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RACIAL DIFFERENCES IN HEALTH IN LONG-RUN PERSPECTIVE:
A BRIEF INTRODUCTION

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Racial Differences in Health in Long-Run Perspective: A Brief Introduction
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ABSTRACT

The United States has a long and ongoing history of racial inequality. This paper surveys the literature on one aspect of that history: long-run trends in racial differences in health. We focus on standard measures such as infant mortality and life expectancy but also consider the available data on specific diseases and chronic conditions. Our basic conclusion is that large improvements have occurred in the average health of African Americans over the twentieth century, both in absolute terms and relative to Whites. These health advancements occurred steadily throughout the twentieth century, with the peak period of improvement between 1920 and 1945 (for infant mortality) and 1940 and 1960 (for overall life expectancy). We attribute the improvements to successful efforts to fight specific diseases, improvements in public health, and narrowing racial gaps in education and income. Although racial inequality in health outcomes has fallen in the long term, significant disparities remain today.

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1.0 Introduction

The United States has a long and ongoing history of racial inequality. Labor economists and economic historians have documented the secular evolution of racial differences in income, wealth, and education over the late nineteenth and twentieth centuries.¹ Our chapter follows in this tradition by describing long-term trends in racial differences in health.

Like other economists, we view health as a component of human capital that can contribute directly to a person's well-being. Better health is also an input into the production of income. A healthy person can provide more labor and earn more income, if she desires; and health and other forms of human capital, such as schooling, may complement each other.² Health is a function of inherited characteristics (genetics) and environmental conditions experienced throughout the life cycle. These environmental factors include income and wealth, which can be used to purchase commodities that create better health – better diet, shelter, clothing, access to medical care – and local public goods, such as clean water.

We begin our chapter with a short review of contemporary racial differences in health, setting the stage for our discussion of long-term health trends. We focus on standard measures of health, namely life expectancy and infant mortality, but also consider the available data on specific diseases and chronic conditions.

Large improvements have occurred in the average health of African Americans over the twentieth century, both in absolute terms and relative to Whites. These health advancements occurred steadily throughout the twentieth century, with the peak period of improvement between 1920 and 1945 (for infant mortality) and 1940 and 1960 (for overall life expectancy).

¹ This extensive literature includes Higgs (1982), Smith (1984), Margo (1984, 1990), Smith and Welch (1989), Donohue and Heckman (1991), and Collins and Margo (2006, 2012).

² On these points, see Deaton (2003), Currie (2009) and Bleakley, Costa, and Lleras-Muney (2014).

The best current estimates indicate that life expectancy at birth for African Americans at the turn of the twentieth century was about 42 years, nine years shorter than life expectancy at birth for Whites. The most recent data show Black life expectancy at birth to be about 75 years in 2011, approximately four years shorter than Whites. Since 1900, the absolute racial gap in years of life has been cut in half, and, expressed as a percentage of Black life expectancy, the racial gap has declined even further (from around 20 percent to around five percent). Other indicators of health show analogous improvements.

However, we emphasize that examining trends in health over the long run requires considerable care. We argue that, in previous research, limited data availability led to large overstatements in the degree of improvement in Black (but not White) life expectancy over the twentieth century, especially from 1900 to 1940. In particular, the first estimates of life expectancy were based on states with early death registries, a sample that is biased toward urban areas, thereby leading Black life expectancy to be severely understated circa 1900. More nationally representative evidence on child mortality from the census suggests that Black life expectancy at birth was substantially higher in 1900 than previously thought, implying less improvement over the twentieth century.

After surveying historical trends in life expectancy and infant mortality, we discuss potential causes of improvements in Black health conditions over time. Large advances in Black health in the first decades of the twentieth century can be attributed, in part, to investments in public health, including clean water supplies and sewerage, in urban areas. Yet, only 25 percent of the Black population lived in cities at the time, suggesting that efforts to eradicate diseases endemic in the South may have been quantitatively more important. Given that cities continued

to have higher death rates at the time, black migration from the rural South to industrial cities counterbalanced some of the improvements in life expectancy before 1940.

The most rapid improvements in Black life expectancy occurred between 1940 and 1960, corresponding to a period of rising real incomes and racial convergence in both income and educational attainment. Existing estimates suggest that higher income and education levels can explain much of the advancements in Black health. Black infant mortality also notably declined from 1965 to 1980, which can be attributed in large part to the desegregation of southern hospitals during the Civil Rights era. Yet, despite these improvements, stubborn racial differences in health remain today even after controlling for many relevant factors – such as income and access to medical care.

2.0 Racial Disparities in Health and Their Long-Term Evolution

2.1 Contemporary Racial Disparities in Health

Racial disparities in health in the modern United States have been widely noted by specialists in public health, health economics, and medicine.³ Table 1 presents racial differences in life expectancy at various ages in 2011, using the most recent data available. In 2011, life expectancy at birth for African Americans was 75.3 years, compared with 79 years for Whites, a gap of 3.7 years.

Conditional on surviving the first year of life, the racial gap in life expectation declines – for example, at age one, the racial gap in life expectation fell to 3.2 years. By middle age, the gap in years of life expectation falls to 2.6 and, by age 70, the gap is less than one year. Blacks who survive to age 80 or older have very similar or even lower mortality than Whites, perhaps due to

³ For brief introduction to the medical literature, see Smedley, Stith and Nelson (2009); Peterson, et al. (1997); Bach, et al. (1999) and Barnato, et al. (2005).

selective attrition. That is, persons who survive to old age likely have a genetic predisposition to longer life or an unusual healthy lifestyle; because of the higher mortality rates at younger ages, these forces of selective attrition may be greater in the Black population, causing those who survive to age 80 to be hardy relative to Whites in this age bracket.

The age patterns observed in Table 1 suggest that racial disparities in health begin very early in life – essentially, in the womb. Early racial differences in health are also apparent in infant mortality rates. In 2011, the black infant mortality rate was twice as high as the White infant mortality rate (1,058 versus 516 deaths per 100,000 live births). Early disparities are a key factor in the emergence of chronic conditions later in life which, in turn, produce higher levels of adult mortality for the middle-aged Blacks and those nearing retirement.⁴

The lower levels of Black life expectancy suggest that blacks face higher mortality rates than whites today at given ages. Figure 1 presents the share of deaths attributable to various causes by race in 2011. Overall, the distribution of causes of death today is remarkably similar by race, suggesting that excess Black mortality is not concentrated in a particular set of diseases. A higher proportion of Blacks succumb to heart disease but a somewhat smaller fraction die from cancer, the two largest killers. Among less common conditions, Blacks are more likely to die from complications from diabetes and hypertension, but are less likely to commit suicide, die in accidents, or succumb to Alzheimer’s disease.

In an accounting sense, higher rates of Black mortality can be due either to a higher prevalence of particular conditions or to a lower probability of survival, conditional on

⁴ The relationship between health conditions in utero and later life disease was first proposed by David Barker and his co-authors (Barker, et al., 1989a and 1989b). Almond and Currie (2011) survey the literature in economics testing the “Barker hypothesis.” Preston, Hill and Drevenstedt (1998) show that some childhood conditions, including having literate parents and being co-resident with both parents, are associated with longevity for African Americans.

contracting a particular disease. It is difficult to get accurate data on racial disparities in the prevalence of disease because individuals typically need to be in contact with the medical establishment in order to receive a diagnosis. If access to medical care varies by race, self-reported health conditions may be biased. Survival rates conditional on having a particular disease are easier to observe and do seem to vary by race. Cancer is an important example. Table 2 shows racial differences in surviving cancer conditional on having received a cancer diagnosis. For the most recent period for which data are available (2004-10), Black cancer patients exhibit lower survival rates than White patients (60 percent versus 67 percent). Blacks may be less likely to survive a cancer diagnosis either because they receive their diagnosis at a later stage in the disease or because they are less likely to have access to high quality treatment even at a given stage.

