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Differences In Life Expectancy Due To Race And Educational Differences Are Widening, And Many May Not Catch Up

ABSTRACT It has long been known that despite well-documented improvements in longevity for most Americans, alarming disparities persist among racial groups and between the well-educated and those with less education. In this article we update estimates of the impact of race and education on past and present life expectancy, examine trends in disparities from 1990 through 2008, and place observed disparities in the context of a rapidly aging society that is emerging at a time of optimism about the next revolution in longevity. We found that in 2008 US adult men and women with fewer than twelve years of education had life expectancies not much better than those of all adults in the 1950s and 1960s. When race and education are combined, the disparity is even more striking. In 2008 white US men and women with 16 years or more of schooling had life expectancies far greater than black Americans with fewer than 12 years of education—14.2 years more for white men than black men, and 10.3 years more for white women than black women. These gaps have widened over time and have led to at least two “Americas,” if not multiple others, in terms of life expectancy, demarcated by level of education and racial-group membership. The message for policy makers is clear: implement educational enhancements at young, middle, and older ages for people of all races, to reduce the large gap in health and longevity that persists today.

Overall, the populations of the United States and other developed nations have enjoyed more than a century of rarely interrupted rising life expectancy and notable improvements in quality of life. Striking among these transitions in health and longevity were the rapid declines in mortality at early ages observed at the beginning of the twentieth century, reductions in mortality from heart disease during the last third of that century, and declining mortality in old age in recent decades.¹

There is reason to be optimistic about the fu-

ture of health and longevity in the United States^{2,3} and the positive impact that increased longevity could have on national and global economies.^{4,5} Advances in medicine and biomedical technology, including an understanding of the genetics of exceptional longevity, are occurring at an accelerated pace;⁶ genetic engineering could cure or control some inherited diseases; the prevalence of smoking has declined;⁷ recent efforts to attack childhood and adult obesity are encouraging;^{8,9} new approaches to reducing health disparities have been proposed;¹⁰ and scientists may be on the

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verge of finding a way to slow biological aging.¹¹⁻¹³

All this is not to say that worrisome trends in health have not already emerged—such as the rise of childhood obesity, diabetes, and their complications—that could counteract these promising developments. Although living longer than currently expected could also pose financial challenges to national age entitlement programs such as Social Security and Medicare, the extension of healthy productive life would transform these challenges into opportunities.¹⁴ For example, people who reach older ages with their health intact will require fewer resources from Medicare, and some may choose to work longer—lessening the impact of a shifting age structure on the Social Security Trust Fund.

As bright as the future looks in this general context, beneath the surface of national vital statistics is an alarming persistent divide among subgroups within the United States.¹⁵ These disparities persist even when some major causes of differential survival among the subgroups are eliminated.^{10,16,17} Health disparities—a well-documented part of US society—reflect racial and ethnic differences as well as differences in education and income that are linked directly and indirectly to behavioral risk factors.¹⁸⁻²²

Indeed, it has been proposed that social conditions can be “fundamental causes”^{10(p72)} of health inequalities, which is why interventions based exclusively on modifying biomedical risk factors have not been, and are not likely to be, successful in substantially reducing health disparities. The fact that such disparities still persist, during a period of heightened optimism about the future of medicine and biomedical technology and the increase in longevity and population aging already under way,³ has led the MacArthur Foundation Research Network on an Aging Society to examine this issue in greater depth. If a productive and equitable aging society is going to emerge in America in this century, we must understand and then eliminate—or at least reduce—the health and longevity barriers that divide the subgroups among us.

Education is an important variable known to influence health inequalities, and it is also a principal component of socioeconomic status. Educational attainment is only one of several indicator variables used to measure socioeconomic status, all of which can influence health and longevity.²³ However, it has the unusual advantage of appearing on death certificates, thus permitting the links between life expectancy and education, along with its related socioeconomic status correlates, to be quantified. Hereinafter, when we refer to links between education and longevity disparities, we include

various other socioeconomic variables—such as income, occupation, and access to health care—that are linked to education either directly or indirectly.

In this article we update estimates of the impact of race and education on past and present life expectancy, examine trends in disparities from 1990 through 2008, and place observed disparities in the context of a rapidly aging society that is emerging at a time of optimism about the next revolution in longevity. Disparities by age, race, sex, and education in the United States and the demographic measure of life expectancy (a generic measure of health status that can be compared among population subgroups) are the metrics we used to examine these issues.

Study Data And Methods

We drew the number of deaths in the United States in 2008 from the Multiple Cause of Death public use data file.²⁴ Deaths were stratified by age, race, sex, and level of completed education at age twenty-five. Race was categorized as non-Hispanic white, non-Hispanic black, Hispanic, American Indian, and Asian and Pacific Islanders. Disparities between non-Hispanic white, non-Hispanic black, and Hispanics are compared in this article; results for the other two racial subgroups are not presented because of small sample sizes.

Population counts were obtained from the Vintage 2009 bridged-race estimates for residents of the United States published by the National Center for Health Statistics in collaboration with the Census Bureau.²⁵ These data provide estimates of the population by age, race, and sex as of July 1, 2008. We used the 2008 American Community Survey Public Use Microdata Sample File²⁶ to further stratify the midyear population size by educational attainment.

The American Community Survey, which replaced the decennial census long form, is the largest national household survey in the United States. In 2008 the survey sampled about 1 percent—or approximately 1.3 million records—of the households in the nation and provided detailed demographic and socioeconomic information about them, including people's age, sex, race, and education.

The accuracy of high school graduation rates provided in the past by the Census Bureau's Current Population Survey has been questioned.²⁷ James Heckman and Paul LaFontaine²⁸ suggested that the published rates were too high and that the gap in educational attainment between minority and majority groups had been systematically underestimated. These scholars recommended changes in the way the survey

counts people who earn general equivalency degree certificates as well as prison, military, and immigrant populations. By using the American Community Survey instead of the Current Population Survey as the data source of our analysis, we addressed concerns regarding the capacity of the surveys to count all relevant people, especially those in racial and ethnic minority groups.

We recoded the twenty-four categories of the educational attainment variable in the American Community Survey into four distinct categories. The original categories for all grades up to the eleventh were recoded as less than or equal to 11 years; the categories of “grade 12 no diploma,” “regular high school diploma,” and “general equivalency degree or equivalent” were recoded as 12 years; categories for associate degree and some college but no degree were recoded as 13–15 years; and categories for bachelor’s degree and above were recoded as 16 years or more.

For each group of people ages 25–84 and categorized according to age, race, sex, and education, we calculated age-specific death rates by dividing observed deaths from the National Center for Health Statistics by the midyear population from the Census Bureau. All levels of education cannot be observed among younger people—for example, fifteen-year-olds cannot have sixteen or more years of education—and in the data used to estimate educational attainment distribution among the midyear population, individual age was top-coded. In other words, any age above eighty-five years was recorded as eighty-five. Therefore, we calculated death rates for people younger than twenty-five and older than eighty-four only by age, race, and sex.

