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Trends in healthy life expectancy in the United States, 1970–1990: gender, racial, and educational differences

Eileen M. Crimmins[a,*], Yasuhiko Saito[b]

[a] *University of Southern California, Andrus Gerontology Center, Los Angeles, CA 90089-0191, USA*
[b] *Nihon University, Tokyo, Japan*

Abstract

This paper examines healthy life expectancy by gender and education for whites and African Americans in the United States at three dates: 1970, 1980 and 1990. There are large racial and educational differences in healthy life expectancy at each date and differences by education in healthy life expectancy are even larger than differences in total life expectancy. Large racial differences exist in healthy life expectancy at lower levels of education. Educational differences in healthy life expectancy have been increasing over time because of widening differentials in both mortality and morbidity. In the last decade, a compression of morbidity has begun among those of higher educational status; those of lower status are still experiencing expansion of morbidity.

Keywords: Healthy life expectancy; Active life expectancy; Educational differences; Racial differences; Gender differences; USA

Introduction

Inequality in health is one of the most important health issues facing low-mortality countries today. Socioeconomic status is related to virtually all health outcomes in most countries. People with more education or income live longer and experience fewer adverse health events. Differences in healthy life expectancy summarize the combined effects of different levels of mortality and morbidity on the overall length of healthy life and provide a good summary indicator of the total health impact of differences in socioeconomic well being.

Changes over time in healthy and unhealthy life expectancy can be used to measure the overall effect on population health of time trends in the processes of mortality and morbidity (Robine, Romieu, & Cambois, 1997). Differences in time trends by socioeconomic status can be evidence of inequality in health progress. Increases in life expectancy accompanied by an increased proportion of life spent healthy can be regarded as evidence of compression of morbidity; changes in life expectancy with a decreased proportion of life healthy can be evidence of an expansion of morbidity (Bone, Bebbington, & Nicholaas, 1998; Fries, 1981).

This paper examines healthy or disability-free life expectancy at three dates for racial and education subgroups in the United States. The major questions addressed include: how does healthy life expectancy differ among educational groups of the population and how have the differences changed over two decades? Did all educational segments experience the expansion of morbidity during the 1970s and the compression during the 1980s?

Background

Differences in healthy life expectancy by socioeconomic status

There is ample evidence that healthy life expectancy differs dramatically by socioeconomic status in many countries of the world. Socioeconomic differences in healthy life expectancy have been generally found to be

*Corresponding author. Tel.: 213-740-8241.
E-mail address: crimmin@almaak.usc.edu (E.M. Crimmins).

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substantial and to exceed differences in total life expectancy (Bebbington, 1993; Bone, Bebbington, Jagger, Morgan, & Nicolaas, 1995; Kaprio, Sarna, Fogelholm, & Koskenvuo, 1996; Katz et al., 1983; Sihvonen, Kunst, Lahelma, Valkonen, & Mackenbach, 1998; Valkonen, Sihvonen, & Lahelma, 1997; van den Bos & van der Maas, 1993; Wilkins & Adams, 1983).

It has long been recognized that those of lower socioeconomic status have higher mortality in the United States (Kitagawa & Hauser, 1973). The size of the socioeconomic difference in mortality, however, varies by gender, age, and race (Elo & Preston, 1996; Manton, Corder, & Stallard, 1997a; Sorlie, Backlund, & Keller, 1995; Sorlie, Rogot, Anderson, Johnson, & Backlund, 1992). Estimates of healthy life expectancy by indicators of socioeconomic status have not been available for the population of all ages for the United States because of the lack of life tables by socioeconomic status. Newly available follow-up data from sample surveys now allow this possibility.

Differential socioeconomic status is assumed to be the cause of large differences in healthy life expectancy for racial groups in the United States (Crimmins, Saito, & Ingegneri, 1989; Hayward & Heron, 1999; Sullivan, 1971; Williams & Collins, 1995). When healthy life expectancy at birth is estimated for the United States, whites are found to have longer healthy life and African Americans to have longer life in some disabled states (Crimmins et al., 1989; Hayward & Heron, 1999).

For the older US population, there have been a number of studies that have examined the impact of education as well as race on healthy life expectancy. While both education and race are related to healthy life expectancy, education has been found to be a more important predictor of differences in healthy life expectancy than race (Crimmins, Hayward, & Saito, 1996; Guralnik, Land, Blazer, Fillenbaum, & Branch, 1993).

At the older ages, the reported pattern of differences in healthy life expectancy by race varies somewhat (Branch et al., 1991; Guralnik et al., 1993; Manton & Stallard, 1991). In a national sample of those aged 70 and over, African American and white total life expectancy was quite similar, while white healthy life expectancy exceeded African American healthy life expectancy (Crimmins et al., 1996). However, in a North Carolina sample, African American life expectancy and healthy life expectancy above age 75 have been found to exceed white values (Guralnik et al., 1993; Land, Guralnik, & Blazer, 1994).

Trends in life expectancy and healthy life expectancy

During the 1980s, there were decreases in disability in the United States at some ages (Crimmins, Saito, & Ingegneri, 1997; Manton, Corder, & Stallard, 1993; Manton, Stallard, & Corder, 1997b; Waidmann, Bound, & Schoenbaum, 1995). During this time, increases in life expectancy for the total population of the United States were concentrated in years without disability; this differed from the 1970s when increases in life expectancy were in disabled years (Crimmins et al., 1997). Thus, a decade of morbidity compression followed a decade of expansion. Similar trends have been observed in France (Robine, Mormiche, & Sermet, 1998).