2.2 Historical Data on Health by Race: Issues of Data Comparability

The remainder of this section places current racial disparities into long-run perspective by presenting historical trends on health for Blacks and Whites. Before doing so, this subsection describes the available historical data on health outcomes for the United States, along with concerns about data comparability over time. Our discussion begins with historical mortality data and then proceeds to health outcomes among the living.

In the contemporary United States, “vital events” – births and deaths – are recorded by public officials at the time of their occurrence. The Census Bureau also tracks the age structure of the population by conducting annual surveys, supplemented by full population counts in the decennial census years. With this information in hand, it is possible to measure changes in population on an annual basis; and, in particular, to produce reliable annual estimates of age-

specific death rates and complete life tables both for the overall population and for various sub-groups, such as by race.

Today, births and deaths are recorded in official birth and death registries. The first state to implement such a system was Massachusetts in the 1850s. Other states followed but sufficient information to construct national life tables was only available by 1900 (Glover, 1921). By 1933, all states met government standards to be incorporated into the official Birth Registration Area (BRA) and Death Registration Area (DRA). Yet under-reporting was still a problem in some states. By 1950, the records are believed complete enough to be regarded as reliable by most demographers. With regard to age structure, the Census Bureau began to routinely collect the Current Population Survey, a moderate sample that tracks population on a monthly basis shortly after World War II; and in 2001, the American Community Survey, a much larger random sample that is conducted on an annual basis.

For the years before the official birth and death registries began, estimates of life expectancy can be inferred from the age structure of the population in decennial censuses. In particular, demographers combine information on changes in the age structure between successive censuses with data on net migration to estimate ten-year survival rates for various age groups.⁵ These survival rates are then matched to standard model life tables in order to compute life expectancy at birth or other ages.⁶ The earliest census for which such calculations are

⁵ Survival rates are usually not calculated for persons under age 5 or over age 40 in the base year because of concerns over under-enumeration (under age 5), or age mis-reporting (over age 50). Because the survival estimates do not cover the full range of ages, the data alone cannot be used to provide a full life table and must instead be matched to model life tables to generate life expectation estimates.

⁶A model life table is the average of a set of country-specific life tables which are known to be based on accurate data. Model life tables are grouped into “systems” thought to represent similar overall mortality conditions. The most commonly used Princeton tables are grouped into four

feasible for either race is 1850. Using these methods, trends in White life expectation can be measured (fairly) reliably from the middle of the nineteenth century to the present. Yet the statistical situation for Blacks is far less sanguine. While there are estimates of Black life tables prior to 1900, their quality is questionable due to measurement problems in the underlying census data on age.

Until recently, historical estimates of Black life expectancy were based on two sources of evidence that are subject to severe biases: death records from the selected states incorporated into the DRA and census survival rate methods. We believe that both approaches produce estimates of Black life expectation circa 1900 that are too low, thereby overstating the degree of improvement in Black health that took place in the first half of the twentieth century.

Using data from the DRA states, Glover (1921) estimated that Black life expectation at birth was 33 years in 1900-02. Based on this estimate, it would appear that Black life expectation at birth increased by 42 years since 1900, more than doubling from 1900 to the present. Even at the time, the Census Bureau recognized that the infant mortality experience of Blacks in the DRA states was not likely to be representative of the national Black population (U.S. Bureau of the Census, 1918). Most DRA states in 1900 were in the North, and Blacks resident in these states were predominantly urban. Circa 1900, there was a substantial urban penalty in infant mortality (Preston and Haines, 1991; Condran and Cummins, 1980; Haines, 2001). The Census Bureau believed that infant mortality in the rural South, where the vast majority of African Americans lived in 1900, was considerably lower than for Blacks in the DRA states.⁷ Correcting

such systems – North, South, East, and West – representing different regions of the world, and then further categorized by mortality level.

⁷ Less than five percent of the Black population lived in the DRA states in 1900; see Preston and Haines (1991, p. 50). In contrast, nearly 30 percent of the White population lived in a DRA state

for this bias could easily produce a higher estimate of Black life expectation at birth in the early twentieth century.

To evaluate this concern, demographers applied the census survivorship technique discussed above to the Black age structure data in the late nineteenth and early twentieth century censuses (Demeny and Gingrich 1967; Meeker 1976). These calculations again yielded estimates of Black life expectation at birth in the vicinity of 33 years, similar to Glover's. Because these calculations were based on the national Black age structure, rather than data from the DRA states alone, they seemed to validate Glover's original figure. However, census survivorship estimates are generated from Census counts of individuals between the ages of five and 40 (see footnote 6). Yet Black mortality rates at these prime ages were relatively high in the late nineteenth century, while infant and child mortality was correspondingly low. Thus, in fitting the high prime-age mortality to model life tables, Blacks were assumed to have a low level of life expectation at birth.

In considering the evidence, we believe that estimates of Black life expectancy based on either DRA states or on census survival methods are understated circa 1900. Instead, we are convinced by Preston and Haines (1991), who build new estimates of Black life expectancy from census data on child mortality by race in 1900 and 1910. In these years, the census asked adult women to report both their number of children ever born and their number of surviving children (as of the census date). Ages of children still present in the household are also known. Preston and Haines use this data to produce estimates of "q(A)," or the cumulative probability of death

in this year and the White urbanization rate did not differ much between covered and non-covered states.

prior to exact age A. Preston and Haines then fit these estimates to model life tables to recover life expectancy.⁸

After extensive data analysis Preston and Haines consider their most reliable estimates to be $q(3)$, $q(5)$, and $q(10)$. For Whites, these estimates differ relatively little from Glover's but, for Blacks, the differences are substantial. Consider $q(5)$, the cumulative probability of death before exact age 5. Glover's estimate for Blacks is 0.338 – that is, approximately 34 percent of Black children born at the turn of the twentieth century died before reaching their fifth birthday. Preston and Haines' preferred estimate is 0.255, considerably lower. Preston and Haines' best estimate of Black life expectation at birth is 41.8 years circa 1900, almost *nine years* higher than earlier estimate. The major source of discrepancy between Preston and Haines' estimate and the estimate based solely on census survival methods is the fact that Blacks had lower child mortality circa 1900 than one would expect given the relatively high rates of adult mortality in that year.⁹

Beyond mortality data, it is also useful to have information on morbidity, both chronic and acute, among the living. Although there are numerous modern sources of data on health outcomes among the living, their historical counterparts are few. Questions on certain types of disabilities – for example, blindness – were asked of the population from 1850-80 (in 1850-60, for slaves as well as free persons). The 1880 census also included questions on whether the

⁸ In particular, Preston and Haines calculate the proportion of children surviving to the census date by age for women in a given age range, or in a given range of marital duration. Alternatively, they propose a method that uses as a starting point a model life table to get an initial set of $q(A)$'s, and then iterates backwards from the age structure of surviving children to produce a final set of $q(A)$'s that match the total number of children ever born and surviving along with their ages.

