



Life expectancy in adulthood is falling for those without a BA degree, but as educational gaps have widened, racial gaps have narrowed

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A 4-y college degree is increasingly the key to good jobs and, ultimately, to good lives in an ever-more meritocratic and unequal society. The bachelor's degree (BA) is increasingly dividing Americans; the one-third with a BA or more live longer and more prosperous lives, while the two-thirds without face rising mortality and declining prospects. We construct a time series, from 1990 to 2018, of a summary of each year's mortality rates and expected years lived from 25 to 75 at the fixed mortality rates of that year. Our measure excludes those over 75 who have done relatively well over the last three decades and focuses on the years when deaths rose rapidly through drug overdoses, suicides, and alcoholic liver disease and when the decline in mortality from cardiovascular disease slowed and reversed. The BA/no-BA gap in our measure widened steadily from 1990 to 2018. Beyond 2010, as those with a BA continued to see increases in our period measure of expected life, those without saw declines. This is true for the population as a whole, for men and for women, and for Black and White people. In contrast to growing education gaps, gaps between Black and White people diminished but did not vanish. By 2018, intraracial college divides were larger than interracial divides conditional on college; by our measure, those with a college diploma are more alike one another irrespective of race than they are like those of the same race who do not have a BA.

life expectancy | educational divide | bachelor's degree | racial divide

This paper concerns two related phenomena, faltering life expectancy and, within that, the increasing divide between Americans with and without a bachelor's degree (BA).^{*} A near century of declining mortality up to the late 1990s continued into the 21st century for more-educated Americans but stalled for the population as a whole and reversed for the two-thirds of Americans who do not have a college degree.

As we have documented elsewhere (1–3), Americans without a BA have seen rising mortality from drugs, suicide, and alcoholic liver disease—deaths of despair. The reduction in deaths from cardiovascular disease which was the driving force of mortality reduction in the last third of the last century has slowed for everyone but has stopped and reversed among those without a 4-y degree. Deaths from smoking-related diseases continue to be important especially among White women without a BA (4). Similar divergence can be seen in morbidity—pain of all kinds (5), disability, difficulty socializing, and self-rated health—and in marriage, churchgoing, life evaluation, money, and in jobs. Here too, the big differences are between those with and without a 4-y degree; people with some college do better than those with only a high school degree, but the biggest step is between some college and a 4-y degree.

Good jobs have become increasingly rare for workers without a college diploma, many of whom have lost their jobs to globalization and automation and for whom the cost of employer-provided healthcare has increasingly priced them out of the high-quality labor market. For them, real wages have fallen as has participation in the labor force. By 2010, the earnings premium for the BA over high school had reached a record 80% (6).[†] These changes in the labor market have undermined the conditions for a successful

working life to the point in which, according to the political philosopher Michael Sandel, “the college degree is a condition of dignified work and of social esteem.” (7) For Americans without a college diploma, it is increasingly difficult to build a meaningful and successful life; in this paper, we explore what the BA divide has done to the length of those lives.

In 2019, among those aged 25 or over, only 36% of Americans had a 4-y college degree or more, 35% of men, and 37% of women; the fractions are lower among Black people, 24% and 28%, and Hispanic people, 17% and 21% (8).

According to the National Center for Health Statistics (NCHS), American life expectancy peaked at 78.9 in 2014; in 2018, the last available year, it was 78.7, 0.1 y more than in 2017 but still below the peak (9). Adult life expectancy—the expectation of life at age 25, or e_{25} —peaked earlier, in 2012, at 54.85 so that at age 25, conditional on age-specific mortality rates not changing, the expected age of death was 79.85.[‡] All of these familiar measures are period measures, estimates for each period (here, year) of expected years of life on the (almost certainly false) assumption that the age-specific mortality rates for that year remain unchanged as people age. Each measure is a convenient summary of the mortality rates in a specific year and not a forecast of how long a birth cohort can be

Significance

Without a 4-y college diploma, it is increasingly difficult to build a meaningful and successful life in the United States. We explore what the BA divide has done to longevity, focusing on a measure of expected years lived between ages 25 and 75. In the richest large country in the world, with frontier medical technology, expected years lived between 25 and 75 declined for most of a decade for men and women without a 4-y degree, even prior to the arrival of COVID-19. For those with and without a BA, racial divides narrowed by 70% between 1990 and 2018, while educational divides more than doubled for both Black and White people.

