Can Job Opportunities Account for the Mortality Gaps by Educational Attainment in the United States?

Submission to "Beyond Deaths of Despair: New Research on the Health and Well-being of Low and Moderately Educated Americans"

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We study one of the most popular but least understood explanations for the increasingly stark advantage in longevity that highly educated Americans possess over their low and moderately educated peers: Job opportunities. Linking millions of rich household surveys to administrative death records, we first show mortality rates over time by granular levels of education, including the first estimates of mortality by college major. We confirm, in these novel data, that recent gains appear reserved for four-year-college graduates and show that even majors with relatively low earnings potential have lower mortality rates than people with an associates degree. We then plot mortality rates for various conceptions of a working class, such as men in manufacturing or other blue-collar industries, to see if the modern ails of less educated Americans bear heavily on them. We find no evidence, however, that a traditional working class is faring significantly worse than everyone else in terms of longevity. Finally, we estimate mortality gaps that are conditional on industry, occupation, income, and other labor market outcomes to more formally quantify the extent to which job opportunities can explain the growing chasm. These factors can explain a substantial portion of the educational divide, but most of that account lies in the fact that highly educated Americans are much more likely than low and moderately educated Americans to have a job at all.

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I. Introduction

Americans with a four-year college degree lead much longer lives than those without one. In 2019, for instance, working-age Americans without a BA were, on any given day, nearly twice as likely as college graduates of the same age to die. The recent pandemic exacerbated the gap, which was already steadily widening, and highly educated Americans continue to grow apart from their less educated countrymen.

What confers the protective nature of a four-year college degree? A common refrain is the job opportunities that educational attainment affords—for good reason. Jobs impart not only material determinants of health, such as income and insurance, but a sense of purpose, dignity, and status (Case

& Deaton, 2021a). Jobs are increasingly stratified by education, and the deterioration in health outcomes for less educated Americans has coincided with erosion in their job prospects (Cherlin, 2014).

Assessing the contribution of job opportunities to mortality gaps, however, is an exceptionally difficult task. Any reasonable approach requires, at least, a large number of death records attached to education and employment information of decedents. In national vital statistics registries, these data elements are generally not available in tandem, and mortality-linked surveys are generally too small to permit detailed study.

To gain a foothold, we have linked complete death records from the Social Security Administration to an expansive set of person-level microdata from the Census Bureau. The result is a massive, *single-source* mortality file with a vast array of demographic, geographic, and socioeconomic characteristics, including employment status, occupation, and industry for close to one hundred million Americans who were interviewed at some point over the last 25 years.[1] The size and breadth of our data lead to several insights about how mortality varies with both the education people obtain and the jobs they hold.

Our guiding question is whether jobs opportunities can account for the mortality gaps by educational attainment in the United States, and we will build up to that as the final of three steps. Throughout, we will focus on the trends observed since 2000, when the already poor mortality rates of Americans with low levels of education became markedly worse, rising even for certain demographic groups (Case & Deaton, 2015).[2] Our data run through 2023, meaning our analysis includes one of the first views of the recovery from the pandemic, which differentially burdened low and moderately educated Americans.[3] We will focus further on a part of midlife that has received the most attention in the literature, ages 50 to 54, when education is generally complete, careers are stable, and mortality gaps are pronounced. We will not focus on any particular race because of the pervasiveness of health disparities by education, but we will note some important differences between men and women that warrant greater attention.

We begin, in the first of three parts, by showing mortality rates by educational attainment in new detail. We first recreate the seminal division from Case & Deaton (2023) of Americans with and without a BA. We find a picture very similar to theirs, in which a large advantage for Americans with a BA steadily grows. This is not, however, a trivial replication. There are some concerns, for example, with the education variable in vital registries long used to study educational gradients. Our data alleviate some of the concerns, and we confirm their conclusion about the divergent trajectories of Americans with and without a BA. Because the concerns are much more serious at low levels of education, however, our data are most enlightening as we progress to more granular levels of education.

We then split Americans without a four-year college degree into three groups: those without a high school diploma, those with a high school diploma but no college education, and those with some college but no four-year degree. There is recent, compelling evidence that high school drop-outs, demonstrating

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[1] By single-source, we mean that counts of deaths and counts of people who could have died come from the same data source. We discuss this important feature in Section II.

[2] The seminal work of Case & Deaton (2015) catalyzed research on adverse mortality trends in the United States. See, for example, Abrams et al. (2023), Currie & Schwandt (2016), Cutler & Lleras-Muney (2012), Dowd et al. (2024), Elo et al. (2019), Ho & Henri (2018), Monnat (2020), Polizzi & Dowd (2024), Preston & Vierboom (2021), Schwandt et al. (2021), and Wolf & Schoomaker (2019) for recent research on mortality trends.

[3] For references to to studies devoted to the mortality burden of the COVID-19 pandemic, see Section III.

a shocking rise in mortality since 2000, are driving the wedge between Americans with and without a BA. We find a rise among dropouts, but not to the degree seen in existing datasets, again supporting the conclusions of Case & Deaton (2017) that a four-year degree is a key demarcation. We will, however, emphasize clear heterogeneity in the trends by sex, wherein mortality is rising for low educated women much more so than low educated men, as in Novosad et al. (2022) as well as Hendi (2017).[4]

We then drill down further on education to a granularity that that is nearly impossible to recreate in other data sources. We split education into eight different categories, including specific grades during which people may have dropped out of high school and specific degrees beyond the BA, such as masters and doctoral degrees. We find clear monotonicity. More schooling, whether dropping out in 10th grade instead of 8th or obtaining a graduate degree in addition to a BA, is always associated with a noticeable reduction in mortality. Importantly, the BA and higher degrees are the only categories sustaining clear improvement over this time period. Again, low and moderately educated women show particularly adverse trends. Even women with some college show rising mortality rates.

To close out the opening section dedicated to educational attainment, we provide the first ever snapshot of mortality rates by field of study. In a large subset of our data, we observe the college major of people with a BA. Fields of study may provide different job opportunities and, therefore, differentially impact mortality. We find wide variation among majors even after controlling for sex and race. Majors with particularly strong job opportunities, such as STEM fields, have the lowest midlife mortality rates, with one-year death rates about half those of the poorest performing majors, such as English majors. Notably, however, every single major that we study still has a lower mortality rate than an associates degree. This is true despite associates degrees providing job opportunities similar to some, albeit few, of those majors. This finding is again consistent with a bachelors degree holding special importance.

Educational divisions, such as these, are intended partially to identify a "working class" of Americans who, by many accounts, are facing growing hardship in recent decades. Although the term resonates with millions of Americans, it is difficult to define, and questions abound as to whether the Americans who feel they belong to the working class are also the Americans dying too young.

In the second part of our analysis, we leverage the employment information in our data and consider alternative definitions of a working class that emphasize work over schooling. We first choose a literal one: working at all. Today, almost a quarter of Americans age 50 to 54 are not employed. We find very large differences in mortality between those who are working and those who are not. In some ways this gap is mechanical. A common reason that working-age Americans provide for not working is their poor health.[5] The gap is, nonetheless, a stark reminder that public health is an economic condition. As we will show, the difference in mortality by employment is so large that high school drop-outs with jobs have much lower mortality rates than BA holders without one.[6] Indeed, the protective nature of the four-year college degree may lie, not so much in the strata of job opportunities that education affords, but in the stability of working at all.

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[4] With broader foci, Montez & Zajacova (2013), Geronimus et al. (2019), and Leive & Ruhm (2022) also provide useful contrasts of mortality between men and women of various education levels.