⁹ To compare their estimate with Glover's, Preston and Haines use their methods to estimate Black child mortality for the DRA states in 1900. Their estimates in these states closely resemble Glover's, further confirming that the DRA states were not representative of the national average.

individual was sick on the day of enumeration “so as to be unable to attend to ordinary business or duties,” or whether the individual was “maimed, crippled, bedridden, or otherwise disabled. Reported rates of sickness and disability in 1880 were low (around two percent of the population), suggesting that the true prevalence of these conditions was underreported. If taken at face value, the Census measure suggests little difference in sickness and disability by race; 1.7 percent of prime-age Blacks (16-64 years old) report being sick or disabled in 1880, compared to 1.8 percent of Whites. In the 2000 Census, prime-age Blacks are substantially more likely than prime-age Whites to report having “a lasting physical or mental health condition that causes difficulty working” (17 percent versus 11 percent).

The historical census data on disability have the merit of covering the national population. Other historical data with race-specific information on health, however, are less representative (if still informative). An important example, which we refer later in the chapter, involves archival data on health outcomes over the life-cycle for persons who served in the Union Army during the American Civil War. These data pertain to Whites who served in the regular Union Army, survived the war, and who later applied for an army pension; as well as to a similar selection of Black soldiers who served in the United States Colored Troops.

2.3 Long-Run Trends in Life Expectation at Birth by Race

Keeping the issues of data comparability in mind, Figure 2 graphs several time series of life expectation at birth by race compiled from available sources. The “White – PH” and “Black – PH” series reproduce estimates from Preston and Haines (1991) and Haines (2001) for 1900 and 1910. The White PH series then picks up with vital statistics data from 1940 to the present, whereas the Black PH series picks up continuously from 1970 to the present; 1970 is the first

year in which vital statistics were reported separately for Blacks, as opposed to all Non-Whites.¹⁰ Given our reading of the evidence, we believe that these series represent the best known information about trends in life expectancy by race over time.

For comparison, we also illustrate two series based on vital statistics records from the (shifting set of) states incorporated into the Death Registration Area. The “White – DRA” series runs from 1900 to 1939, and thereafter is identical with the national “White – PH” series. The “Non-White” series pertains to selected DRA states before 1940, and thereafter reports the standard national series for Non-Whites. These series has been used widely by economic historians and demographers in the past.

The dominant feature of Figure 2 for both races is the strong upward trend in life expectation at birth. There has been a very substantial gain in life expectation at birth from 1900 to the present for Whites, whether using the DRA or the Preston-Haines 1900 estimate for the base year. Between 1900 and 1950, life expectation at birth for Whites increased by 19.5 years, before increasing by another 10 years between 1950 and 2011. Approximately two thirds of the rise in White life expectancy since 1900 occurred during the first half of the twentieth century.

Blacks also experienced notable improvements in life expectation but the extent of this improvement depends on the data series in question. According to the Preston-Haines series, Black life expectancy increased by 18 years from 1900 to 1950, and then again by around 16 years from 1950 to 2011, suggesting that the increase in Black life expectation occurred in equal measure in the first half and second half of the twentieth century.¹¹ The DRA series, which likely

¹⁰ 98 percent of the non-white population was African-American in 1900. This share had fallen to 90 percent by 1970.

¹¹ We do not have a separate estimate for Black life expectancy in 1950. If we assume that the ratio of Black to Non-White life expectation is constant between 1950 and 1970, we can compute that Black life expectancy was 59.7 years in 1950 (ratio of Black to Non-White = 0.98).

understates Black life expectancy in 1900 and 1910, instead suggests much larger improvements for Blacks between 1900 and 1950 (28 years). Choice of data series also influences our understanding of racial convergence in life expectancy. According to the DRA series, the absolute gap in life expectation declined from 15 years in 1900 to four years in 2011, whereas the Preston-Haines series shows a much more muted decline (from nine years to four years).

The pace of improvement in life expectancy varied substantially across time periods for both races. The first panel of Table 3 calculates the average annual additions to life expectancy by race over five key periods of the twentieth century.¹² For Whites, the largest improvements in life expectancy occurred between 1900 and 1940, a period associated with improvements in sanitation and public health in urban areas. For Blacks, instead, the largest improvement in life expectancy occurred between 1940 and 1960, an era of rapid racial convergence in both earnings and education. We discuss these and other potential causes for improvements in life expectancy in the next section. Both races also experienced large increases in life expectancy between 1970 and 1980, a decade characterized by rapid advancement in the treatments for both cancer and heart disease (Mukherjee, 2010; Jones, 2012).¹³ Figure 2 also suggests that the annual fluctuations in mortality were much larger before 1940 for both races. While some of these fluctuations reflect biases due to changing coverage of the DRA states and other sources of incomplete data, others are real events. The most obvious example is the 1918 flu epidemic which greatly lowered life expectation at birth in the immediate short run.

2.4 Long-Run Trends in Infant Mortality by Race

¹² Periods were selected to correspond to particular eras in African American economic history, but also to reflect noticeable differences in the pace of improvement in life expectancy over time.

¹³ Modern chemotherapy, which involves a “cocktail” of drugs, was discovered in 1965. The first heart bypass surgery using modern methods was performed in 1968.

Infant mortality is another important indicator of health status. Figure 3 presents long-run trends in infant mortality by race from 1920 to 2011. In absolute terms, there have been enormous declines in infant mortality for both races since 1920. White infant mortality rates fell from 82 per 1,000 live births in 1920 to 5 per 1,000 live births in 2011. Over the same period, Black infant mortality rates fell from 135 per 1,000 live births to 12 per 1,000 live births. As with overall life expectancy, there were steeper improvements in infant mortality before 1950 than afterwards.

Interpreting the evolution of Black-White differences in infant mortality over time is sensitive to choice of measure. In absolute terms, the racial gap in infant mortality declined from 53 deaths per 1,000 live births in 1920 to 7 deaths per 1,000 live births in 2011. Yet, in relative terms, the racial gap in infant mortality rates has worsened over time. In 1920, the Black infant mortality rate was 64 percent higher than the White rate, while today the Black infant mortality rate is now 140 percent higher than the White rate. The discrepancy between these two approaches is due to the dramatic (and widely shared) reduction in infant mortality rates over time; Black infant mortality rates are now twice as high as White rates, but this racial gap is now judged relative to a low overall base rate of infant mortality.

The second panel of Table 3 presents average annual reductions in infant deaths per 1,000 live births by race over certain periods. For both races, the largest declines in infant mortality occurred between 1925 and 1945. For Whites, the pace of improvement in infant mortality then declines monotonically over the century. In contrast, there is a noticeable uptick in improvements in Black infant mortality rates from 1965 to 1980, a period directly after the passage of Civil Rights legislation that resulted in, among other things, the desegregation of southern hospitals. These patterns are consistent with Collins and Thomasson (2004) who

analyze state-level infant mortality rates by race between 1920 and 1970. Even after controlling for race-specific income and education levels, they find that infant mortality declined most sharply between 1920 and 1950 and that the pace of improvement leveled off thereafter.