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^{*}When we refer to those with a BA, we include those with higher qualifications.

[†]This premium continued to grow after 2010 and stood at 86% in 2019 (authors' calculations using the CPS).

[‡]Earlier figures for life expectancy e_0 and for adult life expectancy e_{25} are taken from the US life tables from 1990 through 2017, available at https://www.cdc.gov/nchs/products/life_tables.htm.

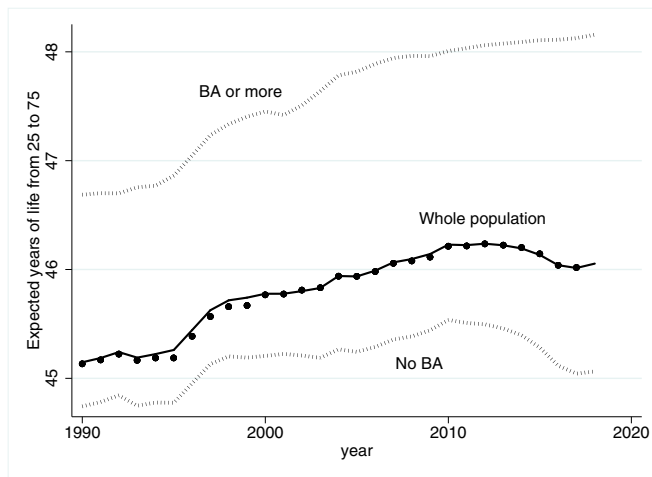


Fig. 1. Expected years of life from 25 to 75 by BA status.

expected to live. We follow this period methodology throughout this paper, and when we refer to expected years, it is always in that context; we are summarizing mortality rates in each year using a measure that has a convenient interpretation in terms of years lived, not making predictions of future life lengths. Our interest is in the evolution of mortality rates over time, not in following people as they age through the changing mortality environment.

Life expectancy at birth obviously cannot be divided according to a 4-y college degree, and the NCHS does not publish estimates of e_{25} by educational attainment. The literature has several estimates for some years, usually for a range of educational attainments including for those with a 4-y degree, which can be compared with the NCHS's estimates for the population as a whole. Meara et al. (10) showed that almost all of the increase in adult life expectancy from 1990 to 2000 had accrued to those with at least some college, while Olshansky et al. (11) documented rising adult life expectancy for Black and White men and women with at least 16 y of education with data from 1990, 2000, and 2008. Sasson (12) and especially Sasson and Hayward (13) anticipated some of our key results and showed, comparing 2010 and 2017, that adult life expectancy rose (fell) for those with (without) a college degree; they also examined the associated changes in expected years of life between 25 and 85, ${}_{60}e_{25}$, by cause of death. All of these papers use the National Vital Statistical System (NVSS) to cull information from death certificates, the same methodology employed below. There are a number of papers on education and mortality that use the mortality follow-up to the National Health Interview Survey (NHIS);⁸ we discuss our own choices in the *Methods* section, noting here only that although the levels are different by source, trends are not. Our work focuses on the college divide and provides the annual time series from 1990 that is needed to see the shape and timing of trends and reversals in life expectancy, particularly the changing gaps by race and by education.

Our main measure is the number of years a 25 y old can expect to live before his or her 75th birthday on the assumption that mortality rates do not change, ${}_{50}e_{25}$ in standard notation.⁹ Like life expectancy at birth or adult life expectancy, it is a period measure and should be thought of as a summary of mortality rates between ages 25 and 75 in a given year; these are the ages between which adverse trends have occurred in the last three decades (17–19). Unlike age-adjusted mortality rates, which we examine in the *SI Appendix*, ${}_{50}e_{25}$ does not depend on the choice of a reference

population and has a simple interpretation as expected years (given unchanging mortality rates) with an (ideal) upper bound of 50.