[5] Author's calculations using CPS data (Flood et al., 2024).

[6] In all analyses, we caution that results are not causal. We intend only to provide a new set of facts with which causal theories should reckon.

We then define a working class based on the jobs that working Americans hold. We adopt a classification based on Cherlin (2014): men working in manufacturing, construction, utilities, or transportation. Examining midlife mortality rates since 2000 for these groups suggests that education, rather than a blue-versus-white collar divide, may better distinguish the stresses leading to high mortality rates in the United States.[7]

It is entirely possible, however, that manufacturing and similar industries were a more relevant symbol of the working class prior to 2000 and that education has since overtaken it.[8] At the same time, the largest sustained decline in manufacturing in US history has occurred since 2000. Therefore, to conclude the second part, we spotlight two sectors that have received a great deal of attention: autoworkers in the Midwest and textile workers in the South. Both sectors have been economic lynchpins in their regions for decades but have shed thousands of jobs since 2000, partially the result of rising import competition. If economic distress is causing poor health, then one would expect to see deteriorating health among these workers. We do find rising mortality for both groups. However, we also find similar increases in adjacent manufacturing industries that were not subject to substantial job losses. We also show that, in both of those industries, workers with a BA, although few in number, were immune to rising mortality.

In the third and final component of our analysis, we ask whether job opportunities account for the mortality gaps by educational attainment in the United States. The two preceding sections have provided hints. To test the idea more formally, we reproduce the graphs of mortality by education after conditioning on a host of employment characteristics. The richness of our data allow us to control also for small geographies, income, or the precariousness of the work, such as hours. Motivated by our previous results, we will focus on the gap between those with and without a four-year college degree. We will estimate, in each year and for each sex, the difference in annual death rates and sequentially add controls, eventually for jobs and income. Absent controls for job characteristics, mortality gaps are substantial and widening, as can be gleaned directly in the first part of this paper. The question is whether they remain that way as the controls are added.

We find ultimately that job characteristics—employment status, industry, occupation, and income—can explain about half of the mortality differential between Americans with and without a BA. For men specifically, once we condition on these factors, the BA gap is not only much smaller, it is no longer increasing. For women, job characteristics narrow the gap (albeit less than for men), but do little to halt the upward trend. Critically, however, for both men and women, the designation of working at all accounts for most of the explanatory power that jobs have. That is, most of the reduction in the BA gap occurs when we condition on working at all. Further conditioning on industry, occupation, and income does reduce the disparity, especially for men, but by much less than employment. The implication is that the BA gap and employment gap should be studied in tandem.

The insights from this paper are enabled by the data that we have assembled. So, before explaining our results in detail, we outline the construction of our samples and the measurement problems that they

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[7] In the online appendix to this paper, we also explore a definition of working class that uses occupation to form three strata: the "service class," the "intermediate class," and the working class—a derivation of the Goldthorpe class schema, which originated from Erikson, Goldthorpe, & Portocarero (1979).

[8] Cherlin (2014), which artfully chronicles the rise and fall of the working class, notes that the successes of the working class in the 20th Century were largely an historical outlier.

overcome. We end by highlighting the contributions that we feel are most important for future research into why the mortality gains of the 21st Century appear reserved for Americans with a four-year college degree.

II. Data

The key barrier to studying the relationship between work and mortality in the United States is the general inability to connect employment information to death records. Although vital registries once collected "usual occupation," that variable never lent itself to a suitable denominator (i.e., exposure), and it was discontinued soon after education first became available in 1989. Recognizing this deficiency in the wake of the pandemic, national registries reinserted occupation in 2022, but the timing is too late to study the socioeconomic chasms that widened greatly in the first part of the 21st Century and further at the height of the pandemic.

Even if employment and education were always jointly available in vital registries, questions would remain about the quality of the information reported there. The information in vital registries is generally completed by the mortician according to interactions with next of kin, if any occur (i.e., posthumously by a person with little knowledge of the decedent). The resultant errors are well documented, and they are serious (Sorlie & Johnson, 2016; Rostron et al., 2010). They are problematic enough that National Academies of Science, Engineering, and Medicine decided not to study education as part of its consensus report on high and rising mortality among working-age Americans, despite education, as reported, capturing enormous heterogeneity in mortality risk (National Academy of Science, Engineering, and Medicine, 2021). There is no reason to believe that occupational information reported in national vital registries would be any less flawed.

Even if the data elements were perfectly reported, other problems with using vital registries would persist. Estimating a mortality rate requires not only a count of deaths but a count of people who could have died. If these counts are tabulated in systematically different ways, those differences (e.g., undercounting or overcounting) will show up as differences in mortality rates, often called "denominator biases." As the subpopulation a researcher wishes to describe gets smaller, these biases become larger, and they are magnified further when comparisons are made between groups. Such problems, therefore, must be avoided if, for example, a researcher is to compare specific levels of education or specific occupations as we will.

Person-level surveys linked to mortality data, such as the National Health Interview Surveys (NHIS), offer a useful alternative to vital registries. They are based on self-reported education. Although people tend to exaggerate their own levels of education, these self reports offer a substantial improvement over a mortician's best understanding (Sasson, 2017; Sorlie & Johnson, 2016; Rostron et al., 2010). These linked surveys also contain much more information about decedents than vital registries, including some employment information in the case of the NHIS. They also circumvent issues of denominator bias because death and exposure to death is derived from a single set of people. The problem, however, is that these sets of people are typically too small to utilize the more accurate and more detailed information. Even a "simple" task like plotting the mortality rate of high school drop-outs, about 10 percent of the adult population, is imprecise to the point of being virtually uninformative (Sasson, 2017; Novosad et al., 2022).

We create mortality-linked surveys that are large enough to describe American mortality in detail

otherwise unattainable. Within the confines of a Federal Statistical Research Data Center, we link administrative death records from the Social Security Administration to confidential person-level data from the Census Bureau. These death records are complete for the ages we study and for any ages outside of childhood (Finlay & Genadek, 2021). They are available in nearly real-time, such that we are able to trace the mortality rates of specific groups through the pandemic. The data are all-cause records (i.e. do not contain cause of death), but, given the widespread nature of the malaise befalling Americans with low and moderate levels of education, this limitation imparts little hindrance (Mehta et al., 2020).

We create two mortality-linked survey instruments, each with a distinct survey from the Census Bureau for distinct purposes. First, we link respondents of the 2000 Decennial Census "long-form," a special questionnaire sent to 1-in-6 randomly selected Americans along-side the "short-form," the standard enumeration of all people every ten years. For its roughly 40 million respondents, the long-form contains close to 100 questions, including employment status, hours worked, industry, occupation, and other facets of jobs as well as detailed educational attainment.

Upon linkage, we effectively add variables for whether a given respondent died in a particular time period since 2000, creating a panel of mortality from a single cross-section of interviews. To plot mortality rates incrementally from 2001 to 2023 for ages 50 to 54, we decrement the window of cohorts in lockstep. For example, to generate a mortality rate for 2001, we use the long-form respondents who were born between 1947 to 1951 and survive to the start of 2001. In 2002, we consider cohorts between 1948 to 1952 and survived to 2002, and so on. A consequence of this setup is that we study a closed population (i.e., one that ignores immigration and emigration). Because notions of a working class are commonly applied to the native population, however, we view our setup as beneficial rather than harmful. Other sources of death statistics typically include recent immigrants, who are exceptionally healthy compared to natives and whose numbers are rapidly rising (Mehta et al., 2016).