In recent years, socioeconomic differentials in life expectancy have reportedly widened in England (Marmot, Kogevinas, & Elston, 1987; Pamuk, 1985; Townsend & David, 1982) and at least for men in the United States (Duleep, 1989; Elo & Preston, 1996; Feldman, Makuc, Kleinman, & Cornoni-Huntley, 1989; Manton et al., 1997a, b; Preston & Elo, 1995). Other countries also report a widening of socioeconomic differentials in mortality.

This reported widening of socioeconomic differentials in mortality, as well as reported declines in the prevalence of disability, and an increase in healthy life expectancy for the population, provides reason to investigate trends in differences in healthy life expectancy by educational status.

Data and methods

Operational definitions

Educational status

Years of school completed or the length of formal education is used as the measure of socioeconomic status in this study because it represents the best indicator of lifetime socioeconomic status across age and over time. Formal education is completed at a relatively young age and stays constant for most people across the adult life. We limit our analysis to those 30 years of age and over, an age at which formal educational levels have been achieved by most adults. Educational status in most data sources is measured by single years of school completed: grouped into elementary education (0–8), high School (9–12), and at least some higher education (13+). In order to make comparisons between similarly defined groups, we retain the same categorization of education at the three dates by matching the categories to the one data source based on categorized education. Others have chosen to look at differences in healthy life or mortality change for socioeconomic groups defined by relative status rather than absolute status (Pamuk, 1985; Preston & Elo, 1995; Sihvonen et al., 1998). Because we want to compare differences in measures combining mortality and morbidity among 12 population subgroups at three time points, we feel the absolute measures of socioeconomic status used here are most appropriate.

Between 1970 and 1990 an increasing proportion of the US population moves up the educational ladder. For instance, in 1970, 28% of the adult population had an eighth grade education or less (US Bureau of the Census, 1971, p. 110). By 1990 only 11% of the adult population was in this educational category (National Center for Education Statistics, 1992, p. 18). The percentages in the low education category are higher at both dates for African Americans, 41 and 16% in 1970 and 1990, respectively.

Unhealthy, inactive or disabled life

The unhealthy population consists of two parts: those institutionalized for physical or mental health problems and those living in the community with an "activity-limiting" disability. This definition of inactivity or disability includes a range from moderate to severe disability.

Estimates of the proportion of the population institutionalized for a physical or mental health problem by age, sex, race and education group are generated from the three decennial censuses taken in 1970, 1980 and 1990[1]. Between 1970 and 1990, there was a trend toward deinstitutionalization at most ages below 85, and a slight increase above that age (Crimmins et al., 1997).

The noninstitutionalized disabled population is estimated from the micro-data tapes of the National Health Interview Surveys (NHIS) for the 3 years including and surrounding each of the census years. The NHIS is an annual ongoing survey conducted by the National Center for Health Statistics. It is designed to monitor health and health-care usage in the community-dwelling American population. Three years of survey data are used for each date in order to increase the reliability of the measures of the percent disabled. For each decennial estimate the sample size of those 30 years and older is over 158,000.

Healthy life in the community is life free from "limitation in normal activity" caused by a physical or mental condition. It is determined using a series of questions about an individual's usual activity over the past 12 months and inability or limitation in ability to perform this as well as other activities. This measure is used as the basis for monitoring trends in overall disability in the United States.[2] Using this measure all limited life is included in disabled life and all non-limited life is non-disabled. There is no weighting of disability states by severity. This is a self-reported measure and we must recognize that at comparable levels of functional capacity, persons with different levels of schooling could be more or less likely to report disability. It is also possible that with the passage of time people change their assessment of disability (Verbrugge, 1989; Wilson, 1981).

Mortality

Decennial life tables of the US for gender–race groups for 1970, 1980, and 1990 provide the basis of the mortality estimates used in constructing healthy life expectancy for this analysis. Educational differences in mortality rates are based on analysis of the micro-records from the US National Longitudinal Mortality Study (NLMS), a follow-up of mortality of more than a million persons between 1979 and 1989 (Rogot, Sorlie, & Johnson, 1992a; Rogot, Sorlie, Johnson, & Schmitt, 1992b) and the published data from the 1960 Matched Records study conducted by Kitagawa and Hauser (1973). From these sources, mortality ratios for educational groups can be computed within age–race–gender groups for 1960 and for the period of 1979–1989. Trends in relative educational differences are determined assuming linear change for each group between 1960 and the middle of 1984, the center point for the follow-up period of the NLMS. The relative mortality ratios are estimated for the dates 1970, 1980, and 1990 from these trends and applied to the appropriate life tables for sex–race groups to estimate sex–race–education-specific life tables.

[1] Estimates of the proportion institutionalized for health reasons for each age–sex–race–education group are obtained from the micro-data tapes for the 1970 and 1980 decennial censuses. The age-specific schedules are then smoothed and used as the input to the calculations. Because the 1990 public use Census tape does not include detailed information on the type of institution, estimates of the age–sex–race–education-specific proportion institutionalized in 1990 are made assuming that the age–sex–race-specific changes in the institutionalized between 1980 and 1990 are the same for all education groups (Crimmins et al., 1997).