Methods

Data are taken from the death certificates in the NVSS; we use records for all 48.9 million deaths of people aged 25 through 84 between 1990 and 2018 (deaths at ages 75 to 84 are used for the graphs of adult life expectancy in the *SI Appendix*). The death certificates record year of death, age, sex, race, ethnicity, and education since 1989. However, a few states delayed adding education to death records: Oklahoma (1997), South Dakota (2004), Georgia (2010), and Rhode Island (2016). For these and other reasons, 6.64% of death certificates were missing educational information. Missing cases were assigned a BA or not in the same proportion as nonmissings by year, age, sex, race, and ethnicity. The coding of education changed over time. When years of education were reported, we coded those with 16 y or more as having a BA; when degrees were reported, we used the information directly. Data on population at risk by year, sex, race, ethnicity, age, and education were taken from the American Community Survey (ACS) from 2000 on. Prior to that, we used population data from successive Current Population Surveys (CPS). The ACS is an order of magnitude larger than the CPS so that for smaller populations, especially older non-White people with a college degree, estimates of mortality rates before 2000 are less precise except for 1990, in which the CPS is weighted to match the 1990 census. There are too few Hispanic women with BAs—especially elderly Hispanic women—to allow useful calculations, so we present estimates only for Hispanics irrespective of education. For non-Hispanic Black people aged 40 and above with a BA, we smooth the data using fitted mortality rates obtained by regressing the log odds of mortality linearly on age and a set of year indicators.

We used standard life table methods to calculate e_{25} and ${}_{50}e_{25}$, the number of expected years of life between ages 25 and 75, calculated as $(T_{25} - T_{75})/l_{25}$ in standard life table notation, total number of person years lived above 25 minus total number of person years lived above 75 divided by survivors to age 25. Note that this is not the same as $e_{25} - e_{75}$, nor, despite using T_{75} , does it depend on mortality rates at ages 75 or above, because changes in these mortality rates add (or subtract) identical amounts to both T_{75} and T_{25} , leaving their difference unaffected. Estimates by race, sex, and year, but not by education, are available from the NCHS;¹⁰ we use those to check our own estimation procedures. A technical advantage of focusing on ${}_{50}e_{25}$ is that it requires no information on mortality rates of those aged 75 or more, which are harder to measure reliably, especially conditional on education and race; not only is the education information on the death certificates likely to be less reliable at older ages, but population-at-risk estimates by education are uncertain and vary from year to year so that estimates of mortality by education, race, and sex are noisy at best.

The use of NVSS runs the risk of a mismatch between education as reported by the individual in the CPS or ACS and as reported by or to the funeral director and recorded on the death certificate. There is no complete match of the census into the death records that could be used to check this. However, in one study comparing decedents' education reported on death certificates with their education reported in the CPS, the BA/no-BA classification matched closely; differences between the two were more common further down the education distribution, including whether the decedent had a high school diploma (20). An alternative to the NVSS is the mortality follow-up to the NHIS which avoids dual source reporting of education (21). This comes at the price of using a sample, not the whole population, and sampling only from the noninstitutionalized population and so excluding, for example, the homeless, the military, prisoners, and people in elder care facilities; as a result of these exclusions, it understates mortality rates and overstates life expectancy. Nor should it be assumed that education is not misreported in interviews; for example, the fraction of people reporting a BA tends to increase with age within a birth cohort by about 1.3 percentage points each decade of age after age 35. While some of this reflects genuine educational upgrading among adults, some is presumably reporting bias as people award themselves imaginary degrees as they age. Selective mortality—that those with less education are more likely to die at any given age—will increase the average education within a birth cohort with age. However, mortality rates are too low for individuals in their 30s and 40s—about 3% over 20 y—for this to explain more than a small fraction of the increased reports of college completion.¹¹ It is thus good to note that the studies of mortality and

⁸See https://www.cdc.gov/nchs/products/life_tables.htm.