For people ages 85–110, following the convention of the National Vital Statistics Reports for dealing with the well-known problem of age inaccuracy at the oldest ages,²⁹ we estimated death rates using age- and sex-specific conditional probability of death values derived from Medicare data and published by the Social Security Administration’s Office of the Chief Actuary.^{30,31} We selected ages 85–95 as a representative range for estimating a regression equation for conditional probability of death, and we then constrained the intercept to equal the conditional probability of death values by age, race, or sex observed at age eighty-four. In other words, race was incorporated by parallel displacements of the regression line. We used this equation to extrapolate death rates estimated from the conditional probability of death for ages 85–110.

Standard complete life tables were used to estimate life expectancy for a given period by age for each group categorized by race, sex, and education.

Study Results

Regardless of their level of completed education, we found that women in the United States lived longer than men at every age, a result that is consistent with previous research findings.³² White males and females outlived black males and females, respectively, at every age and level of education—with the exception of age sixty, where black females have a slight longevity advantage over white females.

Hispanics appear to have the highest reported life expectancy at birth among the three racial or ethnic categories. However, caution is required when evaluating Hispanic mortality in the United States because of known variation in death rates based on national origin, age, and cause of death. The mortality of immigrant Hispanics is about 10–20 percent lower overall than that of US-born Hispanics, and the proportion of all Hispanics who are US-born (with higher mortality risks) is rising rapidly relative to the immigrant Hispanic population. Some Hispanics return to their country of origin to die; and the people who emigrate from most countries in Latin America tend to be healthier and more highly educated than the population from which they originated, a concept referred to as health selection.^{33,34}

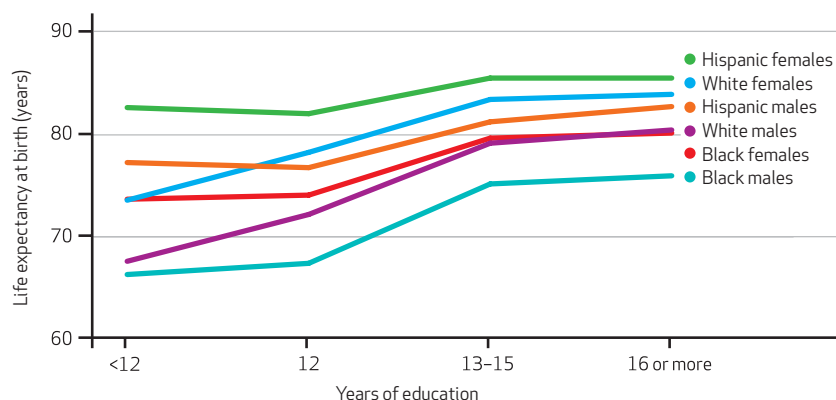
The largest disparity in life expectancy at birth in the United States among the subgroups for which there are reliable data involve differences between the highest educated whites, those with sixteen or more years of education by age twenty-five, and the lowest educated blacks, those with fewer than twelve years of education by the same age (Exhibit 1). The observed disparities in life expectancy at birth between these subgroups in 2008 were 14.2 years for males and 10.3 years for females. And educational disparities have been shown to be even larger when comparing the least educated population with those who have postgraduate degrees.³⁵

Education and its socioeconomic status correlates of income and wealth have powerful associations with duration of life for both sexes and all races, at all ages. Within racial and ethnic groups, the difference in life expectancy at birth between those with the most and those with the least education in 2008 was 10.4 years for white females, 6.5 years for black females, 2.9 years for Hispanic females, 12.9 years for white males, 9.7 years for black males, and 5.5 years for Hispanic males. These differences can be seen in the exhibits in the online Appendix; additional Appendix exhibits also show life expectancy at different ages by years of education, sex, and race.³⁶

The differences in life expectancy gradients within racial groups demonstrate that education and its socioeconomic status correlates are

EXHIBIT 1

Life Expectancy at Birth, By Years Of Education At Age 25, By Race And Sex, 2008



SOURCE Authors' analysis of data from the National Vital Statistics System and the Census Bureau (Notes 24–26 in text).

associated with lifelong health and survival outcomes that transcend the independent effects of race—a finding that is consistent with a large body of scientific literature dating back more than eighty years.¹⁰ Nevertheless, racial-group membership still partially moderates the role that education and socioeconomic status play in influencing disparities.

Trends in life expectancy at birth from 1990 to 2008 within the four educational categories indicate that among the six subgroups, only Hispanic females did not experience rising longevity among those with a high school education or higher, as seen in the Appendix exhibits.³⁶ For those with less than a high school education, white males and white females experienced a consistent pattern of decreasing longevity, while blacks and Hispanics of both sexes exhibited increasing longevity (Exhibit 2 shows the data for white females).

As a result, in 1990 the disparities between life expectancy at birth between the most and the least educated were 13.4 years for males and 7.7 years for females, compared to the 14.2 years for males and 10.3 years for females in 2008 noted above—revealing that during this eighteen-year time period the disparities increased. Trends in life expectancy for the subgroups at higher ages are listed in the Appendix.³⁶

Discussion

Americans experienced a fairly steady rise in life expectancy at birth over the last half-century. However, this fact is tempered by the persisting disparities in health and longevity among racial and ethnic subgroups of the population, despite efforts to reduce behavioral risk factors for members of the groups. The disparities appear to be

related to educational attainment and its socioeconomic correlates of income and wealth.

Differences in longevity between subgroups of the US population are so pernicious and systemic that it is now reasonable to conclude that at least two Americas have formed, with notably different longevity prospects.³⁷ The two are demarcated by level of education and its socioeconomic status correlates, and related to race or ethnicity. A similar concept of “eight Americas” was first proposed by Christopher Murray, Sandeep Kulkarni, and Majid Ezzati,³⁸ based on county-level data on health and longevity in the United States.

Current disparities in life expectancy by race, sex, and education are complicated by the fact that the attributes of people that influence their health and longevity do not operate in isolation from each other. Consider the complex ways in which education and socioeconomic status influence variation in life expectancy among people grouped by race and sex.

We found that on average, blacks and Hispanics with sixteen or more years of education lived 7.5 years and 13.6 years longer, respectively, than whites with less than twelve years of education. This is a clear demonstration of the profound influence that education and its correlates have on length of life. Yet disparities within racial and ethnic groups persist even at the highest level of education. The same highly educated black men and women who live longer than less educated whites still live about 4.2 years less than comparably educated whites and 6.1 years less than comparably educated Hispanics, as shown in the Appendix exhibits.³⁶

This relationship holds true at all ages from twenty through eighty (see the Appendix).³⁶ Thus, it is clear that the higher infant and accidental mortality rates among blacks, compared to whites and Hispanics, do not fully account for the observed differentials. Evidence suggests that blacks are somewhat more likely to be in better health than whites at older ages because blacks have a higher mortality rate at younger ages, leaving behind a heartier group of survivors.³⁹ But something other than differences in education and early life risks for blacks is continuing to cause these survival disparities. One possible mechanism is the documented accumulated lifelong stress associated with disadvantage and the accelerated attributes of biological aging that accompany it, such as genetic damage that occurs at a more rapid pace for disadvantaged populations.^{40,41}

Within the subgroups of blacks and Hispanics, having less than twelve years of education has only a marginal impact on life expectancy, and the benefit diminishes among cohorts alive at

older ages in 2008. This could be a result of being born earlier rather than later, for blacks (that is, cohort effects), and of belonging to the first generation of Hispanic immigrants, who tend to be healthier than subsequent US-born generations of Hispanics.