[2] Because of change in survey procedures after 1981, the data for the 1989–1991 period for those 70 years of age and over are not comparable to those from earlier years and to those for ages 30–69 in 1989–1991. At the older ages, the survey was changed in 1982 to ask about ability to perform personal care functions rather than the normal activities referenced at other ages. For 1990, therefore, the age–sex–race–education-specific proportions limited in activity for those 70 plus are estimated by making an adjustment for the survey change. The adjustments for survey change were based on a time trend regression using survey data for each year from 1969 through 1991 of the age–sex–race–education-specific proportions limited. Trends within each subperiod, 1969–1981 and 1982–1991, as well as the change from one period to the other caused by the question change were identified. The proportions limited assuming no change in definition were then calculated for each age–sex–race–education group 70 years of age and over using the within period trend and the identified jump caused by the question changes. Age schedules of limitation for the age–sex–race–education-specific groups were smoothed for input to the analysis.

Methodology

Healthy life expectancy is estimated using what is called the "Sullivan" method, a prevalence-based method of estimating healthy life expectancy (Jagger, 1997). The years lived in each age group derived from sex–race–education-specific life tables are divided into healthy and unhealthy years using the proportion of the subgroup disabled at each age. Expected years healthy at a given age are then computed by summing years lived in the healthy state for that age and each older age. Years lived disabled can be summed in the same way. Further details on the prevalence-based methodology for estimating healthy life expectancy and the data applied here can be found in Crimmins et al. (1989, 1997).

We also compute years of potential life lost to clarify the education–race–gender differences in years never lived as well as healthy and unhealthy years lived (Sihvonen et al., 1998). We assume that the longest-lived race–gender–educational group sets the standard for calculating potential years of life lost. This group is African-American women with some college education. There is no potential life lost in this group; for all other groups life lost is calculated by subtracting their total life expectancy from that of the reference group.

Results

Differences and trends in healthy life expectancy are determined by the underlying differences and trends in mortality and disability. To begin, we examine differentials and changing differentials in these inputs to healthy life expectancy.

Mortality differentials by educational status

The ratios of mortality rates for those in the lowest and middle educational groups relative to those in the highest educational grade (indexed to 100) from the 1960 to 1979–1989 studies are shown for white men and women in Figs. 1 and 2. African American differences are shown using two educational categories because less age and education detail on mortality differentials among African Americans is available from the 1960 study (Fig. 3). Because the highest educational group is indexed to 100, values over 100 represent the percentage of higher mortality in the lower educational groups. For white men there are large educational differences and they are greatest at the younger adult ages. Looking at the differences in 1979–1989, white men with an elementary education have mortality rates that are from about 200 to 125% higher than those with some college, depending on age. Differences between those with high school education and college, while smaller, are also larger at younger ages. For white women educational differences are generally smaller at the younger adult years and greater at the older adult years than those of men. For white women the differences are not related to age. For African American men and women less than 64 years of age, the differential at the later date between those with a grade school education and those with higher education is greater than any observed for white men, almost 300%.

Examination of the figures clarifies that mortality differentials between those with high and low education have widened in recent years for African American men and women and white men. For these three groups, differentials were nonexistent at the older ages in 1960;

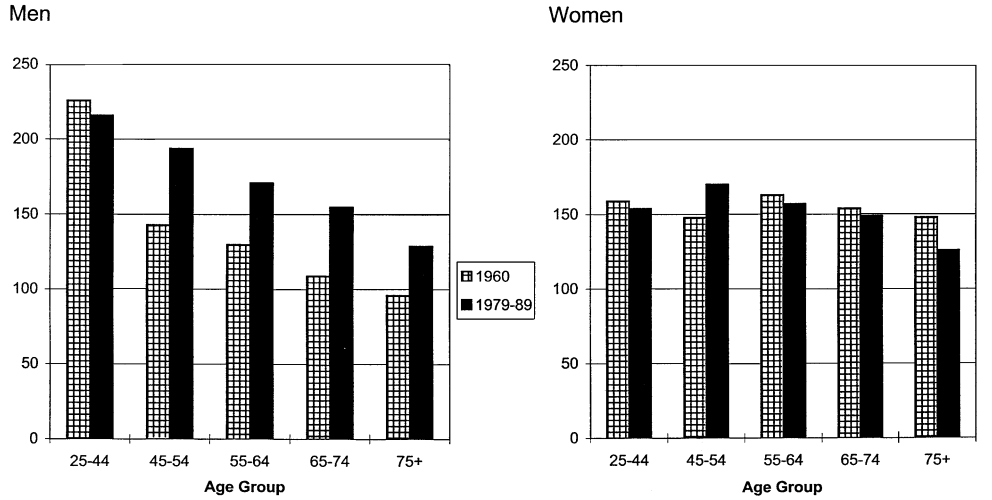

Fig. 1. Ratio of age-specific mortality rates for whites with elementary school education to those with some college and above: 1960 and 1979–1989.