Another common measure of health early in life is birth weight. Costa (2004b) examines nearly 2,000 births that took place to predominately working-class mothers at the Johns Hopkins hospital in Baltimore, MD in the first three decades of the twentieth century. In comparing this sample to modern data from the National Maternal and Infant Health Survey (from 1988), she finds that the birth weights of both Black and White babies have remained remarkably constant over the century.¹⁴ However, in each period, Black infants were around 10 percent lighter than White infants. Lower Black birth weights can be explained, in part, by higher Black rates of prematurity. Premature infants tend to be lighter than infants who are born at full term, and Black babies were more than twice as likely as White babies to be born pre-term (13 versus 7 percent in the Johns Hopkins sample). Costa argues that a large portion of the racial gap in prematurity in the early twentieth century can be explained by high rates of untreated syphilis in the Black population. The high rates of Black prematurity today are harder to explain.

2.5 Causes of Death and Chronic Conditions

Understanding the roots of improvement in life expectancy is aided by examining long-run trends in causes of death and the prevalence of chronic conditions. A useful source of historical information on these patterns is the ongoing study of the health status of Union Army veterans at the Center for Population Economics at the University of Chicago. Extensive health

¹⁴ The infants born at Johns Hopkins may have been lighter than the national average circa 1910, given the health penalty likely present in a big city like Baltimore and the selection of more complicated births into hospitals at the time.

information on Civil War veterans was collected in the late nineteenth and early twentieth centuries as part of their process of applying for a federal pension. This information has been retrieved by the CPE and augmented by linking individuals to census data. Samples have been produced for both White (the Union Army, or UA sample) and Black soldiers (the United States Colored Troops or USCT sample).

Data on chronic conditions is based on a surgeon's examination conducted as part of the pension application process. Cause of death is typically gleaned from death certificates sent to the pension office by deceased relatives (e.g., widows) seeking to prove eligibility for further benefits. Figure 4 shows racial differences in causes of death for men ages 60-74 in the UA and USCT samples circa 1910. As in the most recent data (Figure 1), the causes of death by race were relatively similar in the early twentieth century. The two largest categories – diseases of the heart and other causes – account for 56 percent of deaths for both groups, although Whites are five percentage points more likely to die from heart disease and Blacks are five percentage points more likely to be in the 'other' category. Among the less common conditions, Blacks were more likely than Whites to die of infectious and respiratory diseases or of genitourinary disease (including syphilis), and were less likely to die of cerebrovascular disease (strokes) or cancer (on this point, see also Costa, 2005).

The UA and USCT samples also provide evidence on the prevalence of chronic conditions in the early twentieth century. Figure 5 compares the relative prevalence of each condition by race in 1910 and in the 1990s. In 1910, doctors examining Union Army veterans are more likely to report that Black patients have five of the eight chronic conditions: joint and back pains ("musculoskeletal problems" associated with manual labor); irregular pulse and arteriosclerosis (signs of heart disease) and decreased breath sounds (sign of respiratory

problems). Whites were more likely to have “adventitious sounds” – “added” sounds such as crackles and wheezes when breathing. Blacks and Whites had similar rates of heart murmurs and valvular heart disease.

By the 1990s, the prevalence of chronic conditions had declined for both Blacks and Whites but the Black-White prevalence ratios were again at or above one for all conditions, indicating higher rates of disease in the Black population.¹⁵ Furthermore, for five conditions, the racial gap in prevalence rose over time. The most notable case is arteriosclerosis, for which the Black-White ratio increased from 1.7 in 1910 to 2.6 in the 1990s. The one exception to this pattern is back problems, the prevalence of which declined over time for both groups but at a slower rate in the White population, leading to slightly higher rates of back problems among Whites by the 1990s.

Costa (2004a) compares soldiers in the Union Army by race on a series of anthropometric measures, including height and Body Mass Index (BMI). In general, height is positively correlated with health and BMI is negatively associated with health, at least at higher levels. For men in their late twenties, Black soldiers were 1.5 centimeters shorter than White soldiers; were slightly heavier than White soldiers; but also exhibited less central body fat. On net, this anthropometric evidence does not provide particularly strong evidence of ill health for Blacks in the mid-nineteenth century. Military data from 1988 attests to general growth in BMI over the twentieth century; a similar racial gap in BMI is also apparent in the modern data.

3.0 Historical explanations for improvements in Black life expectancy

¹⁵ Costa (2000) studies the potential causes of the decline in chronic conditions for White men over the twentieth century. She documents that around 30 percent of the decline can be attributed to a shift from manual to white collar occupations. Another 20 percent is due to a reduction in exposure to infectious disease.

The previous section reviewed facts about racial disparities in health over the twentieth century. Black health is worse than White health in the contemporary data, as reflected in higher levels of mortality at all ages as well as higher rates of chronic conditions and higher mortality conditional on a given diagnosis. For the most part, causes of death are similar by race. As important as these disparities are today, it is critical to keep in mind that racial gaps in health were much worse a century ago. Not only has the health of African Americans improved substantially and steadily over time, the pace of change has been quicker than among Whites, and thus the racial gaps have narrowed.

In this section, we consider a number of potential causes for the improvements in Black life expectancy over the twentieth century, including investments in public health and sanitation in cities; improvements in disease environment in the South; migration from the South to the North; improvements in Black income and education; and the desegregation of hospitals during the Civil Rights Era. We organize these explanations into three time periods: 1900-1940; 1940-60 and 1965-1985. After 1985, the pace of improvements in Black life expectancy slowed, although notable improvements in Black life expectancy did occur in the 2000s.

From 1900 to 1940, the best estimates suggest that Black life expectancy increased from 42 to 55 years (Figure 2). White life expectancy also increased over this period, but at a faster rate, leading to an expansion in the racial mortality gap. This pattern is consistent with a lack of racial convergence in earnings before 1940 (see, for example, Smith, 1984). Yet, the absolute increase in Black life expectancy over this period is notable and in need of explanation. This absolute increase in life expectancy can be attributed to an improvement in the disease environment in both urban areas (due to investments in clean water and sewerage infrastructure) and in the rural South (due to treatment and eradication programs for a range of diseases). Given

that around 75 percent of the Black population lived in the rural South in 1900, we believe that efforts to combat disease in the rural South were the more significant of these two trends.

In 1900, there was a substantial urban mortality penalty, due in large part to higher rates of infectious and water-borne disease in cities (Condran and Crimmins, 1980; Haines, 2001).¹⁶ Municipal investments in clean water and sewerage infrastructure resulted in a large decline in urban mortality rates in the early twentieth century (Cutler and Miller, 2005; Alsan and Goldin, 2014). Troesken (2004) convincingly demonstrates that Black residents benefitted from these public health investments, both because the networked structure of sewer pipes made it difficult to exclude Black neighborhoods and because Black urban dwellers lived in (relatively) unsegregated neighborhoods circa 1910.

Yet, over this period, the majority of the Black population lived in the rural South and thus did not benefit from investments in urban infrastructure. Therefore, we suspect that investments in disease eradication in the South were likely more important in explaining overall increases in Black life expectancy. Given its climate and high rates of poverty, the South was beset by a series of tropical diseases in the early twentieth century, including yellow fever, malaria, pellagra, and hookworm.¹⁷ Aided by private philanthropy, southern areas reduced disease rates from 1900 to 1940. Bleakley (2007) studies the efforts of the Rockefeller Sanitary Commission to eradicate hookworm in southern counties. Surveys conducted by the Rockefeller Commission discovered that, in 1910, 40 percent of southern children were infected by hookworm. The Commission combined immediate treatment for infected individuals with a

¹⁶ Costa (2005) documents that the urban penalty was substantially larger for Blacks than for Whites in the late nineteenth century, perhaps because Black households did not have the income necessary to protect themselves against disease (e.g., through adequate nutrition).