The second survey we link to death records is the American Community Survey, or ACS. The ACS replaced the long-form in 2000, so the questionnaire is similarly rich. The sample size is "only" 1.5 percent of US households, but it is conducted every year, forming a huge repeated cross-section with close to 60 million distinct individuals interviewed between 2001 and 2022, the latest year we can link to death records. To produce mortality rates ages 50 to 54 from the ACS, we reuse the logic we applied to the long-form and consider individuals from the appropriate cohorts who survive to the period of interest.

In the analyses to follow, we will oscillate between using the long-form and using the ACS depending on the suitability for the task at hand. The strength of the long-form is its size, granting remarkable precision despite our focus on narrow age ranges and small pockets of Americans, such as those who dropped out of high school in 8th grade or those who worked in the textile industry in the South in 2000. The strength of the ACS is its recurring nature. With multiple cross-sections to leverage, we will often restrict attention to ACS interviews from just the year prior to the year of death, providing up-to-date information on decedents. This is particularly useful when studying employment. Although education is generally fixed through adulthood, employment characteristics vary naturally with age. The restriction also relaxes the assumption of a closed population and allows us to study compositional changes over time when needed.

The linkages between these surveys from the Census Bureau and the death data from the Social Security Administration are imperfect. About 10 percent of the people in both the long-form and the ACS

cannot be linked to the death data. The individuals who fail to match are not a random subset of respondents. They are, for example, less educated than the remainder, such that our final samples are slightly healthier than the overall population, but we are interested primarily in gaps and trends in mortality rather than specific levels of mortality, and, still linking about 90 percent of the nationally representative data, our levels remains close to estimates derived from national registries.

III. Mortality and Education

We begin our analysis by estimating mortality rates by educational attainment. Therefore, methodologically, this section follows the pioneering work of Kitagawa & Hauser (1973), in which administrative death records were linked to educational attainment and other socioeconomic markers collected in Census records at a national scale for the first time. Kitagawa & Hauser (1973) find large mortality gaps by education, and a subsequent literature on what they coin "socioeconomic epidemiology" has filled in many details about the nature of that differential.[9] Recent work by Anne Case and Angus Deaton places special emphasis on education differentials, in particular the dividing line of a BA and the "two Americas" that they describe (Case & Deaton, 2023; Case & Deaton, 2022; Case & Deaton, 2021b). Researchers across disciplines, including authors in this special issue, are continuing to make headway into understanding the widening mortality gap between Americans with and without a bachelor's degree.[10]

[FIGURE 1 HERE]

We first show mortality rates separately for Americans with and without a BA and confirm the centrality of the four-year college degree. Figure 1 shows the education mortality gap from 2001 to 2023 for Americans ages 50 to 54 who responded to the 2000 Census long-form.[11] The results in Panel A of Figure 1 show that midlife mortality for those without a BA stagnated from 2001 to 2019, while midlife mortality for those with a BA gradually declined during this same time period. This finding verifies the widening mortality gap between those with and without a BA, as highlighted by Case & Deaton (2023), but with an entirely different data source with very different properties.

Our single-source data allows us to view granular levels of education while circumventing many issues with measurement such as denominator biases. Panels B and C of Figure 1 show midlife mortality for four and eight levels of education, respectively, which, in addition to BA attainment, include educational attainment and years of schooling for low and moderately-educated Americans. Panel B shows mortality rates for individuals with no high school diploma, high school only, some college (including associates

[9] See, for example, Meara et al. (2008), Cutler et al. (2006), Cutler et al. (2008), Cutler et al. (2011), Preston & Elo (1995), Elo & Preston (1996), Sasson (2016), Lleras-Muney (2005), Clark & Royer (2013), Galama et al. (2018), Rogers et al. (2010), and Cutler & Lleras-Muney (2010).

[10] See, for example, Olfson et al. (2021), Couillard et al. (2021), National Academies of Sciences, Engineering, and Medicine (2021), Montez et al. (2019), Leive & Ruhm (2022), Hendi et al. (2021), Hendi (2017), Montez et al. (2012), Montez & Zajacova (2013), Olshansky et al. (2012), Geronimus et al. (2019), and Sasson & Hayward (2019).

[11] Throughout this paper, the figures show all-cause mortality rates for US-born individuals ages 50 to 54 at the time of survey. The narrow age window we use follows from Case & Deaton (2017), which avoids concerns of age-adjustment for larger age windows, while simultaneously cutting down on the volume of material for presenting single-age windows (Gelman & Auerbach 2016). We expand our age range to include all working age adults in Section V when we conduct our regression analysis. We indicate in our figure panels whether we separate mortality results for men and women. All figures, unless stated otherwise, show mortality on a logarithmic scale.

degree), and a four-year college degree. Panel C breaks these education categories down into even more specific groups. Panels B and C, nonetheless, tell a similar story. Both panels show that midlife mortality for those without a BA is stagnating, and mortality rates for those with only a high school degree even increases slightly during this period, and both show declining midlife mortality rates from 2001 to 2019 for individuals with only a BA (but no graduate degree) and individuals with graduate degrees.

[FIGURE 2 HERE]

We also observe increases in mortality rates by educational attainment when we split our sample to study mortality for men and women separately, as shown in Figure 2. Panel A of Figure 2 indicates that the mortality gap for those with and without a BA is widening for both men and women. The mortality rate for low-educated men (no high school degree or only a high school degree) is largely stagnant from 2001 through 2019. The mortality rate for low-educated women, however, increases over the same time period. We believe the increase in mortality for low-educated women that we find is socially and economically important and warrants further attention in the literature, and theories on the drivers of the widening mortality gap by education may need to account for this heterogeneity.

While we find a qualitatively consistent increase in mortality for low-educated women as Novosad et al. (2022), we do not find a quantitatively similar result. Our observed increase is lower than the rise in mortality that they estimate over the time period studied (2001 to 2019). The difference between our findings and theirs—which are constructed in careful detail with the best publicly available data, including some clever uses of non-mortality data—underscores just how difficult it is to estimate mortality rates by educational attainment. Important differences can hinge on the data used, highlighting the importance of obtaining a large single-source dataset measuring both education and mortality that circumvents denominator errors.[12]

There is an important feature of our figures that we have, to this point, ignored. Our figures are among the first to show mortality rates through the end of 2023, the first year that can be viewed as a recovery from the pandemic.[13] We see in 2023 a clear rebound in mortality across all education groups. Each group appears to nearly return to rates consistent with their pre-COVID trend. Indeed, the figures we present in this paper have a recurring theme: mortality rates for individuals with lower educational attainment increased more than their higher educated counterparts in absolute terms during the pandemic. Our findings are consistent with the existing literature.[14] The increasing BA mortality gap during COVID-19 becomes even more apparent in Section V and remains even after conditioning on job characteristics.

The results presented in Figures 1 and 2 single out the BA as conferring mortality benefits, but the ties between college and the the job market may vary widely depending field of study. Different college

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[12] Linkage rates between our surveys and our death records are imperfect, but we do not believe that the omitted groups materially drive our mortality trends. Nor do we believe that our result settles matters about high school dropouts. We provide an additional data point with data that is not yet part of the literature. Sasson (2017) provides a discussion of limitations of mortality and linked samples.

[13] According to the Centers for Disease Control and Prevention, COVID-19 deaths fell by almost 70 percent from 2022 to 2023 (Ahmad et al., 2023).