Recent evidence indicates that second- and third-generation Hispanics at all ages have higher mortality rates than the members of their parents' and grandparents' generations. This suggests that as Hispanics become a larger proportion of the total US population, their current longevity advantage may diminish rapidly.³⁴

In contrast, having fewer than twelve years of education has a dramatic negative effect on life expectancy among whites from all birth cohorts in the twentieth century. In fact, over time the negative associations of low educational status has grown notably worse for whites, as shown in the Appendix.³⁶

For all racial and ethnic groups, having an additional four years of education beyond high school yields a pronounced longevity advantage. Having a postgraduate degree produces an even greater advantage.³⁵

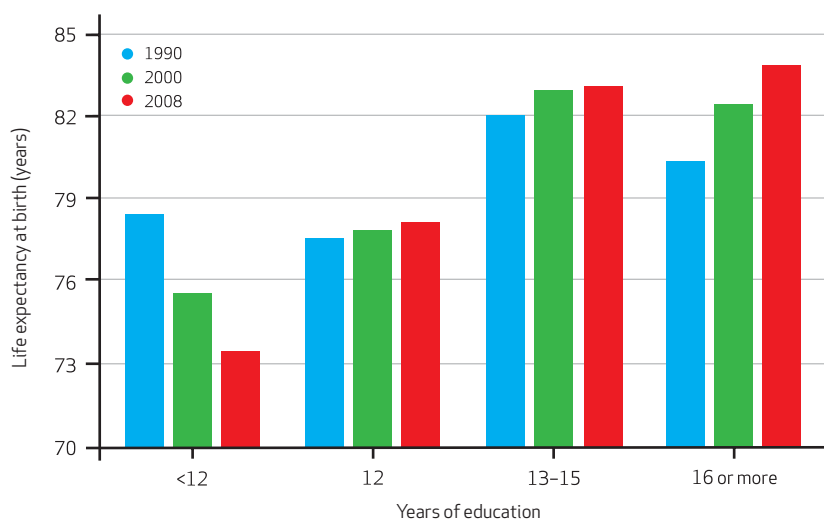
Historical statistics provide some perspective on the magnitude of the disparity in longevity by race and level of education. The current life expectancy at birth for US blacks with fewer than twelve years of education is equivalent to the life expectancy observed in the 1960s and 1970s for all people in the United States,⁴² but blacks' longevity has been improving with time. White males with fewer than twelve years of education currently have a life expectancy at birth equivalent to that of all men in the United States born in 1972, while white females with similar education have the life expectancy of all women in the country born in 1964.⁴² And the longevity of these white males and females is growing worse over time.

The distribution of education by race and sex in the United States in 2008 indicates that at ages twenty-five and older, about 8 percent of whites, 16 percent of blacks, and 36 percent of Hispanics had less than a high school education. Blacks and whites in this educational category were living with unacceptably high mortality risks that were up to a half-century behind their better-educated counterparts. About 31 percent of whites, 18 percent of blacks, and 13 percent of Hispanics currently enjoy the health and longevity benefits of having sixteen or more years of education and the benefits of the socioeconomic status that accompanies that level of education (Exhibits 3 and 4).

There has been controversy about whether education alone has a direct influence on longevity, in addition to its indirect effect through giving

EXHIBIT 2

Life Expectancy At Birth, By Years Of Education At Age 25 For White Females, 1990–2008



SOURCE Authors' analysis of data from the National Vital Statistics System and the Census Bureau (Notes 24–26 in text).

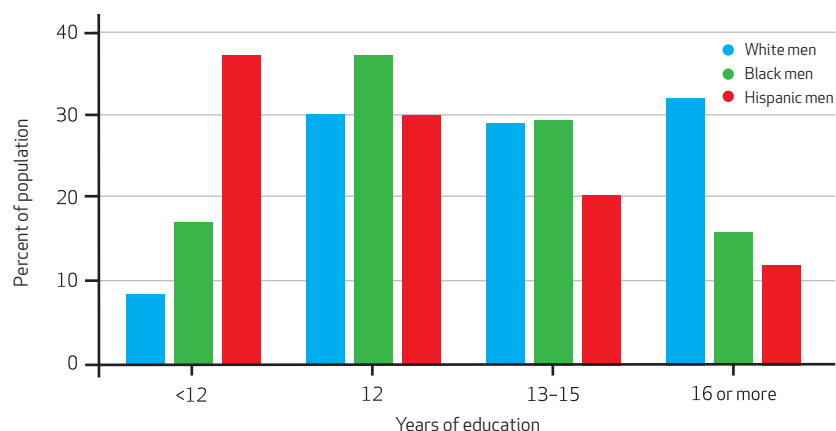
access to better jobs and higher incomes. The current evidence suggests that education may have direct influences on both health and duration of life.^{15,43–45} That is, health disparities by education and other related socioeconomic status indicators persist even after major proximal risk factors for health and longevity—such as age and sex—are controlled for.

Trends in life expectancy at birth by race and sex in the United States (independent of education) indicate that the differential between blacks and whites declined by 1.9 years for females and 2.7 years for males from 1990 to 2008⁴⁶—in large part because of more rapid increases in life expectancy for blacks relative to whites.^{47,48} The life expectancy advantage of Hispanics relative to whites rose during this time by 0.5 years for females and 1.5 years for males.

Although larger and more rapid reductions in death rates are feasible when death rates are high, it is unclear whether the trend toward a declining disparity between blacks and whites will continue. Blacks experienced more rapid reductions in death rates from circulatory diseases (and other causes) relative to whites since 1990, and the proportion of blacks at high levels of education has risen at the same time.⁴⁹ If education and its related risk factor benefits remain powerful factors in declining mortality in the United States,⁵⁰ and the education gap between blacks and whites continues to narrow, disparities in longevity by race could continue to decline. In fact, the Census Bureau has predicted a convergence in life expectancy between whites

EXHIBIT 3

US Male Population, By Race And Years Of Education At Age 25, 2008



SOURCE Authors' analysis of data from the National Vital Statistics System and the Census Bureau (Notes 24–26 in text).

and blacks.⁵¹

The favorable life expectancy advantage of Hispanics over whites that now exists is expected to disappear as second- and third-generation Hispanic immigrants begin to move through the age structure. These younger immigrants have higher age-specific death rates than first generation immigrants.^{33,34}

The relationship between education and longevity is complicated by race-specific variations in disease prevalence and related behavioral risk factors. For example, relative to a few decades ago, today a college education and its accompanying benefits have more powerful beneficial effects on longevity. But perhaps more important, the absence of a college or postgraduate

education now has a much greater negative association with longevity for whites than in the past.⁵⁰

In other words, along the educational and socioeconomic status gradient, those at the top are gaining modest amounts of longevity, but whites at the bottom are losing ground at a faster pace—that is, they are either experiencing a decline in life expectancy or a slower rate of increase relative to those at the top. This trend toward widening educational disparities in life expectancy that are unfavorable for whites at the lowest level of education, now well documented in the literature,⁴⁸ is masked when comparisons of longevity are made independent of education.