¹⁷ Humphreys (2009) discusses the campaigns to investigate and eliminate each disease in the South.

public health campaign emphasizing the importance of hygiene and prevention. As a result, infection rates were cut in half over the next 10 years. Bleakley shows that children in treated cohorts enjoyed improved literacy rates and adult earnings. Adult health outcomes also likely improved.

The Rockefeller Foundation was also involved with malaria control in South (Humphreys, 2001; Stapleton, 2004). Reduction in malaria transmission was primarily achieved by draining wetlands to eliminate mosquitos and their breeding grounds. Malaria became rare in southern cities by 1900, but was still prevalent in the countryside. Therefore, migration from rural areas to southern cities and particularly to the North contributed to declines in malaria rates. Barreca, Fishback and Kantor (2012) demonstrate that migration over the 1930s in response to the Agricultural Adjustment Act of 1933 tended to shift population from high-malaria to low-malaria environments. Kitchens (2013) describes a counter-trend, whereby the Tennessee Valley Authority dams built in the 1930s created pools of standing water, thereby increasing malaria prevalence. Yet, despite the TVA-driven rise in malaria, overall malaria rates in the US South had fallen substantially by 1940.

Over 40 percent of the southern Black population migrated out of the South between 1915 and 1970, typically to large industrial cities. These migrants left behind the poor disease environment of the South and moved to cities with new public investments in clean water and sewerage. Yet, despite *reductions* in the urban health penalty in the early twentieth century, it is not clear that moving to a city generated a net improvement in health. Black migrants lived in dense, segregated neighborhoods close to industrial sites, which may have contributed to deaths from heart disease, cancer, and other causes.

Two recent papers suggest that Black migration to urban areas worsened health conditions. Black, Sanders, Taylor, and Taylor (2014) use Medicare records to assess the effect of migration on Black mortality rates. The Medicare system keeps detailed records on recipient's place of birth, allowing the authors to instrument for migration using proximity to a train line during childhood. They find that moving to the North reduced longevity – for example, increasing the likelihood of dying between the ages of 65 and 70 by around five percentage points. They suspect that a portion of this Northern health penalty was due to increased prevalence of drinking and smoking. Consistent with this pattern, Eriksson and Niemesh (2014) document higher infant mortality rates in Black migrant households compared to households that remained in the South, even after controlling for a series of family background characteristics.

Taken together, Blacks benefited from improvements in health conditions in both the rural South (due to disease eradication) and the urban North (due to public health improvements). Yet there was also a substantial net migration to urban areas, which continued to be associated with a health penalty. We conclude that reductions in place-specific mortality from 1900 to 1940 were partially offset by migration to a less-healthy environment.

The pace of improvement in Black health increased over the next twenty years, with Black life expectancy increasing by 10 years from 1940 to 1960. This period corresponds to an era of rapid racial convergence in earnings (Smith and Welch, 1989; Donohue and Heckman, 1991). Black-White earnings convergence was due, in part, to relative increases in Black educational attainment. Relative increases in black educational attainment began in earnest in the birth cohort of 1910, members of which would have entered the labor market circa 1930 (Aaronson and Mazumder, 2011; Margo, 1990; Collins and Margo, 2006).

A large literature in epidemiology documents a negative gradient between income (or education) and mortality (Backlund, Sorlie and Johnson, 1996, 1999; Sorlie, Rogot, Anderson, Johnson and Backlund, 1992). On this topic, economists have conducted a series of well-identified studies studying the relationship between education and mortality by exploiting variation in compulsory schooling laws across states and over time (Lleras-Muney, 2005; Oreopoulos and Page, 2006; Almond and Mazumder, 2006). We use estimates from this literature to gauge the share of improvement in Black health outcomes from 1940 to 1960 that can be explained by growth in Black incomes and education.

Existing estimates suggest that increases in black earnings and educational attainment can explain a large portion of the reduction in Black mortality rates from 1940 to 1960. Age-adjusted death rates per 100,000 in the Black population fell from 1,500 to 1,000 over this period, a decline of 33 percent (Haines, 2006). At the same time, median black earnings increased by around \$8,000 (in 2000 dollars). According to Backlund, Sorlie and Johnson (1999, Figure 3), an earnings increase of this magnitude would be associated with a 10 percent reduction in the relative risk of mortality, which can account for around one third of the decline in Black mortality over this period. Furthermore, black educational attainment also increased substantially, rising from a median of six years of schooling for prime-age adults (18-65) in 1940 to a median of eight years of schooling by 1960. Lleras-Muney (2005) estimates that an additional year of schooling is associated with a 1.7 to 3.7 percentage point reduction in the probability of dying over the next ten years, on a base of around 10 percent (or, a 17 to 37 percent decline). Even her lower bound implies that improvements in black education can explain all of the improvements in Black mortality over this period.

Blacks entering the labor market circa 1940 can be characterized not only by their relative increases in years of educational attainment, but also by improvements in the average quality of the school that they attended, as measured by pupil-teacher ratios, the length of the school term, or per-pupil expenditures (Margo, 1990; Card and Krueger, 1992). Frisvold and Golberstein (2011) find modest evidence that improvements in school quality contributed further to Black health improvements, particularly in self-rated health.

Black infant mortality rates experienced a notable decline from 1965 to 1980. These years coincided with key Civil Rights legislation ending the segregation of hospitals in the South. Almond, Chay and Greenstone (2006) document that, before this period, 40 percent of Black births in the rural South occurred outside of hospitals, compared to four percent of White births. The Civil Rights Act of 1964 forbade institutions receiving federal funding from discriminating on the basis of race. The establishment of Medicare in 1965 provided a large potential stream of federal dollars, which encouraged hospitals in the South to desegregate. Almond and co-authors demonstrate that the rapid desegregation of hospitals in 1965 encouraged black births to take place in hospitals, thereby contributing to reductions in Black infant mortality.

In theory, the Medicare program, which provided health insurance to elderly, may have contributed to general improvements in Black life expectancy (beyond reductions in infant mortality) in the 1970s. Yet, Finkelstein and McKnight (2008) find no effect of this program, either on overall mortality or on mortality of non-Whites; they speculate that hospitals could do little to treat chronic conditions at the time, which are the principal cause of elderly mortality.

4.0 Concluding Remarks and Suggestions for Further Research

This chapter has examined long-run trends in racial differences in health. Our discussion concentrated heavily on mortality trends, which have the most complete historical records, and therefore have received the most attention from social scientists, but we have also surveyed the available evidence on chronic conditions and disabilities.

Our most basic conclusion is that racial disparities in health have narrowed substantially over the course of the twentieth century. At the same time, there remain in the United States today medically and economically significant gaps in health outcomes by race – Black health status continues to lag behind White health status. These racial disparities are the subject of extensive and ongoing research by scholars and medical practitioners today, and for good reason.

It is easier to list the factors behind the long-term narrowing of racial differences in health than to conclusively measure and rank their relative importance. Blacks benefited from public health improvements in the early twentieth century, and later from policy interventions in the 1960s that expanded health care for the poor Americans in general and Blacks in particular, through hospital desegregation. Yet much of the improvement in Black health outcomes, in our view, should probably be ascribed to increases in household incomes and education – particular the latter, since some pathways to higher incomes, such as migration from the rural South to the North appear to be associated with worsening health outcomes.