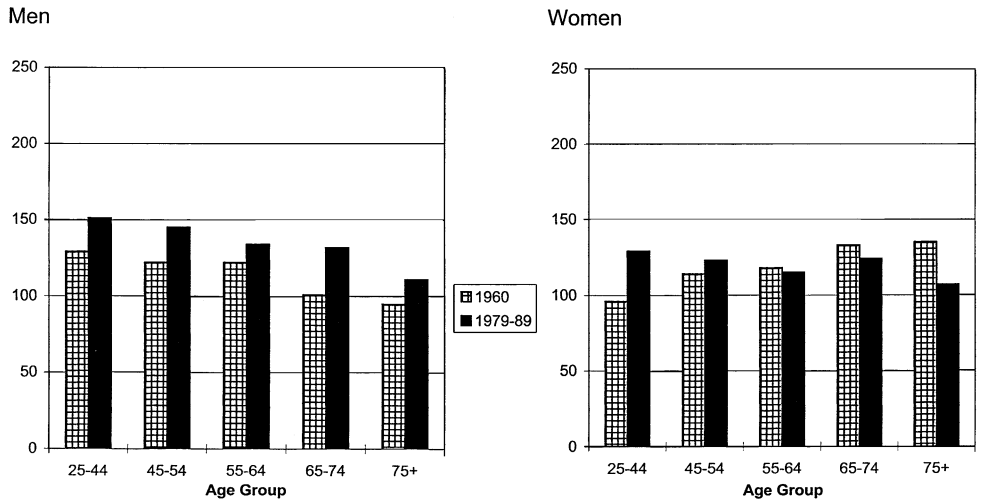

Fig. 2. Ratio of age-specific mortality for whites with high school education to those with some college and above: 1960 and 1979–89.

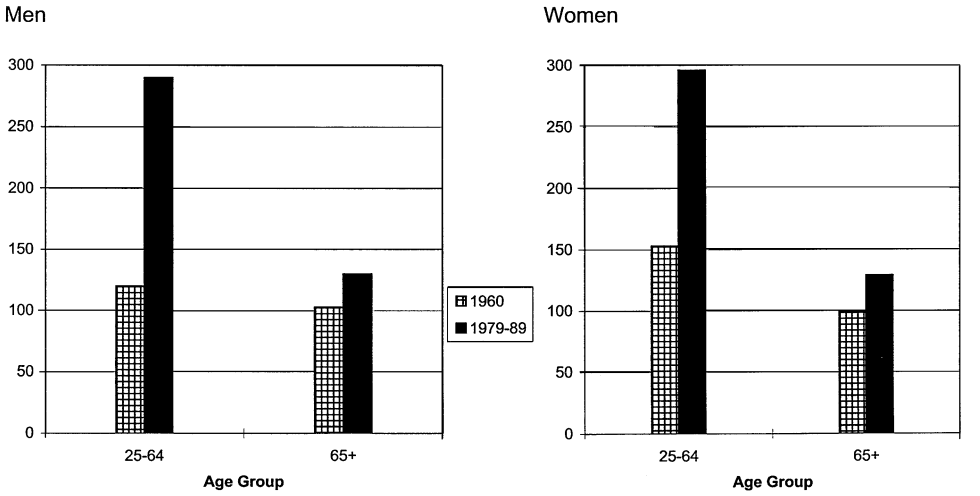

Fig. 3. Ratio of age-specific mortality rates for African Americans with elementary school education to those with some high school and above: 1960 and 1979–1989.

but in 1979–1989, there were educational differences in old age mortality.

For white women the picture is more mixed; generally, the differentials between the educational groups have decreased above age 54 and increased below that age.

Health differentials

For all sex–race–groups of the population there are differences in disability by education and the differences by education are greatest at the younger adult ages. The patterns for two sex–race groups using two levels of education are shown as examples in Figs. 4 and 5. Fig. 4 indicates the ratio of the disability levels of white males with 0–8 years of school to those with 13 or more years of school (indexed to 100) at each of three dates. In 1990, at age 30–35, white men with a grade school education have disability levels almost 3 times (270) those of men with some college. This excess decreases to about 140% for white males in their 80s. African American women 30–34, who have only a grade school education, are four times as likely as those with more education to have some disability. For African American women in their 80s, the differential decreased to less than 150%.

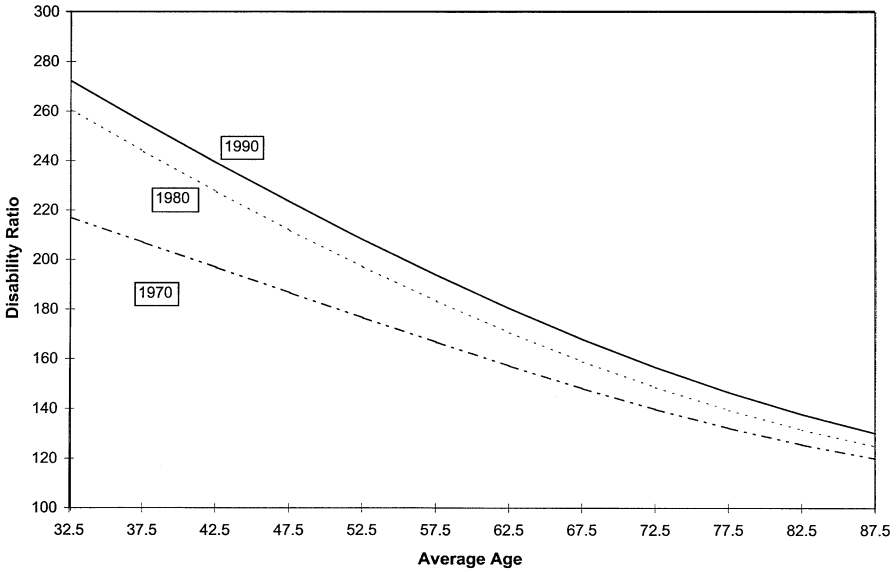

Fig. 4. Ratio of disability for those with grade school education (0–8 years) to that for those with some college (13+): white males, 1970, 1980, and 1990.