[14] See Case & Deaton (2021b), Case & Deaton (2023), Miller et al. (2021), Chen et al. (2022), Schwandt et al. (2022), Gian et al. (2025), Wing et al. (2022), and Finkelstein et al. (2024a) for additional insight into the disparate impacts of COVID-19.

majors, which we observe in our data, may impart (or signal) different skills that are rewarded differently in the labor market. Thus, the protection of the BA may or may not extend broadly across fields of study. Figure 3, however, shows that it does, while also imparting clear advantages for certain ones.

[FIGURE 3 HERE]

In Figure 3, we plot one-year mortality rates by college major as well as the one-year mortality rate for those with an associates degree only. Specifically, Figure 3 shows the predictions from regressing one-year mortality on indicators for college major while controlling for race, sex, and survey year for individuals ages 50 to 54 using ACS survey data from 2009 to 2018.[15] We classify college major categories using the first two digits of the field of degree code (defined by the Census Bureau) and present results for the largest 20 majors (where the "other" is a residual). For instance, detailed major categories such as chemistry and astronomy are classified as physical sciences, while economics and sociology are classified as general social sciences. The results reveal substantial heterogeneity in mortality across college majors. Those who majored in general agriculture or engineering, for example, have substantially lower mortality rates than in English or criminal justice. While these differences are intriguing and invite further study, we find the comparison to associates degree most salient.[16] All college majors that we studied have lower mortality rates than associate degree only, suggesting a broad (albeit varied) protection of the BA. These novel results are consistent with the college degree impacting mortality both through job opportunities and pathways outside the labor market.[17] We explore the relationship between employment and mortality more directly in the next section.

IV. Mortality and Employment

A leading theory as to why less educated Americans diverge from their more educated counterparts is weakening job opportunities, and the data we have constructed offer informative tests of that theory, which we commence in this section. Moriyama & Guralnick (1956) was the first paper to produce mortality by occupation in the United States at scale. A now vast literature explores the relationship between the labor markets and mortality, including the impact of layoffs, recessions, and retirement.[18] The importance of labor markets features in Case & Deaton (2017), who argue that cumulative disadvantage, including a lifetime of poor labor market prospects, rather than factors that affect health contemporaneously can adverse midlife mortality trends in modern times. Recent research on labor market trends and policy continues to contribute meaningfully to understanding the determinants of

[15] The predicted mortality rates presented in Figure 3 arbitrarily show levels for white men age 50 to 54 who responded to the ACS in 2009. The differences in mortality rates across majors remains the same for different reference demographics given our specification without interaction terms. We use ACS surveys starting in 2009 because that is the first year in which the field of degree variable is collected.

[16] One avenue for future research may attempt to correct for selection bias by assessing college majors likely to be positively or negatively selected on health. See Case & Deaton (2023) and Case & Deaton (2024) for discussions of health selection bias.

[17] Cutler & Lleras-Muney (2006), Cutler & Lleras-Muney (2010), and Cutler et al. (2011) outline non-labor explanations for the education-mortality gradient.

[18] See, for example, Preston & Taubman (1994), Cutler et al. (2008), Sullivan & von Wachter (2009a), Sullivan & von Wachter (2009b), von Wachter (2020), Ruhm (2000), Ruhm (2016), Stuckler et al. (2009), Finkelstein et al. (2024b), Autor et al. (2019), Pierce & Schott (2020), Venkataramani et al. (2020), Fitzpatrick & Moore (2018), Garrouste & Perdrix (2022), Chetty et al. (2016), and Guenzel et al. (2024).

midlife mortality in the United States.[19]

We begin by graphically analyzing the relationship between mortality and employment status and definitions of a "working class" that are based on work instead of education.[20] Our findings presented in this section indicate employment is an important determinant of mortality. The figure layout in this section follows the figure layout from Section III. The data source we use for the results presented in this section is the ACS from 2001 to 2022, which (compared to the long-form) gives more contemporaneous employment, occupation, and industry information.[21]

[FIGURE 4 HERE]

Figure 4 shows the mortality rates from 2002 to 2023 for Americans ages 50 to 54 split by whether they were employed or not according to the previous year's ACS. There is a striking difference in the level of mortality rates between those who were employed compared to not employed throughout the time period studied. Middle-aged Americans who are not working are, depending on the year, three to four times as likely as those working to die. For context, the same ratio between men and women or between non-Hispanic Black and White people in the same age range and is less than two. Of course, the employment gap in mortality is so large partially because employment can be a function of health. Some people do not work because they are unwell in some way (and thus more likely to die). We examine this degree of health selection in two ways. In Appendix Figure 2, we replicate Figure 4, but we use ACS respondents from three years prior to the death window (rather than one year prior). This adjustment puts greater distance between the report of employment status and the measurement of death rates. The picture is very similar, suggesting that short-term health shocks are not driving the wedge in Figure 4. In Appendix Figure 3, we again replicate 4 Figure, but we drop people who reported having a disability. The idea is that we restrict attention to people for whom poor health is less likely to be a long-term impediment to working. The gap narrows significantly, as expected; disabled individuals have very high mortality rates and are much less likely to work. Yet even in the non-disabled population, in many years, those who are not working are three times as likely to die.[22]

[FIGURE 5 HERE]

To better understand this difference, Figure 5 breaks down the mortality rate of employed versus non-employed individuals by level of education. The eight series in Figure 5 show mortality rates for employed and non-employed individuals who have a bachelor's degree, some college, high school degree only, or no high school degree. A stark ordering emerges in the mortality levels. Those who are not

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[19] See, for example, Preston et al. (2024), Hajat et al. (2024), Ahonen et al. (2018), Gutin & Hummer (2021), Montez et al. (2020), Cherlin (2014), Brand (2015), Edin et al. (2019), Halpern-Meekin & Talkington (2022), Abraham & Kearney (2020), Autor et al. (2020), and Binder & Bound (2019). Perhaps the closest inquiries to the current one are Gutin & Hummer (2020) and Olfson et al. (2021), who consider how despair varies by conditions of work in mortality-linked data sources.

[20] In the section to follow, to formally test whether jobs "account for" mortality gaps by educational attainment, we estimate mortality gaps by educational attainment with and without controls for occupation.

[21] In this section, we will not report the shares of individuals in a given category (e.g., people in blue collar industries without a BA) over time. Our conclusion is that compositional changes in the groups have little influence on the dynamics seen in mortality over time. The shares of each category (in each figure) are, nonetheless, available upon request.

[22] The relatively small gap in the earliest years in Appendix Figure 3 could be driven by the difference in how disability is measured in the early years of the ACS.

employed have markedly higher mortality rates than individuals who are employed, regardless of education level. That is, BA holders who are not employed have higher mortality rates than workers without a BA. The broad protection previously observed for the BA appears to falter for those who are not employed. Even high school dropouts who are employed have lower mortality rates than BA holders who are not employed. Given the large difference observed in Figures 4 and 5 (as well as Appendix Figures 2 and 3), we believe that understanding the mortality differences between those who have jobs and those who do not is needed to solve how a BA offers increasing protection from poor midlife mortality.

[FIGURE 6 HERE]

In Figure 6, we hone in on a particular group of employed Americans to identify a certain "working class." We closely follow a classification laid out by Cherlin (2014) in defining the working class: men who are *employed* and have jobs in the manufacturing, construction, utility, or transportation industries according to their ACS responses.[23] We denote these industries as "blue collar" and the remainder as "white collar." In Panel A of Figure 6, we show mortality rates for blue and white-collar men ages 50 to 54 from 2002 to 2023. Blue-collar industries show higher mortality rates, but only slightly higher, and the trends for white-collar industries are similar. The implication is that a widely accepted definition of a working class has not demonstrated particularly adverse trends in mortality in the 21st Century.