¹¹Using the ACS, the percent of the 1970 birth cohort reporting a 4-y degree increases from 29.2% at age 30 to 35.4% at age 48. If all deaths for this cohort were among those without a BA between ages 30 and 48, the fraction of the cohort with a BA would rise from 29.2% to only 29.8%; a 14% mortality rate would be required to raise it to 35.4%.

⁸Two of many examples are Montez et al. (14) and Montez and Zajacova (15).

⁹Arriaga (16) proposed the measure, which he refers to as “temporary” life expectancy, a term that does not seem appropriate for a 50-y interval.

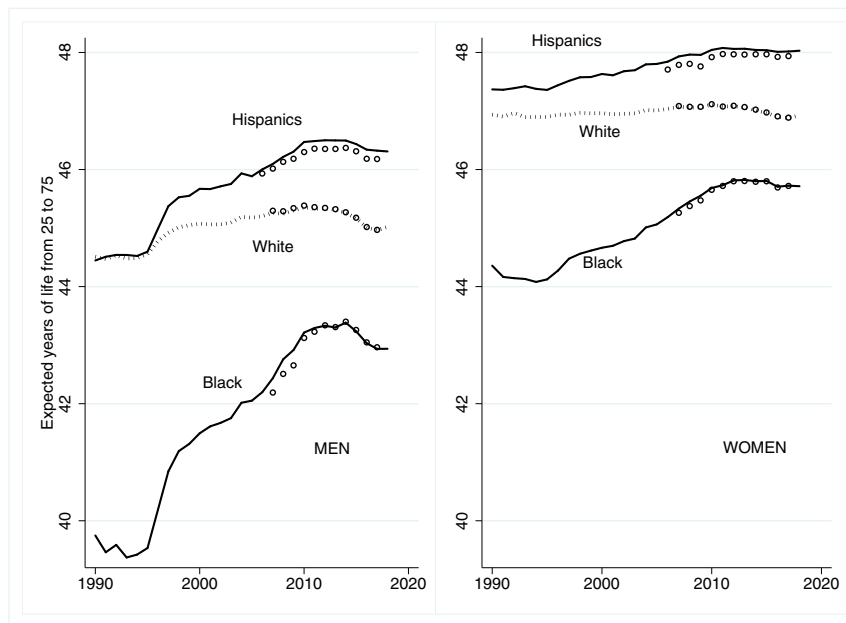


Fig. 2. Expected years of life from 25 to 75 by race, ethnicity, and sex.

education that have used the NHIS find similar trends to those reported here (22).

Results

Fig. 1 shows the time path of expected years of life between 25 and 75 on the standard period assumption of fixed mortality. The graphs are for the US population as a whole as well as for those with and without a BA. The dots on the middle line show the official calculations from the NCHS;** our own calculations are always close, giving confidence to our split by education in which there are no official data to check. The figure establishes a pattern of almost continuous progress for both education groups until 2010 but with widening gaps followed by an absolute decline for those with less education after 2010. Americans with a BA continue to make progress but at a slower rate than before 2010. By 2018, they could expect 48.2 y out of a possible 50, compared with 45.1 y for those without a BA. In the *SI Appendix*, we show that these patterns also characterize adult life expectancy, e_{25} , as well as age-adjusted mortality for ages 25 to 74; the findings are not specific to our choice of ${}_{50}e_{25}$ to summarize mortality. Extending expected years beyond 75 makes the numbers and the gaps bigger, but the pattern is the same. The patterns of adult life expectancy since 1990 have been shaped by what has happened to deaths before age 75 which is where we focus our attention.

Fig. 2 shows racial and ethnic differences without distinction by education. Men are on the left and women on the right, and each panel shows non-Hispanic White (subsequently White), non-Hispanic Black (subsequently Black), and Hispanic people. The circles show the NCHS numbers; the NCHS makes adjustments to the mortality rates for race misclassification so that the rates in the life tables are not identical to the rates from the death certificates which we use and which match those reported in Centers for Disease Control and Prevention Wide-ranging Online Data for Epidemiologic Research (CDC WONDER).^{††} The adjustments are small except for Hispanics in which the

NCHS adjusts mortality rates upwards by about 3% on average (23). For our purposes, these adjustments make no substantive difference to interracial or intertemporal patterns. We do not attempt to replicate them because we have no basis for doing so when disaggregating by education.