In general, disability differentials widened between 1970 and 1990 at all ages among whites of both sexes and African American men. African American females did not experience the same widening of differentials at all ages (Fig. 5). At ages above 50, the relative rates for the three dates were very similar.

Differentials in total and healthy life expectancy in 1990

Life expectancy

Values of life expectancy, healthy life expectancy, and the proportion of healthy life for ages 30 and 65 in 1990 are shown for educational groups in Table 1.[3] Years of potential life lost and years of healthy and unhealthy life lived for the lowest and highest education groups are shown in Fig. 6. There are differences in life expectancy by educational status within each sex–race group. Persons of lower educational status can expect shorter lives than persons of higher status. White men at age 30 with 13 or more years of schooling can expect to live 47.9 years more; for those with 8 or fewer years, expected life is only 41.2 years. Differentials by educational status in years of healthy life are larger than differences in either years lived unhealthy or years of life lost.

The differences in total life expectancy by educational status are larger for males than for females and larger for African Americans than whites. Among whites the differences between the low- and high-education groups in expected life at age 30 are 3.8 years for women and 6.7 years for men. Among African Americans the differences are 10.5 and 11.8 years, respectively.

Within educational groups there are racial differences in total life expectancy; the size of the difference varies with educational level. Differences in total life expectancy by race are largest at the lowest levels of education. Differences are small among those with higher education. The group with the highest total life expectancy at age 30 is African American females with some college education (53.1 years). This group forms the standard for estimating years of potential life lost. African American men with low education have a life expectancy that is much lower than any other group. They live 19.9 years less than the longest lived group.

Healthy life expectancy

The educational differences in healthy life expectancy are even greater than the differences in total life expectancy. At age 30 a high-education white male can expect 10.8 years more of healthy life than a low-education white male. For white women the difference is

[3] Confidence intervals and the size of significant differences are difficult to estimate given the many data sources and methods used here. We have, however, estimated the confidence intervals assuming that the disability data were derived from a random sample and the mortality from a complete register. In this case, the standard error of the estimated life expectancy ranges from 0.1 to 0.4. It is higher at older ages than at younger ages. This range of estimates is similar to that reported by Guralnik et al. (1993) and Rogot et al. (1992a).

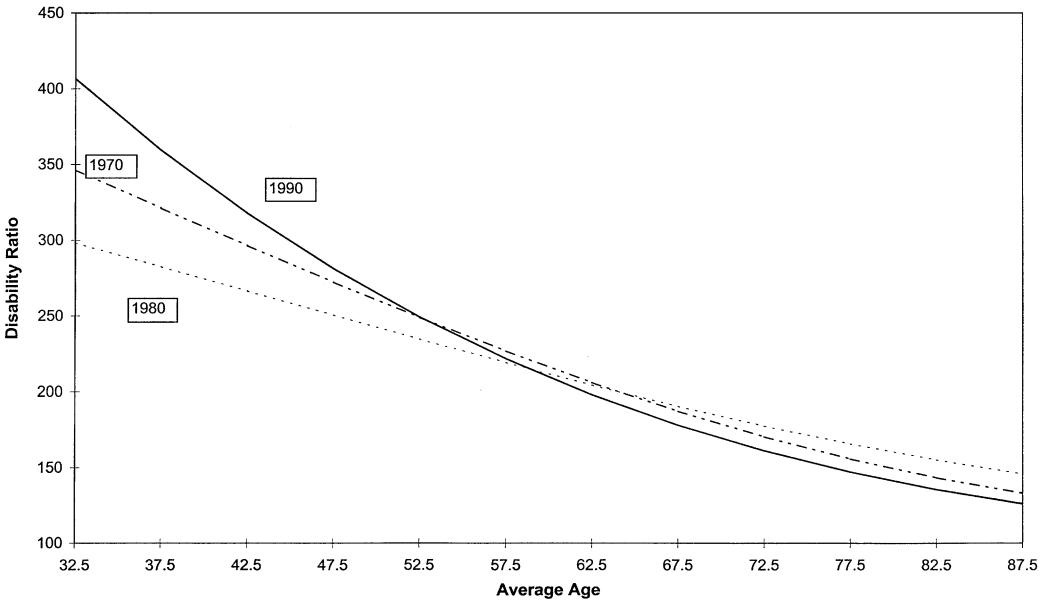

Fig. 5. Ratio of disability for those with elementary school education (0–8 years) to that for those with some college (13+): African American females, 1970, 1980, and 1990.

somewhat less, 9.5 years. Educational differentials are greater for African Americans. Both African American women and African American men with little education can expect 16 fewer years of healthy life expectancy than those with high education.

Racial differences in healthy life expectancy are greater within the lower educational status population than the higher educational status population. African American and white women with at least some college do not differ in healthy life expectancy; while African American and white women with low levels of education differ in expected active life by about 6 years. Among men with the highest level of education, white men have two additional years of healthy life; for those with the lowest level of education, the length of healthy life for black men is 7 years less than that of white men.

Proportion of healthy life

Persons of higher education live a greater proportion of their lives healthy as well as a greater total number of healthy years. As expected from the above findings, the differences by educational group in the proportion of life healthy indicate that African Americans are particularly disadvantaged. In the three educational groups, the expected proportion of healthy life is lowest for African American women.