The trend toward declining disparities in longevity by race or ethnic group could stop or reverse itself, even independent of changes in the groups' levels of education, in certain circumstances. For example, racial and ethnic minorities might become a larger share of those at the lower end of the educational gradient (Exhibit 4). They might acquire harmful behavioral risk factors, such as obesity, more rapidly than whites.⁵² And anticipated life-extending advances, such as those involved with decelerated aging, might initially be available to more highly educated whites with greater financial resources, but not to racial and ethnic minorities—especially those subgroups expected to grow rapidly in the coming decades, including second- and third-generation Hispanic immigrants.

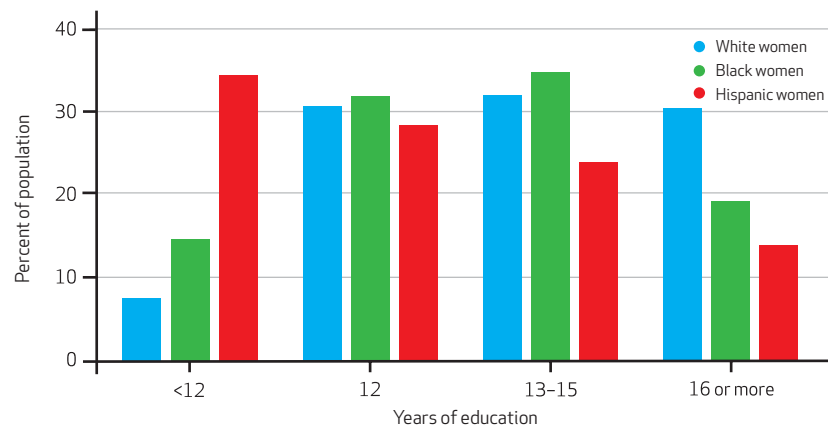
The lifelong relationships of education and its correlates with health and longevity are striking, and there is reason to believe that these socioeconomic status variables collectively may be “fundamental causes” of these disparities.^{10(p72)} Education exerts its direct beneficial effects on health through the adoption of healthier lifestyles, better ability to cope with stress, and more effective management of chronic diseases.⁵³

However, the indirect effects of education through access to more privileged social position, better-paying jobs, and higher income are also profound.⁵⁴ The absence of education and its related socioeconomic status benefits exert their direct harmful effects throughout the relatively shorter lives of those in less fortunate social positions (especially whites). This is one important reason why efforts to modify behavioral risk factors alone are not likely to have a major impact on disparities in longevity.

If new progress is made in health and longevity between now and midcentury, as many researchers anticipate,^{3,11,12} the health and longevity gap between the two Americas could grow larger. Improving the health profiles and life expectancy of people with low levels of education is particularly difficult for those who have already

EXHIBIT 4

US Female Population, By Race And Years Of Education At Age 25, 2008



SOURCE Authors' analysis of data from the National Vital Statistics System and the Census Bureau (Notes 24–26 in text).

passed the phase in life when formal education normally occurs. Thus, implementing public policies that encourage life-long learning—for people of all races and all ages—is one recommendation that follows from this work. Such policies

could be a bridge to the present for those whose prospects for health and longevity are no better than those of Americans living in the 1960s and 1970s. ■

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of the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis. The authors thank anonymous reviewers for suggested editorial changes to an earlier version of this article.

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In this month's *Health Affairs*, Jay Olshansky and coauthors update the evidence on the impact of race and education on past and present life expectancy in the United States. They report that in 2008 US adult men and women with fewer than twelve years of education had life expectancies not much better than those of all US adults in the 1950s and 1960s, and that racial differences made the disparities even greater. The authors say these widening gaps in life expectancy translate into a clear and urgent message for policy makers: act to reduce the large gap in health and longevity by introducing educational enhancements aimed at all ages and races.

Olshansky is a professor at the School of Public Health, University of Illinois at Chicago, and a research associate at both the Center on Ageing at the University of Chicago and the London School of Hygiene and Tropical Medicine. The focus of his research has been estimates of the upper limits to human longevity; the health and public policy implications associated with individual and population aging; forecasts of the size, survival, and age structure of the population; and the pursuit of scientific means to retard aging in people. He earned a doctorate in sociology from the University of Chicago.



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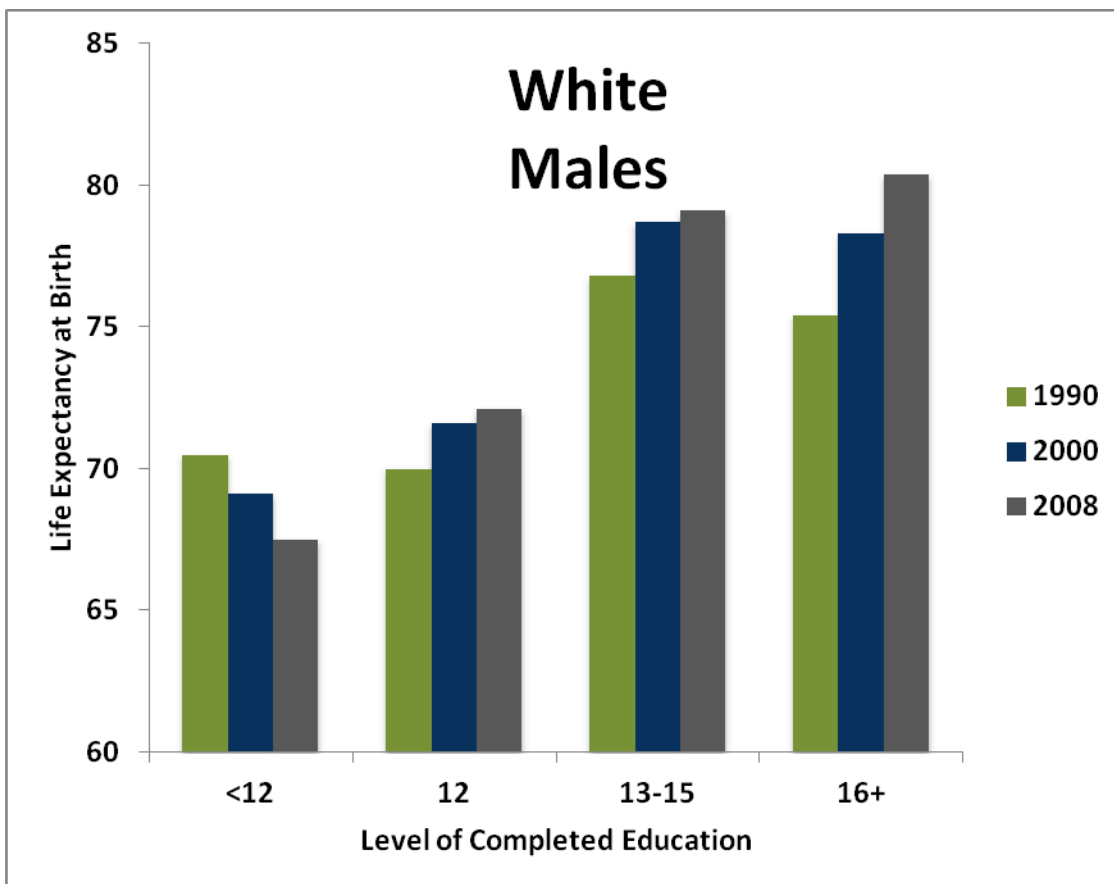