Although the historical trend in Black mortality rates is clear, as is the basic contours of an historical explanation for the trend, much research remains to be done. In particular, the exact timing and location of changes in Black mortality from the late nineteenth century to World War Two requires further illumination. Further work is also needed to clarify the mechanisms behind the long-term decline in Black mortality and other health outcomes.

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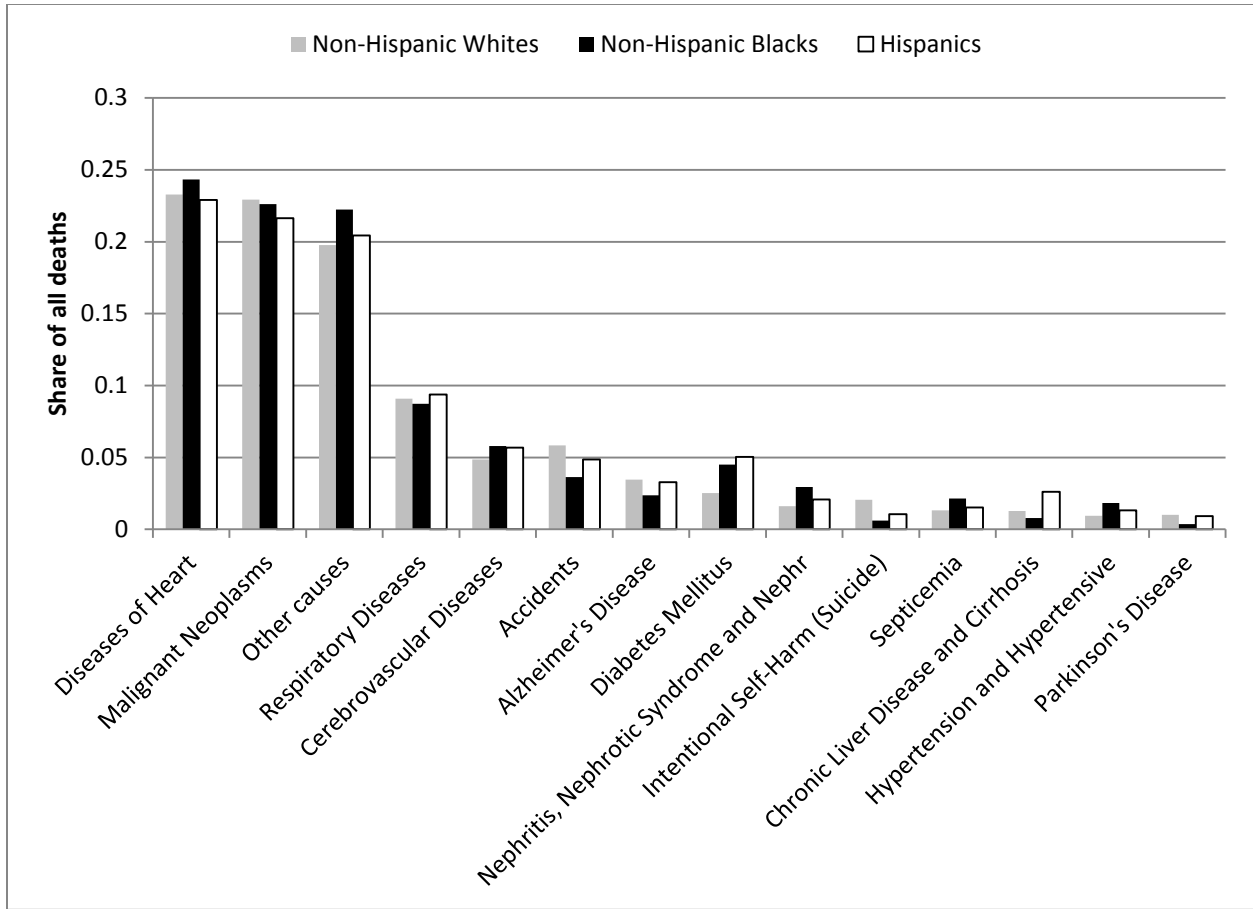
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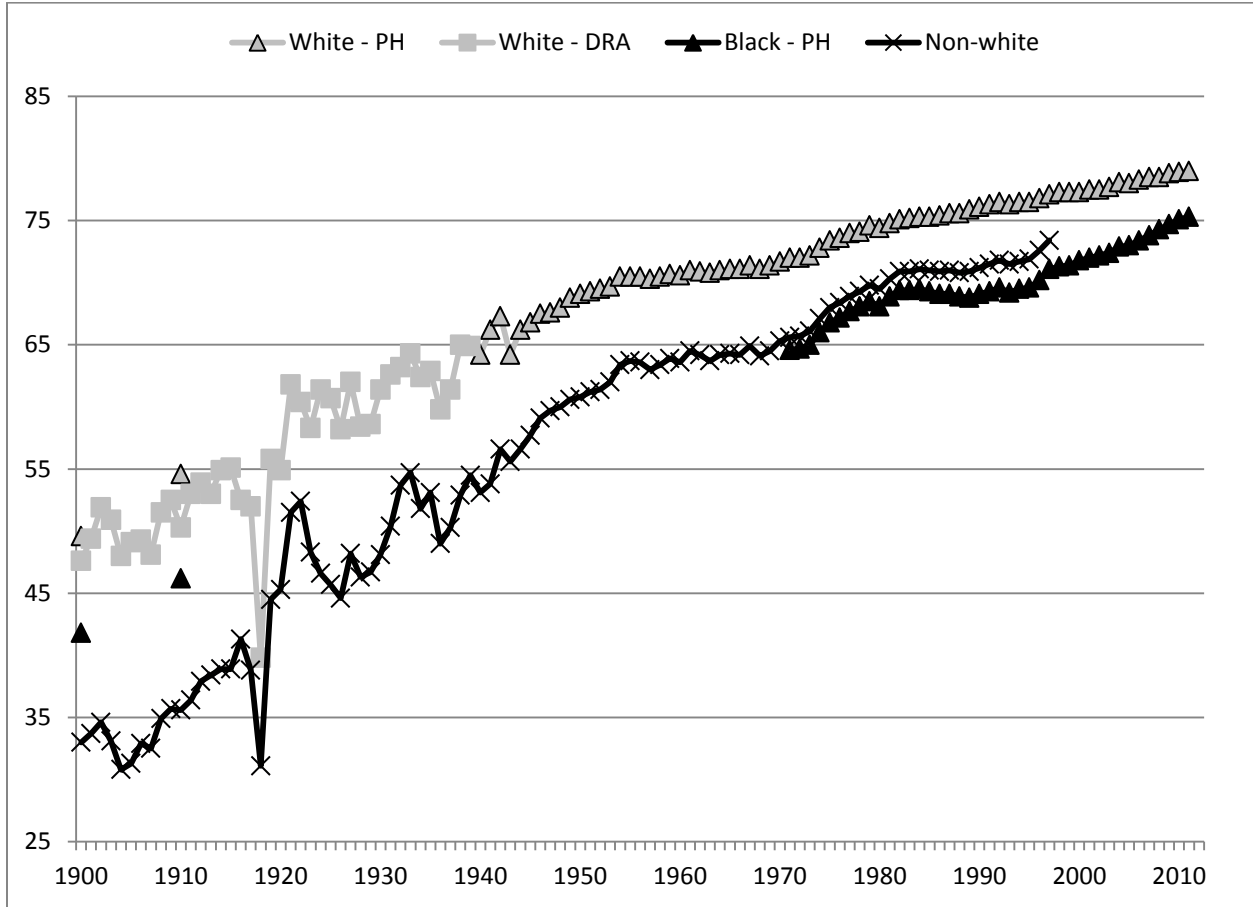
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Figure 1: Causes of Death by Race, 2011