More pointedly, in Panel B of Figure 6, we split blue and white collar workers by whether they obtained a four-year college degree. Critically, the industry distinction matters little, while the degree distinction matters greatly. The educational chasm in the United States appears broader than the working class, typically defined.

In Appendix Figure 4, we consider a definition based on occupation rather than industry that follows the work of Erikson, Goldthorpe, & Portocarero (1979) and subsequent refinements.[24] The purpose of "Goldthorpe's class schema" is to assign occupations to a social strata. We use the collapsed, three-class version: the "service class," the "intermediate class," and the "working class"—where there is an implied hierarchy.[25] To be consistent with the classification from Cherlin (2014) in the previous figure, we again restrict attention to men. In Panel A of Appendix Figure 4, we see that mortality follows the hierarchy, with service-class workers having the lowest mortality rates and the working-class workers having the highest mortality rates. In Panel B of Appendix Figure 4, however, we split the classes by whether respondents hold a BA, and we again see that the four-year college degree seems to be a clearer delineation than job-based class between high and low mortality rates.

[FIGURE 7 HERE]

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[23] Cherlin (2014) discusses the working class during a time before our period of study, but we believe the definition remains useful in classifying a working class based on jobs alone. We group industries according to 2000 Census Industry codes, which largely follow 1997 NAICS codes.

[24] The lineage includes Erikson, Goldthorpe, Portocarero (1982, 1983), Goldthorpe (1987), Erikson & Goldthorpe (1992), Morgan (2017), and Morgan & Lee (2017).

[25] Morgan and Lee (2017) aggregate the Goldthorpe class schemas as follows: service class (I, II, IIIa), intermediate class (IVa, IVb, and V), working class group (IIIb, VI, VIIa), and farmers and agricultural workers (IVc and VIIb). We modify the Morgan and Lee (2017) classification by placing farmers and agricultural workers into the intermediate class. This fourth group alone would be too small to meet disclosures rules surrounding our data access.

Pierce & Schott (2016) note a precipitous decline in employment in the US manufacturing industry since 2000. A rich, related literature discusses reasons for declining job prospects for American workers due to import competition and automation.[26] We spotlight several areas of the manufacturing industry where dramatic change has occurred. In an attempt to explore potential heterogeneity by sex as observed in the previous section, we focus on prominent male and female dominated manufacturing industries. Panels A and B of Figure 7 focus on mortality rates for men who held jobs in automobile and transportation manufacturing (henceforth, autoworkers) in 2000 in the Midwest (East North Central Census Division) according to the 2000 Decennial Census long-form. Panels C and D of Figure 7 focus on mortality rates for women who held jobs in the textile manufacturing industry (henceforth, textile workers) in 2000 in the South according to the long-form.[27] Women in the textile industry in the South and male autoworkers in the Midwest experienced large declines in manufacturing employment since 2000. Our use of the long-form allows us to fix the set of workers who were in the exposed industries before the worst manufacturing employment declines occurred, and we observe their later mortality rates. Figure 7 also shows mortality rates for workers in the food processing and miscellaneous manufacturing industries in the same geographic areas, plausibly comparable industries which did not experience large manufacturing employment declines after 2000. Figure 7 plots fitted mortality estimates for female textile workers and male autoworkers with bachelor's degrees, as the cell sizes were too small to disclose the underlying annual rates.

We note three takeaways from Figure 7. First, Midwestern autoworkers, while trending upward in mortality, are trending upward at approximately the same rate as an adjacent industry that was less impacted by employment declines. Second, Southern textile workers experience large increases in mortality that visually separates from a comparable industry around 2010. Third, mortality rates for those with bachelor's degrees did not worsen even for those who were employed in areas of manufacturing experiencing large employment declines.

We believe the figures presented in Sections III and IV are informative in their own right, and the results shown on the figures suggest the importance of employment and the bachelor's degree in conferring protection from worsening mortality trends. We combine factors studied thus far, education, employment, and jobs, in a regression framework in the next section to account for the widening education mortality gap.

V. Accounting for the Mortality Education Gap by Conditioning on Job Characteristics

This section focuses on trends in the mortality education gap and how it changes when we condition on job characteristics. Panels A and B of Figure 8 show trends in the mortality education gap for men and women ages 50 to 54 from 2002 to 2023 who responded to the ACS. Specifically, Figure 8 shows regression estimates of one-year mortality on an indicator variable for whether an individual has a BA. Regression specifications sequentially add fixed effects for age and race, an indicator for employment, fixed effects for detailed occupation and industry interactions (e.g., a manager in the healthcare industry is distinct from a manager in the construction industry), and a continuous variable for personal wage and

[26] See, for example, Autor et al. (2003), Autor et al. (2013), Autor (2015), Autor et al. (2016), and Abraham & Kearney (2020).

[27] We use the following NAICS3 industry classification codes: automobile and transportation manufacturing jobs (code 336), textile industry (codes 313, 314, 315, and 316), food processing and manufacturing (code 311), and miscellaneous manufacturing (code 339). We focus on the East North Central Census Division of the Midwest, which includes Michigan, and we classify the South as the Census South Region.

salary income (logged). We report the absolute value for the point estimates for the coefficient on whether an individual had a BA. Unless otherwise stated, all results in this section are statistically significant and p-values for reported coefficients are less than 0.001. For aesthetic purposes, we average education mortality gap estimates into two-year buckets, such that the reported 2011 estimate is the average of the one-year estimates for 2010 and 2011.

[FIGURE 8 HERE]

The top series in Figure 8 Panels A and B show the gap in one-year mortality rates between those who have a bachelor's degree and those who do not for men and women, respectively. We highlight three facts that emerge from our estimates. First, the absolute level of the age 50 to 54 mortality gap for those with a BA and those without is higher for men than for women. Second, for both men and women, the BA mortality gap trends upward from 2002 to 2019. The increase in the absolute level of the BA mortality gap for women from 2002 to 2019 is both steadier and steeper than the rise for men over this time period, even though the female mortality gap starts from a lower base. Third, the BA mortality gap spikes during the COVID-19 pandemic for both men and women.

We observe how the BA mortality gap changes when we sequentially control for demographic and job-related factors in our mortality regressions. The second series shows the BA mortality gap after conditioning on race and age fixed effects. The BA mortality gap decreases only slightly. Once we condition on whether an individual is employed, however, as shown with the third series, the BA mortality gap decreases significantly for both men and women. In addition to a level decrease, the upward trend in the BA mortality gap for men dissipates once we control for employment. In contrast, women have a steadily increasing upward trend in the BA mortality gap even after controlling for employment. In 2018 to 2019, the last years before the pandemic, the BA mortality gap for men barely exceeds the gap for women after controlling for employment.

We next control for job characteristics (occupation interacted with industry) followed by the inclusion of wage and salary income. The regression results are shown by the final two lines, respectively. For women, the lines are similar in terms of both levels and trends as the third line. That is, after controlling for job characteristics and income, the BA mortality gap for women remains largely unchanged compared to the BA mortality gap after controlling for employment. In contrast, for men, the mortality gap decreases after controlling for job characteristics (the fourth and fifth series are below the third series). The absolute level of the BA mortality gap for men even falls below the gap for women in 2018 to 2019, the last years before COVID-19, after conditioning on job characteristics.