John Rowe is a professor at Columbia University's Mailman School of Public Health.

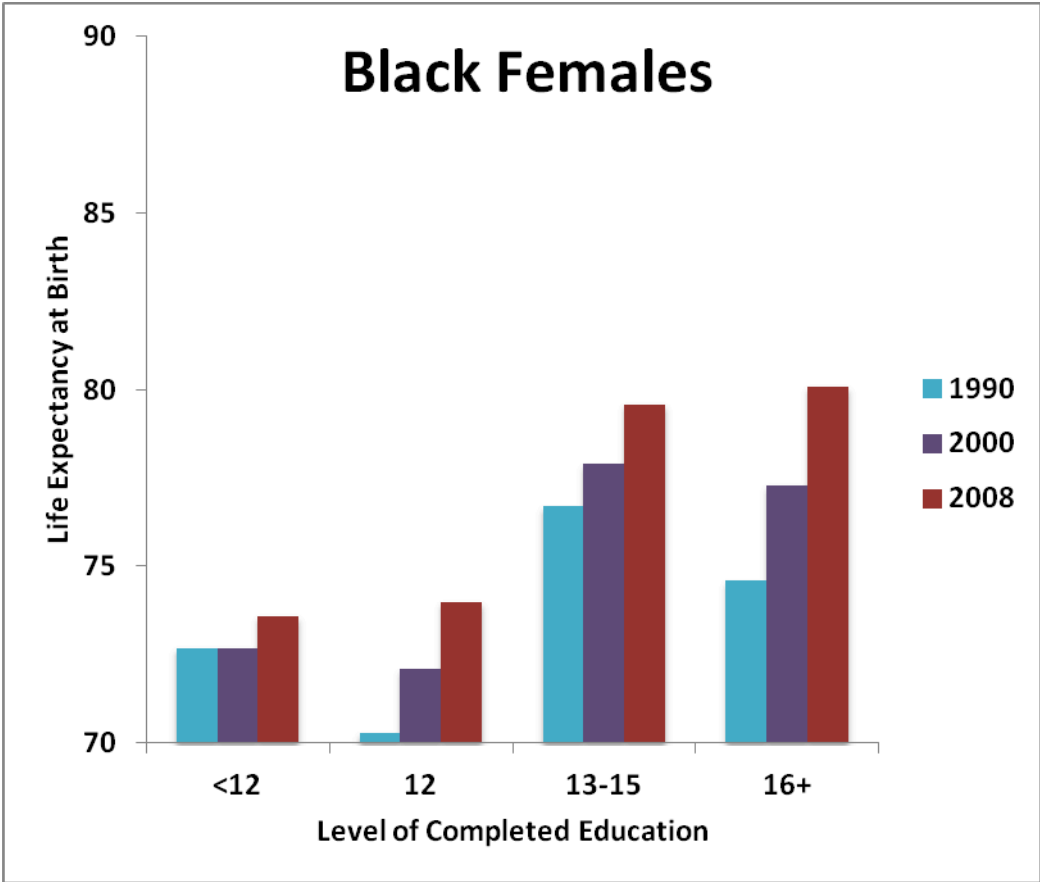
John Rowe chairs the MacArthur Research Network on Aging and is a professor in the Department of Health Policy and Management at Columbia University's Mailman School of Public Health. Previously, Rowe led the program in academic geriatrics at Harvard University, served as president and CEO of Mount Sinai School of Medicine and Hospital, and was the chairman and CEO of the health insurance company Aetna. In addition, he directed the MacArthur Foundation Research Network on Successful Aging. He received his medical degree from the University of Rochester.

Appendix

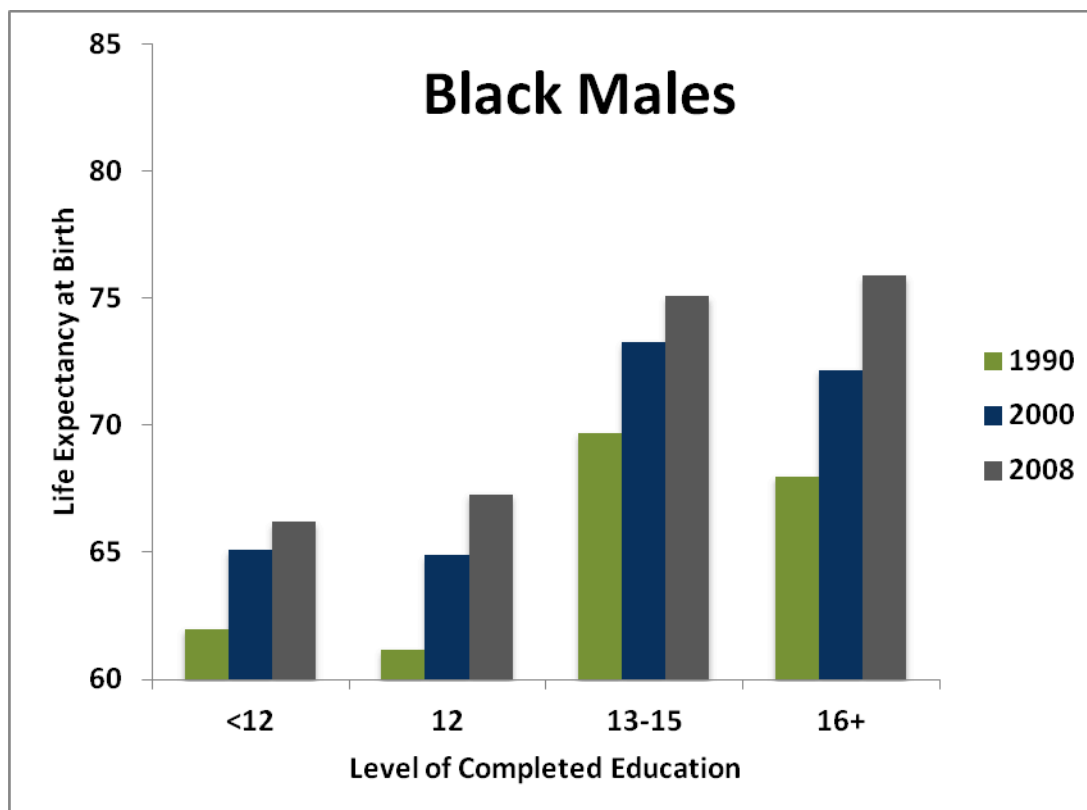
Appendix Exhibit A1. Life expectancy at birth by years of completed education at age 25 for white males (United States, 1990–2008). Source: internal analysis.