The above statements hold in general for expected values of total and healthy life expectancy at age 65. The exceptions are that African Americans with the highest education have longer total expected lives and expected healthy lives than whites with the same level of education. At age 65 the expected proportion of life healthy differs substantially by socioeconomic status. At the lower end of the socioeconomic distribution less than one-half of expected life is likely to be healthy; at the high end of the educational continuum almost two-thirds of expected life is likely to be healthy.

Time trends in total and healthy life expectancy

Life expectancy

Values of life expectancy, healthy life expectancy, and the proportion of life healthy at age 30 for 1970, 1980, and 1990 are shown in Table 2 and change over 20 years in total life expectancy and healthy and unhealthy years are shown in Fig. 7. All white–gender–educational subgroups experience increases in life expectancy in both decades. Among African Americans, all educational groups experienced increasing life expectancy during the 1970s. In the 1980s, there was no increase in life expectancy for those in the two lowest education categories but only for the highly educated. For whites, the increases in life expectancy during the 1980s were higher for the most educated.

Healthy life expectancy

The trend in healthy life expectancy at age 30 also differs by educational status and race. Over the two decades, increase in healthy life expectancy is concentrated among those with the highest levels of education. Those in the lowest educational category, regardless of gender or race, experienced decreases in the length of

Table 1
Total life expectancy, healthy life expectancy, and proportion of life healthy by race, sex, and education: 1990

		Years of school completed			Difference
Race	Sex	(0–8)	(9–12)	(13+)	(13+)–(0–8)
Age 30					
Total life expectancy					
White	Males	41.2	44.3	47.9	6.7
African American	Males	33.2	38.3	45.0	11.8
White	Females	48.3	50.8	52.1	3.8
African American	Females	42.6	46.1	53.1	10.5
Healthy life expectancy					
White	Males	27.1	33.0	37.9	10.8
African American	Males	19.8	28.2	36.0	16.2
White	Females	30.8	37.6	40.3	9.5
African American	Females	24.2	31.6	40.2	16.0
Proportion of life healthy					
White	Males	65.5	74.6	79.1	13.6
African American	Males	59.7	73.6	80.0	20.3
White	Females	63.7	73.9	77.4	13.7
African American	Females	56.8	68.5	75.7	18.9
Age 65					
Total life expectancy					
White	Males	13.8	15.4	17.6	3.8
African American	Males	12.7	13.9	18.1	5.4
White	Females	17.8	19.5	20.2	2.4
African American	Females	16.8	18.1	22.3	5.5
Healthy life expectancy					
White	Males	6.3	8.5	10.9	4.6
African American	Males	5.1	7.1	11.8	6.7
White	Females	8.2	11.1	12.3	4.1
African American	Females	7.0	8.3	13.1	6.1
Proportion of life healthy					
White	Males	45.3	55.0	62.0	16.7
African American	Males	39.9	51.0	65.4	25.5
White	Females	45.7	57.0	61.1	15.4
African American	Females	41.6	46.1	58.5	16.9

healthy life over the 20-year period. This pattern of change caused educational differentials in healthy life expectancy to widen over time. Among African Americans, high educational status males at age 30 have an expected healthy life that is 82% longer than that of low educational status males in 1990; for African American females high status active life is 66% higher. In 1970 these differences were 32 and 41%, respectively. Among whites in 1990 high-status healthy life exceeded low-status healthy life by about 40% for men and 30% for women. This was an increase from an excess of about 20% in 1970.

The pattern of change varied somewhat between the 1970s and 1980s. Only relatively high-status persons experienced improvement in healthy life expectancy during the first decade of the period: the highest educational groups of white men and African Americans of both genders, and the middle educational group of African American men. During the second 10-year period, healthy life expectancy increased for many subgroups including all of the high education groups and all groups of white men. The only groups that experienced a decrease in healthy life expectancy between 1980 and 1990 are African Americans of both genders with a grade school education, white females with a grade school education, and African American females with some high school education.

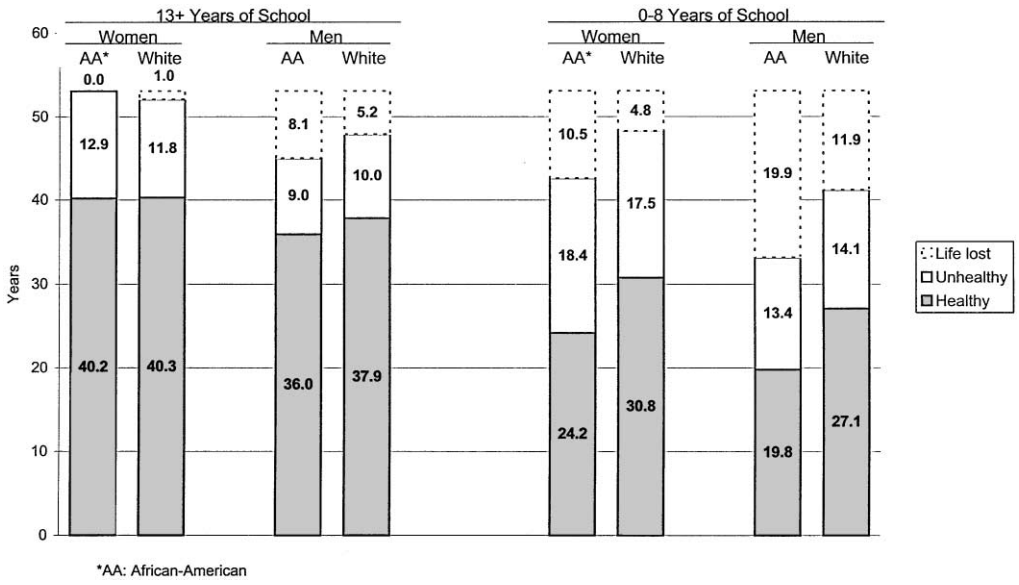

Fig. 6. Years of potential life lost and years of unhealthy and healthy life lived at age 30 sex–race groups with 13+ and 0–8 years of schooling.