We extend our analysis of the BA mortality gap to a wider age range (prime age individuals ages 25 to 54) and death window (one-year, ten-year, and 19-year mortality). Table 1 shows the coefficients of regression estimates of mortality on an indicator for whether an individual has a BA. Each row of Table 1 shows the absolute value of the estimated coefficient for the BA mortality gap for a different set of control variables. Regression specifications sequentially add fixed effects for age and race, an indicator for employment, detailed industry fixed effects, detailed occupation fixed effects, continuous variable for the log of personal wage and salary income, and fixed effects for occupation and industry interactions. In other words, the regression specifications in Table 1 closely resemble those shown in Figure 8. There are, however, two important differences. First, the regressions are estimated based on responses to the long-form. Second, each column presents results from regressions using different death windows (from left to right, one-year, ten-year, and 19-year windows). We separately estimate results for prime aged men

and women (ages 25 to 54).

[TABLE 1 HERE]

The results in Table 1 largely echo the results shown in Figure 8. Job opportunities (particularly employment status) account for a substantial portion of the BA mortality gap, but more so for men than for women. For both men and women, a sizable BA mortality gap remains even after controlling for job characteristics. These findings largely remain true across death windows and for additional age groups.[28]

As with many observational studies, our results should not be interpreted as causal. We do not, for example, attempt to account for health-selection bias into education or reverse causality between health and employment. Recent research has suggested, however, that selection, ostensibly a major concern, is not a primary driver of the widening gap (Novosad et al., 2022; Case & Deaton, 2024). We also acknowledge that our fixed-effect strategy cannot perfectly encapsulate a given job. One may reasonably argue that education itself is a defining feature of a job. To that end, we first note that controlling for income does little to the observed gap. We also note that, in a regression (not shown) where income rather than mortality is the outcome (dropping the control for income), we estimate "only" a 12 percent premium for BAs over non-BAs in the same industry and occupation, which is only one sixth of the general college wage premium today. Furthermore, even if the within-job comparison induced by our fixed effects fails to isolate the impact of the BA, one would likely expect that a worker without a BA in the same job as one with a BA would be (in unobserved ways) high performing or that the worker with a BA would be low performing. In either case, the contribution of jobs would be even less (conditional on employment) than the modest amount we have estimated here.

No matter these interpretation issues, we believe the results shown in Figure 8 and Table 1 will prove useful in explaining the growing BA mortality advantage. For men in midlife, controlling for job opportunities through employment, industry, and occupation, accounts for a significant portion of the wide and growing gap. The upward trend in the male gap dissipates after controlling for jobs, and the level of the gap is reduced by more than half. For women in midlife, controlling for employment status, reduces the level of the BA gap, but the upward trend remains. Additional controls for industry, occupation, and income yield only slight changes. The absolute level of the BA mortality gap for women even exceeds that of men in 2018 to 2019 after controlling for job characteristics, which was never the case in the first decade of the 21st Century. Overall, these findings may be consistent with a theory in which occupation, industry, income, and particularly employment matter for midlife male mortality, and the BA may provide access to such job opportunities. For women, employment (but less so industry and occupation) may help explain how the BA reduces mortality, but this pathway may be increasingly less important than that same labor pathway is for men.

VI. Conclusion

One of the most popular explanations for the wide and growing mortality gaps by educational attainment in the United States is the job opportunities that education unlocks. In concluding their omnibus overview of the college divide in the United States, Case and Dean (2023), for instance, offer the following hypothesis regarding the protective nature of the BA:

[28] Results for additional age ranges are qualitatively similar and available upon request. We use a 19-year mortality window because that is the maximum death window available using our data before COVID-19 begins in early 2020.

> *Finally, we hazard our own guess on the role of the four-year college degree. We have increasingly come to believe that it works through often arbitrary assignation of status, so that jobs are allocated, not by matching necessary or useful skills, but by the use of the BA as a screen.*

Understanding the role of jobs in a modern time period, however, is precluded by the data infrastructure that is available to most researchers. In this paper, we have offered a new vantage by linking administrative death records from the Social Security Administration to microdata from the Census Bureau at the person level.

The resulting data, with their single-source nature, ease substantial empirical challenges in estimating mortality rates by educational attainment, and we have confirmed several key facts about educational gradients in the United States. With their breadth of educational markers, these data reveal new heterogeneity, and we have provided the first estimates of mortality rates by college major among Americans with a BA. With their granular employment information, these data allow for the isolation of particular occupations or industries, and we have highlighted several that have garnered a great deal of attention in the public discourse on poor health in the United States. With their size, these data allow for education and employment to be studied not just separately but in tandem, and we have estimated mortality gaps by education that control for job characteristics. With their routine updating, these data even provide perspective on the recovery from the recent pandemic, and we have plotted mortality rates through 2023 throughout our analyses.

We hope that this paper, both its findings and its process, will open avenues for further research, and we close by highlighting three facts that stand out in our inquiry and that we believe will be most vital to understanding why the lives of low and moderately educated Americans are so different—and so much shorter—than their more educated counterparts.

First, women with low and moderate levels of education exhibit a rise in mortality that is not seen for men at any level of education and not seen among women with four-year degrees, who instead show steep and steady declines. A robust theory of why Americans are increasingly divided by education will explain why the departure is so much more pronounced for women. Jobs characteristics, for example, cannot explain the precipitous rise in their BA advantage over the last 25 years.

Second, Americans who are part of the "working class"—defined by holding jobs in industries like manufacturing and construction—have trends in mortality rates that are similar to Americans working in other industries. This suggests that defining a working class along blue and white-collar lines, despite popular narratives, is unlikely to be a dividing line between improving and worsening health. Even workers in sectors of the economy who have been hit the hardest by rising import competition 21st Century have mortality profiles similar to adjacent blue collar industries that were far less affected by the changing economic landscape.

Third and finally, jobs can explain a substantial portion of the BA mortality gap, and most of the account lies in the employment margin of having a job at all. This observation raises the possibility that a literal definition of a working class—prime-age people who work—is a meaningful demarcation of two Americas, in different standing headed in different directions. Whether by selection or causality, employment is so strongly predictive of mortality that high school drop-outs with a job have much lower mortality rates than BA holders without one. At the same time, however, much of the BA mortality gap

cannot be explained by a host of labor market outcomes. Indeed, the distinction of a four-year college degree appears to confer broad protection that extends well beyond a willingness or ability to work.

If our findings and process provide guidance, we must also emphasize that our data, while offering significant advantages over existing sources, are still imperfect. Perhaps most importantly, we can study trends only since 2000. The current century does appear to be particularly dire, as the mortality gaps between more and less educated Americans and between Americans and their international peers have grown sharply in recent decades. But mortality is a slow-developing process that spans the life course, and, as Case and Deaton (2017) first emphasized, modern ails may be rooted in events that transpired well before mortality rates changed. We cannot rule out, for example, that something long ago affected educational trajectories, job opportunities, and ultimately longevity in a sequence that matches the patterns researchers seek to explain. At the very least though, the results in this article suggest that receipt of a four-year college degree—the gravity it displays across every cut of our data—encodes, if not causes, whatever is pulling Americans toward different fate.

Abraham, Katharine G, and Melissa S Kearney. "Explaining the Decline in the Us Employment-to-Population Ratio: A Review of the Evidence." Journal of Economic Literature 58, no. 3 (2020): 585-643.

Abrams, Leah R, Mikko Myrskylä, and Neil K Mehta. "The "Double Jeopardy" of Midlife and Old Age Mortality Trends in the United States." Proceedings of the National Academy of Sciences 120, no. 42 (2023): e2308360120.