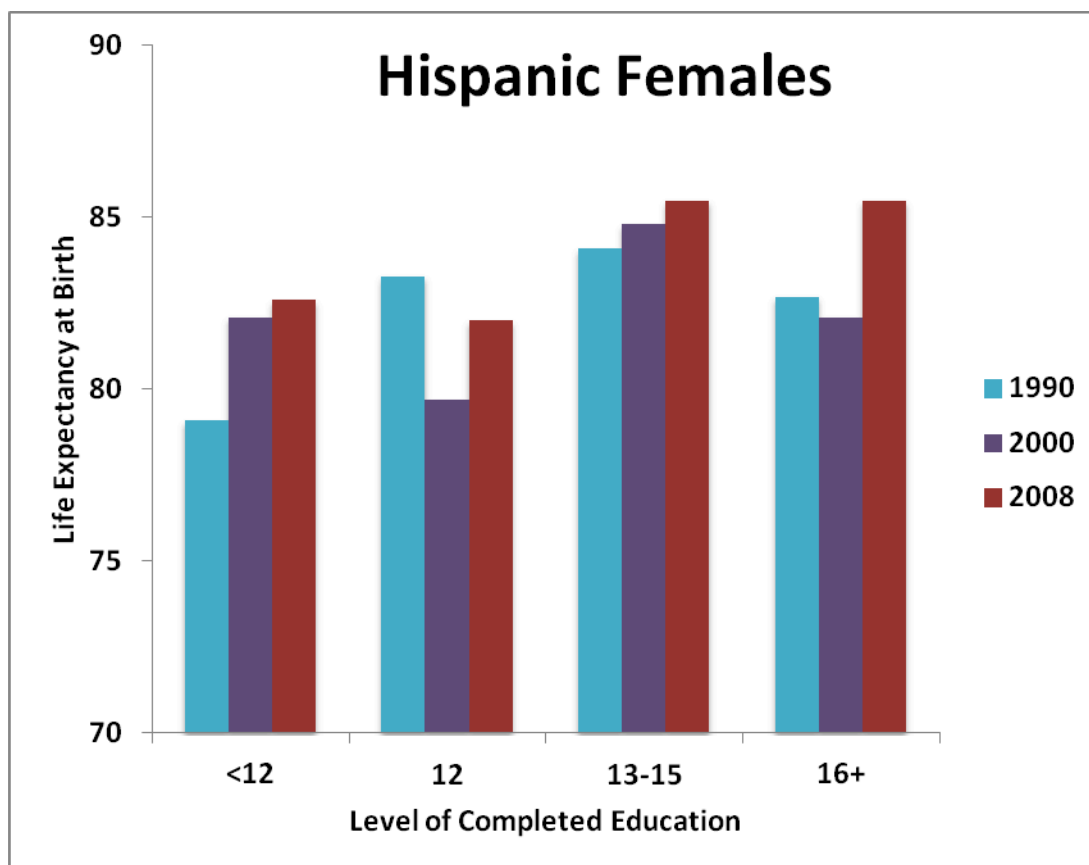
Appendix Exhibit A2. Life expectancy at birth by years of completed education at age 25 for black females (United States, 1990-2008). Source: internal analysis.



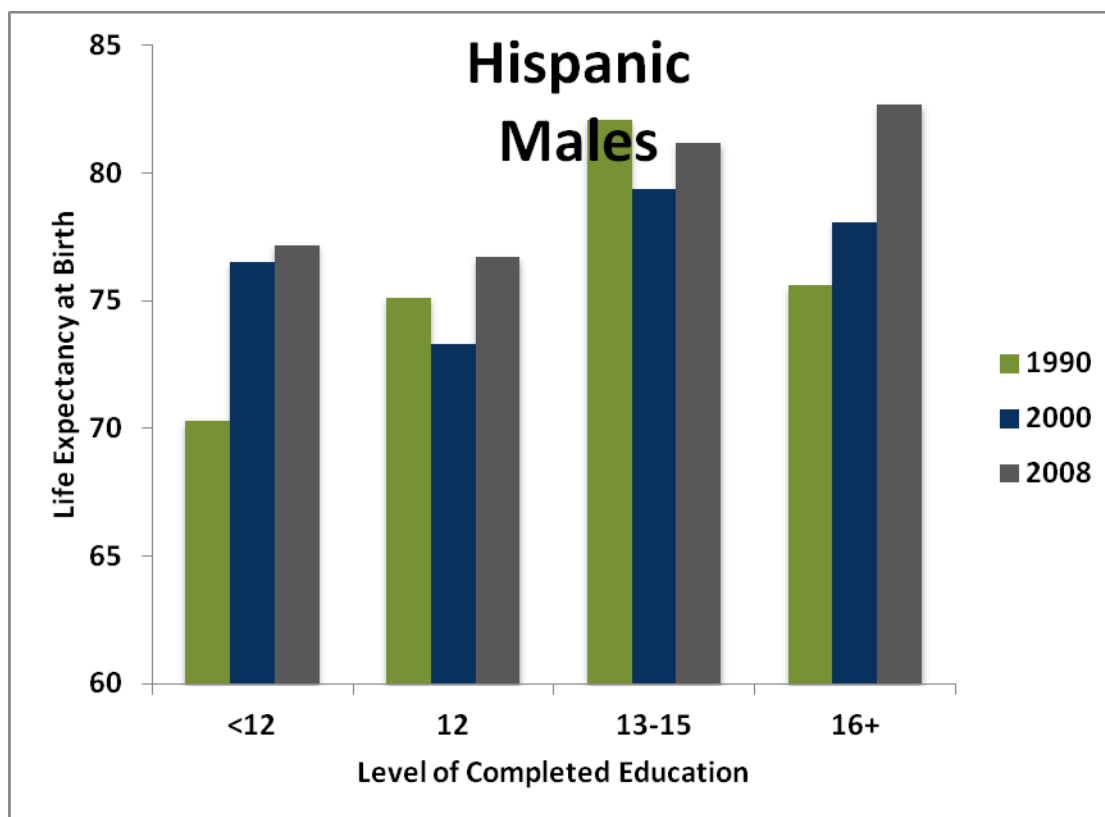
Appendix Exhibit A3. Life expectancy at birth by years of completed education at age 25 for black males (United States, 1990–2008). Source: internal analysis.