Proportion of healthy life

Examination of the proportion of life healthy at age 30 indicates that it is lower in 1990 than in 1970 for every gender–race–education group. This occurs in spite of the fact that for many groups the proportion increased between 1980 and 1990. The fall for those of high education is fairly small; the fall for those with low education is sometimes substantial.

Most of the generalizations about trends made for age 30 are also true for age 65 (Table 3). Most groups experience increase in life expectancy in the 1980–1990 period with the exception of African American women with low education and white females with high education. High-education groups experience steady increase in expected years of healthy life over the 20 years. Among other groups there are both decreases and increases in expected years of healthy life. Between 1970 and 1980 at age 65 all of the lower education groups experience some decrease in healthy life but the middle education group sees small increases. For males with the lowest level of education, both African American and white, there has been little change over the 20 years in healthy life expectancy; for white females with the lowest level of education healthy years decreased from 1970 to 1990.

Discussion

We conclude that socioeconomic differentials in healthy life expectancy in the United States are large and growing. Of course, the validity of our findings depends on the reliability and validity of measurement, particularly of disability. Widening of socioeconomic mortality differentials among the white male and older population of the United States have been previously reported by Feldman et al. (1989), Manton et al. (1997a, b) and Preston and Elo (1995). Our analysis indicates that this is true among both African Americans and whites. Socioeconomic differences in both mortality and morbidity contribute to these differences in healthy life expectancy.

At lower levels of education, the differences in healthy life expectancy between African Americans and whites are greater than at higher educational levels. Racial differences in active life expectancy are small among those with more than a high school education. The fact that large racial differences exist within educational groups leads us to conclude that either our categorization of the population by education does not adequately control for all socioeconomic differences or the effects of low educational or socioeconomic status are particularly devastating for African Americans.

Over time, inequities by educational status in healthy life expectancy have increased. In general, high -status groups are more likely to have experienced increases in healthy life expectancy during both the 1970s and the 1980s while lower-status groups are more likely to have experienced periods of declining expected years of healthy life. These patterns of change in healthy life expectancy have occurred because educational differences have widened in both mortality and morbidity or disability.

Table 2
Total life expectancy, healthy life expectancy and proportion of life healthy at age 30 by race, sex, and education: 1970, 1980 and 1990

Year	Years of school completed			Years of school completed		
	(0–8)	(9–12)	(13+)	(0–8)	(9–12)	(13+)
	White males			White females		
Total life expectancy change						
1970	39.0	41.1	43.1	45.8	48.2	50.5
1980	40.6	43.1	45.8	47.7	50.1	51.9
1990	41.2	44.3	47.9	48.3	50.8	52.1
(1970–1990)	2.2	3.2	4.8	2.5	2.6	1.6
Healthy life expectancy change						
1970	28.3	32.6	35.2	33.3	38.2	40.1
1980	26.3	32.2	35.9	31.2	37.6	40.0
1990	27.0	33.0	37.9	30.8	37.6	40.3
(1970–1990)	−1.3	0.4	2.7	−2.5	−0.6	0.2
Proportion of life healthy change						
1970	72.5	79.2	81.6	72.6	79.4	79.4
1980	64.7	74.8	78.4	65.4	74.9	77.1
1990	65.5	74.6	79.1	63.7	73.9	77.4
(1970–1990)	−7.0	−4.6	−2.5	−8.9	−5.5	−2.0
	African American males			African American females		
Total life expectancy change						
1970	33.1	36.4	38.5	39.8	43.2	45.5
1980	34.4	38.4	42.5	42.8	46.0	50.3
1990	33.2	38.3	45.0	42.6	46.1	53.1
(1970–1990)	0.1	1.9	6.5	2.8	2.9	7.6
Healthy life expectancy change						
1970	23.6	28.0	31.2	26.3	32.0	37.1
1980	21.7	28.2	32.6	24.4	31.9	38.6
1990	19.8	28.2	36.0	24.2	31.6	40.2
(1970–1990)	−3.8	0.2	4.8	−2.1	−0.4	3.1
Proportion of life healthy change						
1970	71.4	76.9	81.1	66.1	74.0	81.5
1980	63.1	73.4	76.7	56.9	69.5	76.7
1990	59.7	73.6	80.0	56.8	68.5	75.7
(1970–1990)	−11.7	−3.3	−1.1	−9.3	−5.5	−5.8

Widening of mortality differentials has been experienced by all but white women; widening of morbidity differentials is characteristic of all but African American women. This widening of disability differentials as well as mortality differentials points to an additional way in which the fortunes of the poor and the well off have diverged in recent years.