Ahmad FB, Cisewski JA, Anderson RN. Mortality in the United States — Provisional Data, 2023. MMWR Morb Mortal Wkly Rep 2024;73:677–681. DOI: http://dx.doi.org/10.15585/mmwr.mm7331a1

Ahonen, Emily Quinn, Kaori Fujishiro, Thomas Cunningham, and Michael Flynn. "Work as an Inclusive Part of Population Health Inequities Research and Prevention." American journal of public health 108, no. 3 (2018): 306-11.

Austin, Benjamin A, Edward L Glaeser, and Lawrence H Summers. Jobs for the Heartland: Place-Based Policies in 21st Century America. National Bureau of Economic Research (2018).

Autor, David, David Dorn, and Gordon Hanson. "When Work Disappears: Manufacturing Decline and the Falling Marriage Market Value of Young Men." American Economic Review: Insights 1, no. 2 (2019): 161-78.

Autor, David, Claudia Goldin, and Lawrence F Katz. "Extending the Race between Education and Technology." Paper presented at the AEA papers and proceedings, 2020.

Autor, David H. "Why Are There Still So Many Jobs? The History and Future of Workplace Automation." Journal of economic perspectives 29, no. 3 (2015): 3-30.

Autor, David H, David Dorn, and Gordon H Hanson. "The China Syndrome: Local Labor Market Effects of Import Competition in the United States." American economic review 103, no. 6 (2013): 2121-68.

———. "The China Shock: Learning from Labor-Market Adjustment to Large Changes in Trade." Annual review of economics 8, no. 1 (2016): 205-40.

Autor, David H, Frank Levy, and Richard J Murnane. "The Skill Content of Recent Technological Change: An Empirical Exploration." The Quarterly journal of economics 118, no. 4 (2003): 1279-333.

Binder, Ariel J, and John Bound. "The Declining Labor Market Prospects of Less-Educated Men." Journal of Economic Perspectives 33, no. 2 (2019): 163-90.

Brand, Jennie E. "The Far-Reaching Impact of Job Loss and Unemployment." Annual review of sociology 41, no. 1 (2015): 359-75.

Case, Anne, and Angus Deaton. "Rising Morbidity and Mortality in Midlife among White Non-Hispanic Americans in the 21st Century." Proceedings of the National Academy of Sciences 112, no. 49 (2015): 15078-83.

———. "Mortality and Morbidity in the 21st Century." Brookings papers on economic activity 2017 (2017): 397.

———. "Deaths of Despair and the Future of Capitalism." (2021a).

_____. "Life expectancy in adulthood is falling for those without a BA degree, but as educational gaps have widened, racial gaps have narrowed." *Proceedings of the National Academy of Sciences* 118, no. 11 (2021b): e2024777118.

———. "The Great Divide: Education, Despair, and Death." Annual Review of Economics 14, no. 1 (2022): 1-21.

———. "Accounting for the Widening Mortality Gap between American Adults with and without a Ba." Brookings Papers on Economic Activity 2023, no. 2 (2023): 1-78.

———. "Education, Health-Based Selection, and the Widening Mortality Gap between Americans with and without a Four-Year College Degree." American Journal of Epidemiology (2024): kwae420.

Chen, Yea-Hung, Alicia R Riley, Kate A Duchowny, Hélène E Aschmann, Ruijia Chen, Mathew V Kiang, Alyssa C Mooney, et al. "Covid-19 Mortality and Excess Mortality among Working-Age Residents in California, USA, by Occupational Sector: A Longitudinal Cohort Analysis of Mortality Surveillance Data." The Lancet Public Health 7, no. 9 (2022): e744-e53.

Cherlin, Andrew J. Labor's Love Lost: The Rise and Fall of the Working-Class Family in America. Russell Sage Foundation, 2014.

Chetty, Raj, Michael Stepner, Sarah Abraham, Shelby Lin, Benjamin Scuderi, Nicholas Turner, Augustin Bergeron, and David Cutler. "The Association between Income and Life Expectancy in the United States, 2001-2014." Jama 315, no. 16 (2016): 1750-66.

Clark, Damon, and Heather Royer. "The Effect of Education on Adult Mortality and Health: Evidence from Britain."

American Economic Review 103, no. 6 (2013): 2087-120.

Couillard, Benjamin K, Christopher L Foote, Kavish Gandhi, Ellen Meara, and Jonathan Skinner. "Rising Geographic Disparities in Us Mortality." Journal of Economic Perspectives 35, no. 4 (2021): 123-46.

Currie, Janet, and Hannes Schwandt. "Mortality Inequality: The Good News from a County-Level Approach." Journal of Economic Perspectives 30, no. 2 (2016): 29-52.

Cutler, David, Angus Deaton, and Adriana Lleras-Muney. "The Determinants of Mortality." Journal of economic perspectives 20, no. 3 (2006): 97-120.

Cutler, David M, Fabian Lange, Ellen Meara, Seth Richards-Shubik, and Christopher J Ruhm. "Rising Educational Gradients in Mortality: The Role of Behavioral Risk Factors." Journal of health economics 30, no. 6 (2011): 1174-87.

Cutler, David M, and Adriana Lleras-Muney. "Education and Health: Evaluating Theories and Evidence." National bureau of economic research Cambridge, Mass., USA, 2006.

———. "Understanding Differences in Health Behaviors by Education." Journal of health economics 29, no. 1 (2010): 1-28.

———. "Education and Health: Insights from International Comparisons." (2012).

Cutler, David M, Adriana Lleras-Muney, and Tom Vogl. "Socioeconomic Status and Health: Dimensions and Mechanisms." (2008).

Dowd, Jennifer Beam, Antonino Polizzi, and Andrea M Tilstra. "Progress Stalled? The Uncertain Future of Mortality in High-Income Countries." Population and Development Review (2024).

Edin, Kathryn, Timothy Nelson, Andrew Cherlin, and Robert Francis. "The Tenuous Attachments of Working-Class Men." Journal of Economic Perspectives 33, no. 2 (2019): 211-28.

Elo, Irma T, Arun S Hendi, Jessica Y Ho, Yana C Vierboom, and Samuel H Preston. "Trends in Non-Hispanic White Mortality in the United States by Metropolitan-Nonmetropolitan Status and Region, 1990–2016." Population and development review 45, no. 3 (2019): 549.

Elo, Irma T, and Samuel H Preston. "Educational Differentials in Mortality: United States, 1979–1985." Social science & medicine 42, no. 1 (1996): 47-57.

Erikson, Robert, and John H. Goldthorpe. "Individual or family? Results from two approaches to class assignment." Acta Sociologica 35, no. 2 (1992): 95-105.

Erikson, Robert, John H. Goldthorpe, and Lucienne Portocarero. "Intergenerational class mobility in three Western European societies: England, France and Sweden." The British journal of sociology 30, no. 4 (1979): 415-441.

———. "Social fluidity in industrial nations: England, France and Sweden." The British Journal of Sociology 33, no. 1 (1982): 1-34.

———. "Intergenerational class mobility and the convergence thesis: England, France and Sweden." The British Journal of Sociology 34, no. 3 (1983): 303-343.

Finkelstein, Amy, Geoffrey Kocks, Maria Polyakova, and Victoria Udalova. "Heterogeneity in Damages from a Pandemic." Review of Economics and Statistics (2024a): 1-45.

Finkelstein, Amy, Matthew J Notowidigdo, Frank Schilbach, and Jonathan Zhang. Lives Vs. Livelihoods: The Impact of the Great Recession on Mortality and Welfare. National Bureau of Economic Research (2024b).