Appendix Exhibit A4. Life expectancy at birth by years of completed education at age 25 for Hispanic females (United States, 1990-2008). Source: internal analysis.



Appendix Exhibit A5. Life expectancy at birth by years of completed education at age 25 for Hispanic males (United States, 1990-2008). Source: internal analysis.



Appendix Exhibits A6 through A11. Life expectancy at ages 20, 25, 40, 60, 65, and 80 by years of completed education at age 25, by race and sex (United States, 2008).
Source: internal analysis.

Appendix Exhibit A6.

Life Expectancy at Age 20

Sex	Age	Year	Race	All	By years of education				Diff in years*	Percent diff**
					<=11	12	13-15	16+		
F	20	1990	Non-Hispanic White	60.2	59.4	58.5	63	61.3	1.9	0.032
F	20	2000	Non-Hispanic White	60.5	56.3	58.6	63.7	63.2	7	0.124
F	20	2008	Non-Hispanic White	61.2	54.1	58.9	64.1	64.6	10.5	0.194
F	20	1990	Non-Hispanic Black	55.5	54.5	52.1	58.6	56.5	2	0.036
F	20	2000	Non-Hispanic Black	56.1	54	53.4	59.4	58.7	4.7	0.087
F	20	2008	Non-Hispanic Black	58	54.8	55.2	60.9	61.4	6.6	0.121
F	20	1990	Hispanic	62.4	60.1	64.4	65.1	63.7	3.6	0.059
F	20	2000	Hispanic	62.7	62.8	60.4	65.5	62.8	0	0
F	20	2008	Hispanic	63.9	63.3	62.6	66.1	66.2	2.9	0.047
M	20	1990	Non-Hispanic White	54	51.6	51.2	58.1	56.7	5	0.097
M	20	2000	Non-Hispanic White	55.6	50	52.6	59.7	59.4	9.4	0.187
M	20	2008	Non-Hispanic White	56.6	48.3	52.9	60	61.4	13.1	0.271
M	20	1990	Non-Hispanic Black	46.8	44.3	43.5	52.2	50.6	6.2	0.141
M	20	2000	Non-Hispanic Black	49.7	46.8	46.5	55.2	54	7.3	0.155
M	20	2008	Non-Hispanic Black	51.9	47.7	48.8	56.8	57.7	10	0.209
M	20	1990	Hispanic	55.3	51.6	56.6	63.6	57	5.4	0.105
M	20	2000	Hispanic	57.4	57.5	54.2	60.4	59.1	1.6	0.028
M	20	2008	Hispanic	59.3	58.1	57.6	62.1	63.6	5.5	0.094

* Diff in years = LE (educyears >=16) - LE(educyears <=11)

** Percent diff = (Diff in years) / LE(educyears <=11)

Appendix Exhibit A7.

Life Expectancy at Age 25

Sex	Age	Year	Race	All	By years of education				Diff in years*	Percent diff**
					<=11	12	13-15	16+		
F	25	1990	Non-Hispanic White	55.4	54.5	53.6	58.2	56.4	1.9	0.035
F	25	2000	Non-Hispanic White	55.6	51.4	53.8	58.9	58.4	7	0.136
F	25	2008	Non-Hispanic White	56.3	49.2	54	59.2	59.7	10.5	0.214
F	25	1990	Non-Hispanic Black	50.7	49.8	47.3	53.9	51.7	2	0.04
F	25	2000	Non-Hispanic Black	51.3	49.2	48.6	54.6	53.9	4.7	0.096
F	25	2008	Non-Hispanic Black	53.2	49.9	50.4	56.1	56.6	6.6	0.133
F	25	1990	Hispanic	57.6	55.2	59.5	60.3	58.8	3.6	0.065
F	25	2000	Hispanic	57.8	58	55.5	60.7	57.9	0	0
F	25	2008	Hispanic	59	58.4	57.7	61.3	61.3	3	0.051
M	25	1990	Non-Hispanic White	49.3	47	46.5	53.5	52.1	5.1	0.108
M	25	2000	Non-Hispanic White	51	45.3	47.9	55	54.7	9.4	0.208
M	25	2008	Non-Hispanic White	52	43.6	48.2	55.3	56.7	13.2	0.302
M	25	1990	Non-Hispanic Black	42.5	40	39.1	48	46.3	6.3	0.159
M	25	2000	Non-Hispanic Black	45.3	42.3	42.1	50.9	49.7	7.4	0.174
M	25	2008	Non-Hispanic Black	47.4	43.2	44.3	52.3	53.2	10.1	0.233
M	25	1990	Hispanic	50.8	47.1	52.1	59.2	52.6	5.5	0.117
M	25	2000	Hispanic	52.8	52.8	49.5	55.8	54.4	1.6	0.03
M	25	2008	Hispanic	54.7	53.5	52.9	57.5	59	5.5	0.103

* Diff in years = LE (educyears >=16) - LE(educyears <=11)

** Percent diff = (Diff in years) / LE(educyears <=11)

Appendix Exhibit A8.

Life Expectancy at Age 40

Sex	Age	Year	Race	All	By years of education				Diff in years*	Percent diff**
					<=11	12	13-15	16+		
F	40	1990	Non-Hispanic White	40.9	40.5	39.3	43.5	41.7	1.2	0.03
F	40	2000	Non-Hispanic White	41.1	37.8	39.5	44.2	43.6	5.9	0.155
F	40	2008	Non-Hispanic White	41.9	35.8	40	44.7	45	9.2	0.258
F	40	1990	Non-Hispanic Black	36.9	37	33.7	39.6	37.4	0.4	0.012
F	40	2000	Non-Hispanic Black	37.3	36.2	34.9	40.2	39.5	3.3	0.09
F	40	2008	Non-Hispanic Black	39.1	36.8	36.6	41.7	42	5.2	0.141
F	40	1990	Hispanic	43.1	41	45.1	45.5	44	3	0.074
F	40	2000	Hispanic	43.3	43.5	41	45.9	43.2	-0.3	-0.006
F	40	2008	Hispanic	44.4	43.8	43.3	46.5	46.5	2.7	0.061
M	40	1990	Non-Hispanic White	35.5	34.1	33.1	39.2	37.7	3.6	0.107
M	40	2000	Non-Hispanic White	36.9	32.5	34.3	40.7	40.1	7.6	0.234
M	40	2008	Non-Hispanic White	38	30.9	34.8	41.1	42.1	11.3	0.365
M	40	1990	Non-Hispanic Black	30.2	29.2	27.1	34.5	32.8	3.6	0.124
M	40	2000	Non-Hispanic Black	32	30.3	29.1	36.9	35.6	5.3	0.177
M	40	2008	Non-Hispanic Black	34	31	31.2	38.3	38.8	7.8	0.253
M	40	1990	Hispanic	37.6	34.4	38.9	45.1	38.2	3.8	0.112
M	40	2000	Hispanic	38.7	39	35.6	41.3	39.9	0.8	0.021
M	40	2008	Hispanic	40.5	39.6	38.8	43	44.3	4.7	0.118

* Diff in years = LE (educyears >=16) - LE(educyears <=11)

** Percent diff = (Diff in years) / LE(educyears <=11)

Appendix Exhibit A9.