While mortality trends are reliably measured and are partly responsible for the widening differential over time, it is possible that today persons of higher or lower educational strata might be more or less likely to report disability given the same level of functional challenge than they were in the past (Crimmins, 1996; Crimmins & Ingegneri, 1993; Verbrugge, 1989). For this to be the explanation for the time change would require that those of lower educational levels be more willing and/or those of higher educational levels less willing to report disability at a given physical level in more recent years. It seems unlikely that such changes would not occur in the same direction in both groups or that they would change in the opposite direction.

While healthy life expectancy has increased over both decades for some subgroups, unhealthy life expectancy has also increased resulting in very little compression of morbidity. The most recent decade has been a period of compression of morbidity for high-education groups of

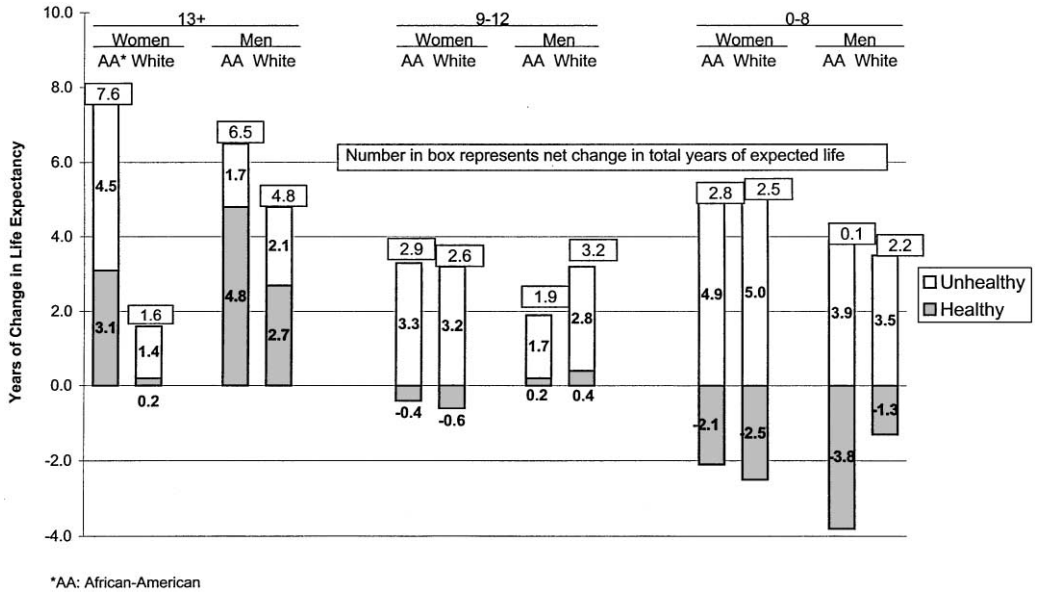

Fig. 7. Change between 1970 and 1990 in total years of expected life and expected years healthy and unhealthy at age 30.

Table 3
Total life expectancy, healthy life expectancy and proportion of life healthy at age 65 by race, sex and education: 1970, 1980 and 1990

Year	Years of school completed			Years of school completed		
	(0–8)	(9–12)	(13+)	(0–8)	(9–12)	(13+)
	White males			White females		
Total life expectancy change						
1970	12.5	13.3	13.8	16.1	17.3	19.3
1980	13.3	14.4	15.8	17.4	19.0	20.3
1990	13.8	15.4	17.6	17.8	19.5	20.2
(1970–1990)	1.3	2.1	3.8	1.7	2.2	0.9
Healthy life expectancy change						
1970	6.2	7.8	8.6	8.7	10.7	11.8
1980	5.9	7.9	9.6	8.5	10.8	12.1
1990	6.3	8.5	10.9	8.2	11.1	12.3
(1970–1990)	0.1	0.7	2.3	-0.5	0.4	0.5
Proportion of life healthy change						
1970	49.4	59.0	62.2	53.7	62.0	60.9
1980	44.6	54.7	60.4	48.5	57.3	59.7
1990	45.3	55.0	62.0	45.7	57.0	61.1
(1970–1990)	−4.1	−4.0	−0.2	−8.0	−5.0	0.2
	African American males			African American females		
Total life expectancy change						
1970	12.4	13.0	14.1	15.5	15.8	16.9
1980	12.9	13.8	16.3	16.8	17.5	20.0
1990	12.7	13.9	18.1	16.8	18.1	22.3
(1970–1990)	0.3	0.9	4.0	1.3	2.3	5.4
Healthy life expectancy change						
1970	5.2	6.2	7.5	6.4	8.3	10.4
1980	5.0	7.5	8.9	6.1	8.6	12.0
1990	5.1	7.1	11.8	7.0	8.3	13.1
(1970–1990)	−0.1	0.9	4.3	0.6	0.0	2.7
Proportion of life healthy change						
1970	42.0	47.7	53.0	41.0	52.4	61.8
1980	38.4	54.2	54.6	36.1	49.0	60.4
1990	39.9	51.0	65.4	41.6	46.1	58.5
(1970–1990)	−2.1	3.3	12.4	0.6	−6.3	−3.3

men at age 30 and all persons with high education at age 65 because for these groups the increase in years of healthy life has exceeded the increase in years with disability. At age 30 those with medium or low levels of education have experienced greater increase in years of unhealthy life than in years of healthy life. Women in below the highest level of education and men in the lowest educational group have experienced absolute decline in the expected years of healthy life over these 20 years. This suggests that much of the compression of morbidity observed for the total population between 1980 and 1990 must be due to the temporal shift from lower to higher education categories (Crimmins et al., 1997).

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