Fig. 2 shows that between 25 and 75, expected years for men are further from the maximum of 50 y than are those for women, and Hispanics are closer to 50 than White people, who, in turn, are closer to 50 than Black people, rankings that hold for both men and women. As to trends, White people have shown little progress; indeed, White women actually lost ground between 1990 and 2018. Until 2012, the date at which adult life expectancy for the whole US population turned down, Black men and women made substantial gains relative to White men and women, narrowing a gap that has existed as far back as the data allow measurement. The gap for men reached its lowest point of 1.88 y in 2014 and rose slightly to 2018; for women, the gap has not shrunk consistently since 2013. Black–White gaps stopped shrinking around the time that life expectancy at birth stopped rising. Hispanics pulled away from White people, although their rate of improvement was less than that of Black people. At some point between 2010 and 2013, progress stopped for all six groups. The turnaround was sharpest for Black men who had to that point been less affected by the opioid epidemic and who saw rapid progress against heart disease stall and rates begin to rise. Over the 28-y period as a whole, Black and Hispanic people gained relative to White people, with progress stopping for all groups at some point on or after 2010.^{‡‡}

Fig. 3 disaggregates these results by education. There are relatively few Hispanics with 4-y degrees, which inhibits accurate estimation but also implies that the lines for Hispanic men and women without a 4-y degree are very close to and only slightly below the lines for Hispanic men and women in Fig. 2 and so are not shown here.

**These are extracted from successive life tables available at https://www.cdc.gov/nchs/products/life_tables.htm.

††See <https://wonder.cdc.gov/ucd-icd10.html>.

‡‡As shown in *SI Appendix, Fig. S4*, Hispanics have a greater advantage in life expectancy at age 25 than their advantage in ${}_{50}e_{25}$. This is due to lower Hispanic mortality rates beyond age 75. The age-adjusted mortality rate for Hispanics ages 75 and older was 4,925.4 in 2018, which compares favorably to those for White non-Hispanics (7,015.1) and Black non-Hispanics (6,847.5). We are grateful to Sam Preston for this observation.

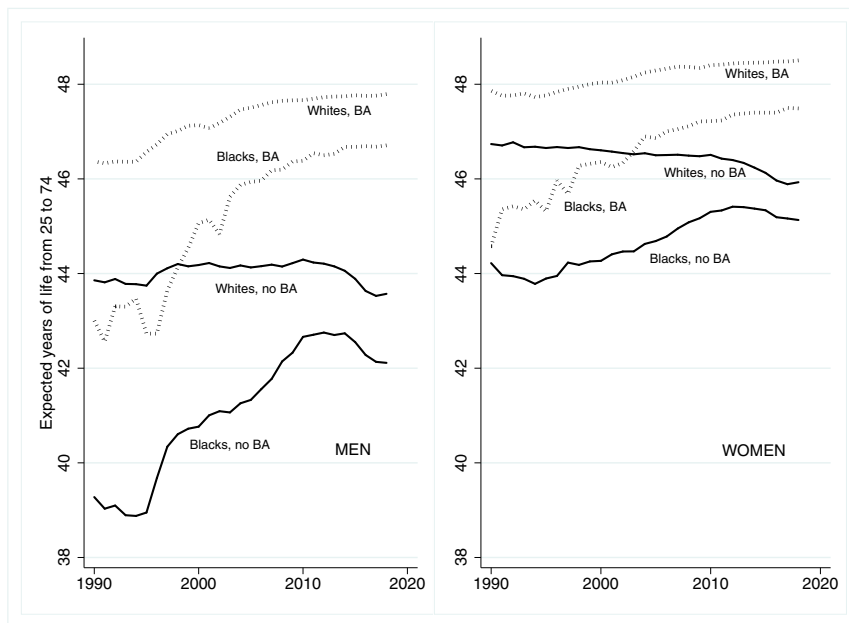


Fig. 3. Expected years of life from 25 to 75 by sex, race, and BA status.