Life Expectancy at Age 60

Sex	Age	Year	Race	All	By years of education				Diff in years*	Percent diff**
					<=11	12	13-15	16+		
F	60	1990	Non-Hispanic White	22.9	23.3	21.6	25	23.3	0	-0.001
F	60	2000	Non-Hispanic White	23	21.9	22	25.6	25	3.1	0.142
F	60	2008	Non-Hispanic White	23.9	20.8	22.8	26.2	26.1	5.3	0.254
F	60	1990	Non-Hispanic Black	20.7	21.3	17.9	22.3	19.9	-1.3	-0.063
F	60	2000	Non-Hispanic Black	20.8	21.2	19.1	22.7	22	0.8	0.038
F	60	2008	Non-Hispanic Black	22.3	22.2	20.6	24.1	24.1	2	0.088
F	60	1990	Hispanic	25	23.5	26.8	26.4	24.8	1.3	0.056
F	60	2000	Hispanic	24.9	25.1	23.1	27	24.4	-0.8	-0.031
F	60	2008	Hispanic	25.9	25.6	25.1	27.6	27.5	1.9	0.073
M	60	1990	Non-Hispanic White	18.6	18.4	16.9	21.5	19.9	1.6	0.085
M	60	2000	Non-Hispanic White	19.8	18	18.3	22.8	21.9	3.9	0.216
M	60	2008	Non-Hispanic White	21	17.2	19	23.3	23.6	6.4	0.373
M	60	1990	Non-Hispanic Black	16.1	16.4	13.5	17.9	16.3	0	-0.002
M	60	2000	Non-Hispanic Black	17	17.2	14.9	20.1	18.8	1.6	0.092
M	60	2008	Non-Hispanic Black	18.5	17.6	16.6	21.4	21.3	3.6	0.207
M	60	1990	Hispanic	21.1	19.1	22.4	27	19.6	0.6	0.03
M	60	2000	Hispanic	21.5	21.9	19.2	23.1	21.7	-0.2	-0.011
M	60	2008	Hispanic	23.1	22.5	22.1	24.8	25.6	3.1	0.136

* Diff in years = LE (educyears >=16) - LE(educyears <=11)

** Percent diff = (Diff in years) / LE(educyears <=11)

Appendix Exhibit A10.

Life Expectancy at Age 65

Sex	Age	Year	Race	All	By years of education				Diff in years*	Percent diff**
					<=11	12	13-15	16+		
F	65	1990	Non-Hispanic White	19	19.5	17.8	20.8	19.1	-0.4	-0.019
F	65	2000	Non-Hispanic White	19	18.3	18.1	21.3	20.7	2.4	0.133
F	65	2008	Non-Hispanic White	19.8	17.6	18.9	21.9	21.7	4.1	0.236
F	65	1990	Non-Hispanic Black	17.3	17.9	14.7	18.6	16.2	-1.8	-0.098
F	65	2000	Non-Hispanic Black	17.2	17.7	15.7	18.7	18.1	0.4	0.02
F	65	2008	Non-Hispanic Black	18.6	18.8	17.2	20.1	20.1	1.3	0.069
F	65	1990	Hispanic	20.9	19.7	22.4	21.9	20.4	0.7	0.035
F	65	2000	Hispanic	20.7	21	19	22.5	20	-0.9	-0.044
F	65	2008	Hispanic	21.6	21.4	20.9	23.2	22.9	1.5	0.072
M	65	1990	Non-Hispanic White	15.1	15.1	13.7	17.7	16.1	1	0.064
M	65	2000	Non-Hispanic White	16.1	14.9	14.8	18.7	17.8	2.9	0.195
M	65	2008	Non-Hispanic White	17.2	14.4	15.8	19.4	19.4	5	0.346
M	65	1990	Non-Hispanic Black	13.4	13.7	11	14.4	13	-0.7	-0.05
M	65	2000	Non-Hispanic Black	14	14.4	11.9	16.2	15.4	1	0.069
M	65	2008	Non-Hispanic Black	15.4	14.9	13.8	17.8	17.5	2.7	0.179
M	65	1990	Hispanic	17.4	15.9	19.1	22.6	15.2	-0.7	-0.042
M	65	2000	Hispanic	17.7	18.1	15.7	18.8	17.5	-0.6	-0.031
M	65	2008	Hispanic	19.2	18.6	18.4	20.6	21.4	2.8	0.148

* Diff in years = LE (educyears >=16) - LE(educyears <=11)

** Percent diff = (Diff in years) / LE(educyears <=11)

Appendix Exhibit A11.

Life Expectancy at Age 80

Sex	Age	Year	Race	All	By years of education				Diff in years*	Percent diff**
					<=11	12	13-15	16+		
F	80	1990	Non-Hispanic White	8.9	9.4	8.1	9.7	8.5	-1	-0.102
F	80	2000	Non-Hispanic White	8.8	8.7	8.3	9.9	9.4	0.7	0.076
F	80	2008	Non-Hispanic White	9.2	8.6	8.9	10.1	9.9	1.4	0.16
F	80	1990	Non-Hispanic Black	8.7	9	7	9.4	7.7	-1.3	-0.141
F	80	2000	Non-Hispanic Black	8.4	8.5	7.9	9.3	8.3	-0.2	-0.022
F	80	2008	Non-Hispanic Black	8.9	9.2	8.2	9.5	9.6	0.4	0.048
F	80	1990	Hispanic	10.2	9.5	11.4	11.4	10.9	1.4	0.148
F	80	2000	Hispanic	9.7	10	8.6	10.3	8.5	-1.4	-0.143
F	80	2008	Hispanic	10.2	10.2	9.6	10.9	10.7	0.5	0.051
M	80	1990	Non-Hispanic White	7	7.3	6.2	8.1	6.9	-0.3	-0.046
M	80	2000	Non-Hispanic White	7.3	7	6.7	8.6	7.9	0.9	0.121
M	80	2008	Non-Hispanic White	7.8	7.1	7.3	8.8	8.5	1.4	0.196
M	80	1990	Non-Hispanic Black	6.9	7.1	5.6	5.8	5.2	-1.9	-0.262
M	80	2000	Non-Hispanic Black	6.8	7.2	5.4	7.3	7.3	0.2	0.023
M	80	2008	Non-Hispanic Black	7.5	7.6	6.8	7.7	8.2	0.6	0.073
M	80	1990	Hispanic	8.3	7.8	10.6	12.5	10.3	2.4	0.31
M	80	2000	Hispanic	8.1	8.4	7	8	7.6	-0.8	-0.095
M	80	2008	Hispanic	8.9	8.7	8.7	9.2	10.4	1.7	0.199

* Diff in years = LE (educyears >=16) - LE(educyears <=11)

** Percent diff = (Diff in years) / LE(educyears <=11)