Source: CDC National Center for Health Statistics
http://www.cdc.gov/nchs/data/dvs/2011_Final_Mortality_Data_Release.pdf

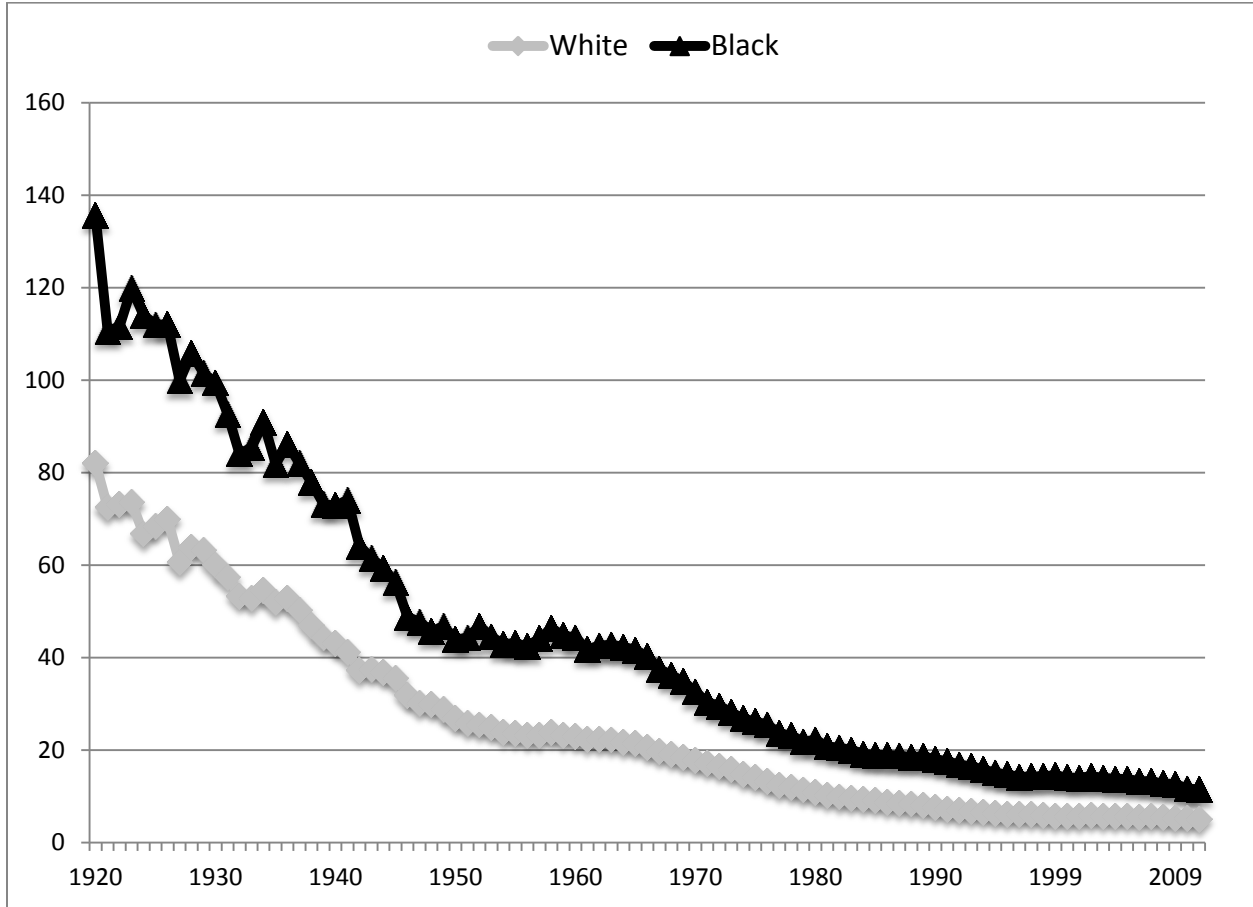
Figure 2: Life expectancy by race, 1900-2011



Sources: “White - PH” and “Black - PH” values in 1900 and 1910 from Preston and Haines (1991, Table 2.5). All other values are from Historical Statistics (1900-1997) and CDC National Center for Health Statistics (1998-2011).

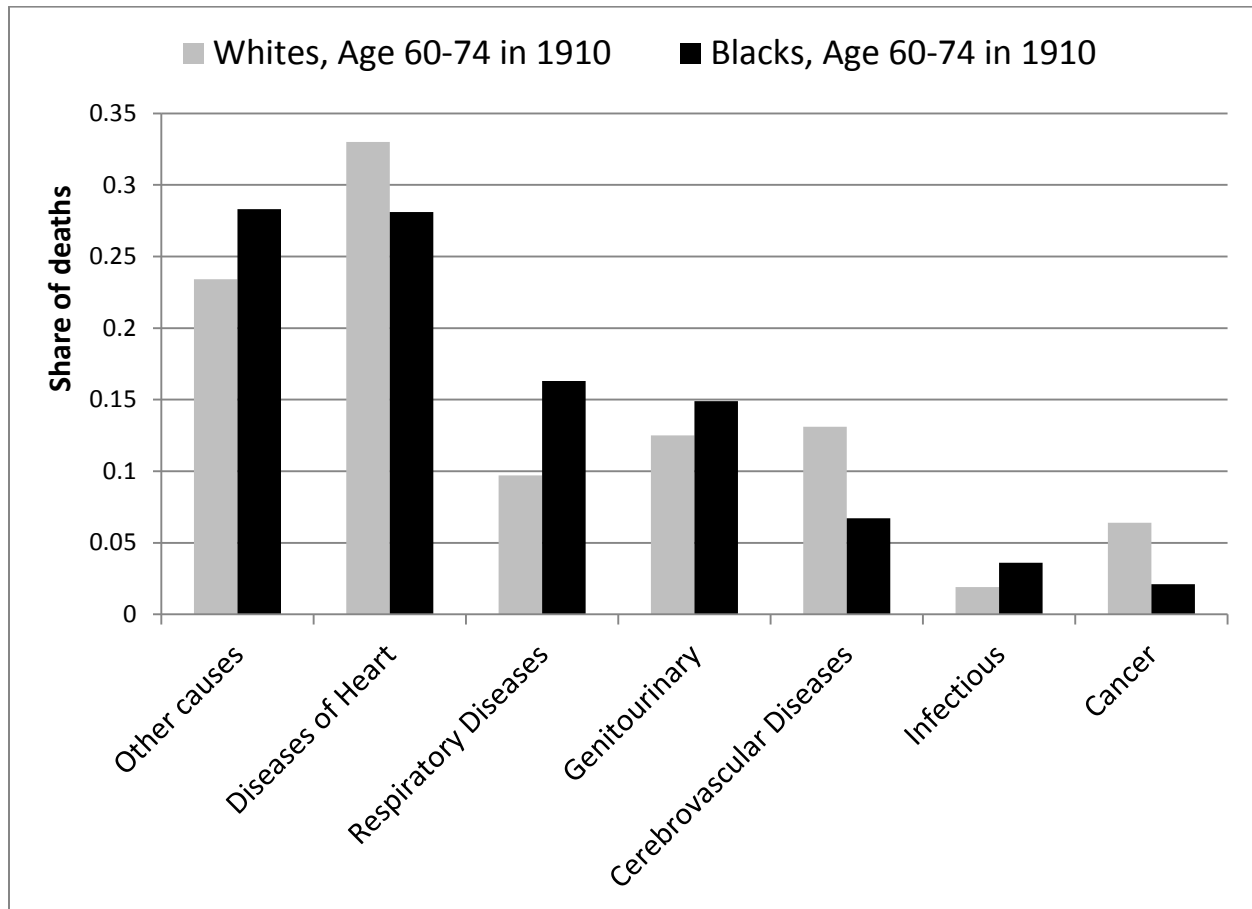
http://www.cdc.gov/nchs/data/dvs/2011_Final_Mortality_Data_Release.pdf.