Remarkably, the mortality turndown is only for those without a BA, one of our two main results. The other, perhaps even more remarkable, is that the narrowing of racial gaps that we have already seen has come with a pronounced widening of the gaps between those with and without a BA. Black men and women with a BA, who used to have fewer expected years from 25 to 75 than White people without a BA, now have more expected years. As a result, Black people with a BA are currently closer to White people with a BA than to Black people without a BA, in sharp contrast to the situation in 1990. The same is true for White people with a BA who are closer to Black people with a BA but much farther from White people without a BA, again something that was not true in 1990. The patterns of closeness and distance reversed between 1990 and 2018, though always with period estimates of expected years from 25 to 75 higher for White people than for Black people and for the more educated relative to the less educated. Table 1 lists the gaps between White and Black people in the top panel and between those with and without a BA in the bottom panel for 1990 and 2018. As we move from left to right across the top panel of the table, the gaps by race become smaller by two-thirds or three-quarters. Across the bottom panel, by contrast, the gaps by education group become larger over time, also by substantial amounts.

These widening gaps have the consequence that for those who made the least progress in Fig. 2, White men and especially White women, those without a BA have done even worse. Fig. 2 shows period estimates of expected years between 25 and 75 continuously falling for White women, while the situation is little better for White men. Black men and women did much better until the reversal around 2010. Again, it is notable that for Black people, as for White people, the reversal is only seen among those without a BA; those with a BA have seen a slowing of gains but no reversal.

Discussion

Our main aim here is to document the patterns in Figs. 1 to 3, that the fall in period life expectancy between 25 and 75 in the US population is confined to those without a 4-y college degree, and that this is true for men and women and for Black and White people. The widening educational differences have meant that

education is now a sharper differentiator of expected years of life between 25 and 75 than is race, a reversal of the situation in 1990. The causes of death behind these patterns have been well researched (19) and are summarized, for example, by Sasson (4) and by Sasson and Hayward (13). Deaths of despair, especially drug overdoses, rose rapidly beginning in the mid-1990s, and cardiovascular disease, which was the main engine of mortality decline after 1970, stopped declining and started to rise for Black and White men and women around or after 2012. If actual deaths are compared with the deaths that would have occurred had previous trends continued, what has happened to cardiovascular disease is by far the largest factor (24, 25). Obesity is likely implicated in this (26). Smoking-related deaths have been important, especially for women who were slower than men both to start and to stop, behavior that also contributes to heart disease mortality. However, the timing of the stalling of progress against cardiovascular disease is too uniform by race and sex for either obesity or smoking to provide a complete explanation.

Our main interest is to document the mortality or period life expectancy premium that comes with the BA, by race, and by gender in exactly the same way that labor economists have long documented the parallel premium in earnings. Discussions of the mechanisms behind those premia and how they change over time are of paramount interest but are not our main focus here. Even so, we hazard some brief remarks.

Our preferred account is that changes in labor markets, especially automation and the increased demands for more educated workers to operate the robots as well as the rising costs of employer-provided healthcare, have reduced the supply of good, well-paid jobs for people without a BA. In the early 1980s, median wages of prime-aged (25 to 54) workers with a 4-y degree were 40% higher than those without. This college wage premium had soared to 80% by the late 20-teens, in part through the rise in real wages for those with a BA and in part through the decline in real wages for those without.^{§§} If people

^{§§}Authors' calculations were made using the CPS. A similar calculation comparing those with a BA to those with a high school diploma is presented in Case and Deaton (3).

Table 1. Gaps in expected years of life 25 to 75 by race and by BA status

	Men		Women		All	
	1990	2018	1990	2018	1990	2018
Difference, White minus Black						
No BA	4.6	1.5	2.5	0.8	3.5	1.1
BA	3.4	1.1	3.3	1.0	3.7	1.0
All	4.8	2.1	2.6	1.2	3.6	1.6
Difference, BA minus no BA						
Black	3.7	4.6	0.4	2.4	1.4	3.6
White	2.5	4.2	1.1	2.6	1.6	3.5
All	3.0	3.9	1.3	2.2	1.9	3.1

set their standard of success as doing at least as well as their parents, it is possible that, since 1970, a rising number see themselves as unsuccessful (27).

