital goods,” in contrast to “consumption goods,” analogous to this study's estimate of foregone benefits), and its estimates imply lost earnings that are 1.35% of EU GDP. The ratio of lost earnings (“capital goods”) to foregone benefits (“consumption goods”) in the EU study is 1 to 7. Applying the EU ratio to the estimate of foregone benefits in this study suggests that lost earnings from education-based health disparities in the U.S. would be roughly \$146 billion annually (i.e., \$1.02 trillion/7).

Another recent study examined the economic burden associated with racial and ethnic health disparities in the U.S.<sup>18</sup> While the approach here is quite different, the authors of the study examining racial and ethnic disparities estimate a very large economic burden (\$1.24 trillion over 3 years, 2003–2006), stemming from the worse health and mortality for African Americans, Hispanics, and Asians, compared with that of non-Hispanic whites.

To be clear, these estimates do not capture the causal effects of education on health. Instead, they estimate the foregone benefits if indeed the less-educated individuals experienced the same health and mortality as the college graduates.

For several reasons, the estimate of potential foregone benefits among American adults of lesser education is most likely a lower bound on the foregone benefits to society as a whole due to SES-related health status disparities. First, the estimates do not reflect the broader economic benefits to families and society of reducing health disparities; they represent only the value of worse health and shorter lives for the individuals directly affected. Second, the estimated gaps in health across education groups rely on models that control for income, marital status, and race/ethnicity.<sup>6</sup> Simple age-adjusted gaps in health across education groups, which would be preferable, are likely to be larger. Third, the estimates do not include disparities in health status among people aged <25 years, a group that was excluded because many have not completed their education.

Fourth, the estimates presume that the mortality disparities by education among the institutionalized population are similar to those among the non-institutionalized population. By scaling up the NLMS-based mortality estimates so that the predicted number of deaths equaled the number of deaths (institutionalized plus non-institutionalized) as estimated by NCHS using vital statistics, the mortality estimates attempted to account for this limitation of the NLMS data. However, the value of health status differentials among those alive is based on population estimates from the CPS, which does not include the institutionalized population. Finally, the exercise does not incorporate intergenerational effects such as the poorer health experienced by children of less-educated mothers.<sup>1</sup>

It is important to recognize that QALYs imperfectly capture the value of health. Health-related quality of life is difficult to measure and even harder to value. Furthermore, the theoretic basis for using QALYs is not well developed except under strong assumptions.<sup>11,19</sup> Despite these concerns, the QALY metric has been found to be a useful tool both for health services and public health policy and research, and in making decisions about regulating risks to human health and safety.<sup>20</sup>

There are also counterbalancing factors that may tend toward overestimation of benefits that would accrue from raising the health status of less-than-college-educated Americans to that of college graduates. Some portion of education gradients may capture effects due to omitted factors other than education, or reverse causation; for example, some less-educated individuals likely have obtained less education due to congenital health problems unrelated even to mother's SES. However, a vast literature has consistently found education effects on health to be robust after controlling for a wide range of confounders.<sup>5</sup> Furthermore, analyses such as instrumental variables estimates in Lleras-Muney<sup>21</sup> have found cross-sectional comparisons to **underestimate** the education effects found in more plausibly causal models.

Thus substantial evidence supports the validity of using cross-sectional educational differences in health and mortality, such as the estimates from Nyman et al.<sup>6</sup> With that said, the gaps in health and mortality that are reported here should not be interpreted as representing causal effects on health and mortality of raising education. At the same time, the estimates highlight the substantial value of the healthier and longer life that socioeconomically disadvantaged Americans are missing, compared to their better-off counterparts.

Finally, the estimates do not include the costs of policies and programs to raise educational attainment or otherwise eliminate the health disparities seen between less- and more-educated Americans. Related work does compare health benefits to educational costs.<sup>14,19,22</sup> A full

accounting of costs and benefits of any treatments, programs, or policies designed to improve the situation of disadvantaged populations should be conducted to determine their cost effectiveness.

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This work was supported by the Robert Wood Johnson Foundation through a grant to the UCSF Center on Social Disparities in Health.

No financial disclosures were reported by the authors of this paper.

Publication of this article was supported by the Robert Wood Johnson Foundation and the Department of Health Policy, George Washington University School of Public Health and Health Services, as part of a supplement to the American Journal of Preventive Medicine (Am J Prev Med 2011;40[1S1]).

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