Figure 3: Infant mortality rates per 1,000 live births by race, 1920-2011



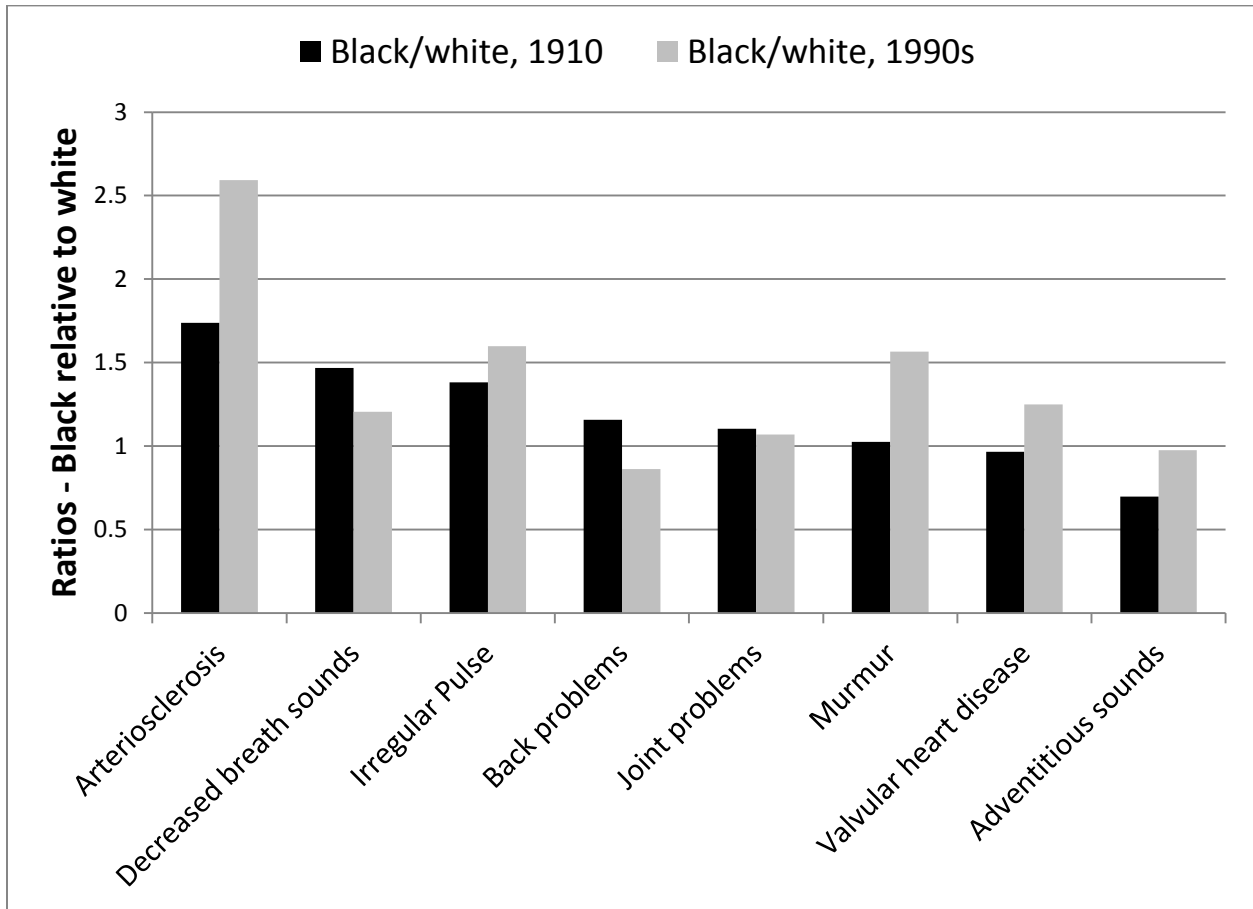
Sources: 1920-1997 from Historical Statistics; 1998-2011 from CDC National Center for Health Statistics (http://www.cdc.gov/nchs/data/dvs/2011_Final_Mortality_Data_Release.pdf).

Figure 4: Causes of death, Union Army sample, Men aged 60-74 in 1910



Source: Costa, Helmchen, and Wilson, *PNAS* 2007, Table 3. Data include whites and blacks in the Union Army data in the birth cohorts of 1836-1850.

Figure 5: Black-White ratios of chronic condition prevalence over time, Men aged 60-74, circa 1910 and circa 1990



Source: Costa, Helmchen, and Wilson, *PNAS* 2007, Table 2. 1910 data include Whites and Blacks in the Union Army data in the birth cohorts of 1836-1850. 1990s data from the National Health and Nutritional Examination Surveys. We report data from 1999-2004 when available; in other years, we report data from 1988-94. These prevalence rates are physician-reported, with the exception of heart murmurs and valvular heart disease.

Table 1: Life expectancy at various ages by race, 2011

Age	White	Black	Racial gap
0	79	75.3	3.7
1	78.4	75.2	3.2
10	69.5	66.4	3.1
20	59.7	56.6	3.1
40	40.7	38.1	2.6
60	23.2	21.5	1.7
70	15.5	14.7	0.8
80	9	9.1	-0.1
90	4.5	5.1	-0.6

Source: Table 7, National Vital Statistics Report (NVSR) “*Deaths: Final Data for 2011.*”

Table 2: Survival rates conditional on cancer diagnosis by race

	1974-1976	1980-1982	1989-1994	2004-2010
White	50	52	62	66.7
Black	39	40	47	59.7
Black-White	0.78	0.77	0.76	0.90

Source: 1974-1994 values: Landis, Murray, Bolden and Wingo. "Cancer Statistics, 1999." *CA – A Cancer Journal for Clinicians*, 1999, 49, 8-31. 2004-2010 values: National Cancer Institute; Surveillance, Epidemiology and End Result Institute

http://seer.cancer.gov/csr/1975_2011/results_merged/topic_survival.pdf

Figure 3: Improvements in life expectancy and infant mortality by period and race

	Average annual additions to life expectancy (in years)	
	White	Black
1900-40	0.39	0.28
1940-60	0.28	0.50
1960-70	0.09	0.11
1970-80	0.29	0.44
1980-2010	0.14	0.22
	Average annual reductions in infant deaths per 1,000 live births	
	White	Black
1920-45	1.65	2.58
1945-65	0.68	0.73
1965-80	0.69	1.36
1980-2010	0.18	0.25

Notes: Calculated from three-year moving averages of data series presented in Figures 2 and 3. Life expectancy calculations are based on the Preston and Haines series.