The decline in wages has been paired with a long-run decline in labor market attachment for those without a BA. In the early 1980s, 6% of prime-aged men without a BA were not participating in the labor force. This grew to 14% by the late 20-teens. By comparison, men with a BA experienced a much smaller (3 percentage point) reduction in labor force participation over that period. Reduced wages and labor force participation for those without a BA have had negative effects on family life. Marriage is often postponed until at least one partner has a job with prospects. In 1980, 80% of adults without a BA were married at age 40. By the late 20-teens, that figure had dropped to 60% (3). American adults without a BA are increasingly more likely to report pain in midlife to the point that those now in middle age report more pain than the elderly, something not observed for those with a 4-y degree (5). These forces work to deprive working-class life in America of meaning and social structure, conditions that since Durkheim have been seen as fertile ground for self-destruction through suicide, alcoholism, obesity, or drugs.

This process was much accelerated after the mid-1990s by an iatrogenic drug epidemic that eventually morphed into an epidemic of illegal drugs, reaching the Black community after 2013. The labor market forces operated for both Black and White people, though Black people had a related but earlier crisis in the 1960s and 1970s, followed by an epidemic of HIV/AIDS; however, since then, they have experienced considerable reductions in discrimination and increases in education and social standing.

The fraction of the adult population with a BA or more increased from 21.3 to 35.0% from 1990 to 2018 with a faster increase for women, 18.4 to 35.3%, than for men, 24.4 to 34.6% (8). There are (at least) two possible effects of increasing prevalence of the BA degree: 1) that both groups, with and without a BA, have become more negatively selected over time and 2) that the requirements for good jobs have been raised as the educational level has risen. We can do no more than recognize these forces while noting that the wage premium associated with the

BA—which might have been expected to fall in these circumstances—has actually risen. Our interest here is in the effects of the BA because of its changing role in the labor market; we do not maintain that those effects should be constant, and we are skeptical whether they can be better understood by studying not the educational qualification themselves but percentiles of the educational distribution which have no immediately interpretable role in the labor market (28–30).

We are also not primarily concerned with the (contested) question of whether education directly causes better health and whether obtaining additional schooling, commonly through legislation that forces young adults to spend an additional year in school, causes individuals to live longer. Our own causal story is not about the treatment effects of education on an individual but about the broader social and economic processes in which the BA degree is increasingly used to separate people. Our fundamental moving forces are the changing techniques of production and how they use human skills, not in education in and of itself.

Death certificates do not contain information on place of birth, so we cannot analyze mortality risk for immigrant and native-born Americans separately. However, analyses using other approaches have found immigrants to have lower mortality risk than the native-born (31, 32).

Our data end in 2018, well before the COVID-19 pandemic. The final accounting on its effect is some years away; data on 2020 deaths according to education would not normally be available until the end of 2021. However, the educational divide in mortality is likely to widen further given those without a BA are more likely to be at risk through their occupations while many of those with a BA or more can work remotely and safely. (The incomes of the less educated are also more likely to be at risk, exacerbating the income to mortality gradient.) We do not yet have data for life expectancy in 2019, but mortality rates will rise in 2020. One careful calculation of life expectancy at birth for 2020, relative to 2017, estimates that it will fall by 1.13 y in 2020 with sharp differences across groups, by 0.68 y for White people but 2.10 y for Black people and 3.05 y for Hispanics (33). The corresponding numbers for expected years between 25 and 75 are declines of 0.35 y for the whole population, 0.15 for White, 0.75 y for Black, and 0.92 for Hispanic people¹⁴ so that the pandemic will exacerbate what has been happening to Black people (and more so Hispanics) since 2010.

Data Availability. All study data are included in the article and/or *SI Appendix*.

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¹⁴We are grateful to Theresa Andrasfay and Noreen Goldman for these calculations.

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