Finlay, Keith, and Katie R Genadek. "Measuring All-Cause Mortality with the Census Numident File." American journal of public health 111, no. S2 (2021): S141-S48.

Fitzpatrick, Maria D, and Timothy J Moore. "The Mortality Effects of Retirement: Evidence from Social Security Eligibility at Age 62." Journal of Public Economics 157 (2018): 121-37.

Flood, Sarah, and Miriam King, Renae Rodgers, Steven Ruggles, J. Robert Warren, Daniel Backman, Annie Chen, Grace Cooper, Stephanie Richards, Megan Schouweiler, and Michael Westberry. IPUMS CPS: Version 12.0 [dataset]. Minneapolis, MN: IPUMS, 2024. https://doi.org/10.18128/D030.V12.0

Galama, Titus J, Adriana Lleras-Muney, and Hans Van Kippersluis. "The Effect of Education on Health and Mortality: A Review of Experimental and Quasi-Experimental Evidence." (2018).

Garrouste, Clémentine, and Elsa Perdrix. "Is There a Consensus on the Health Consequences of Retirement? A Literature Review." Journal of Economic Surveys 36, no. 4 (2022): 841-79.

Gelman, Andrew, and Jonathan Auerbach. "Age-Aggregation Bias in Mortality Trends." Proceedings of the National Academy of Sciences 113, no. 7 (2016): E816-E17.

Geronimus, Arline T, John Bound, Timothy A Waidmann, Javier M Rodriguez, and Brenden Timpe. "Weathering, Drugs, and Whack-a-Mole: Fundamental and Proximate Causes of Widening Educational Inequity in Us Life Expectancy by Sex and Race, 1990–2015." Journal of health and social behavior 60, no. 2 (2019): 222-39.

Gian, Cong, Sumedha Gupta, Kosali Simon, Ryan Sullivan, and Coady Wing. "Do Workers Undervalue Covid-19 Risk? Evidence from Wages and Death Certificate Data." Journal of Risk and Uncertainty (2025): 1-41.

Goldthorpe, John E. "Family life in Western societies." Cambridge: Cambridge (1987).

Guenzel, Marius, Ulrike Malmendier, and Denis Sosyura. Longevity and Occupational Choice. 2024.

Gutin, Iliya, and Robert A. Hummer. "Occupation, employment status, and "despair"-associated mortality risk among working-aged US adults, 1997–2015." *Preventive medicine* 137 (2020): 106129.

Gutin, Iliya, and Robert A Hummer. "Social Inequality and the Future of Us Life Expectancy." Annual Review of Sociology 47, no. 1 (2021): 501-20.

Hajat, Anjum, Sarah B Andrea, Vanessa M Oddo, Megan R Winkler, and Emily Q Ahonen. "Ramifications of Precarious Employment for Health and Health Inequity: Emerging Trends from the Americas." Annual Review of Public Health 45 (2024).

Halpern-Meekin, Sarah, and Adam Talkington. ""Disconnected" Men: Understanding Men's Joint Roles as Workers and Romantic Partners." RSF: The Russell Sage Foundation Journal of the Social Sciences 8, no. 5 (2022): 98-119.

Hayward, Mark D, William R Grady, Melissa A Hardy, and David Sommers. "Occupational Influences on Retirement, Disability, and Death." Demography 26 (1989): 393-409.

Hendi, Arun S. "Trends in Education-Specific Life Expectancy, Data Quality, and Shifting Education Distributions: A Note on Recent Research." Demography 54, no. 3 (2017): 1203-13.

Hendi, Arun S, Irma T Elo, and Pekka Martikainen. "The Implications of Changing Education Distributions for Life Expectancy Gradients." Social Science & Medicine 272 (2021): 113712.

Ho, Jessica Y, and Arun S Hendi. "Recent Trends in Life Expectancy across High Income Countries: Retrospective Observational Study." bmj 362 (2018).

Kitagawa, Evelyn M, and Philip M Hauser.. "Differential Mortality in the United States: A Study in Socioeconomic Epidemiology." Harvard University Press, 1973.

Leive, Adam A, and Christopher J Ruhm. "Education Gradients in Mortality Trends by Gender and Race." Journal of Human Capital 16, no. 1 (2022): 47-72.

Lleras-Muney, Adriana. "The Relationship between Education and Adult Mortality in the United States." The Review of economic studies 72, no. 1 (2005): 189-221.

Masters, Ryan K, Andrea M Tilstra, and Daniel H Simon. "Explaining Recent Mortality Trends among Younger and Middle-Aged White Americans." International journal of epidemiology 47, no. 1 (2018): 81-88.

Meara, Ellen, and Jonathan Skinner. "Losing Ground at Midlife in America." Proceedings of the National Academy of Sciences 112, no. 49 (2015): 15006-07.

Meara, Ellen R, Seth Richards, and David M Cutler. "The Gap Gets Bigger: Changes in Mortality and Life Expectancy, by Education, 1981–2000." Health affairs 27, no. 2 (2008): 350-60.

Mehta, Neil K., Irma T. Elo, Michal Engelman, Diane S. Lauderdale, and Bert M. Kestenbaum. "Life expectancy among US-born and foreign-born older adults in the United States: Estimates from linked social security and medicare data." *Demography* 53 (2016): 1109-1134.

Mehta, Neil K, Leah R Abrams, and Mikko Myrskylä. "Us Life Expectancy Stalls Due to Cardiovascular Disease, Not Drug Deaths." Proceedings of the National Academy of Sciences 117, no. 13 (2020): 6998-7000.

Miller, Sarah, Laura R Wherry, and Bhashkar Mazumder. "Estimated Mortality Increases during the Covid-19 Pandemic by Socioeconomic Status, Race, and Ethnicity: Study Examines Covid-19 Mortality by Socioeconomic Status, Race, and Ethnicity." Health Affairs 40, no. 8 (2021): 1252-60.

Monnat, Shannon M. "Trends in Us Working-Age Non-Hispanic White Mortality: Rural–Urban and within-Rural

Differences." Population research and policy review 39, no. 5 (2020): 805-34.

Montez, Jennifer Karas, Jason Beckfield, Julene Kemp Cooney, Jacob M Grumbach, Mark D Hayward, Huseyin Zeyd Koytak, Steven H Woolf, and Anna Zajacova. "Us State Policies, Politics, and Life Expectancy." The Milbank Quarterly 98, no. 3 (2020): 668-99.

Montez, Jennifer Karas, Robert A. Hummer, and Mark D. Hayward. "Educational attainment and adult mortality in the United States: A systematic analysis of functional form." *Demography* 49, no. 1 (2012): 315-336.

Montez, Jennifer Karas, and Anna Zajacova. "Explaining the Widening Education Gap in Mortality among Us White Women." Journal of health and social behavior 54, no. 2 (2013): 166-82.

Montez, Jennifer Karas, Anna Zajacova, Mark D Hayward, Steven H Woolf, Derek Chapman, and Jason Beckfield. "Educational Disparities in Adult Mortality across Us States: How Do They Differ, and Have They Changed since the Mid-1980s?". Demography 56 (2019): 621-44.

Moriyama, IM, and L Guralnick. "Occupation and Social Class Differentials in Mortality." Trends and differentials in mortality (1956): 9-36.

Morgan, Stephen L. "A coding of social class for the general social survey." Chicago, Illinois: GSS Methodological Report125 (2017).

Morgan, Stephen L., and Jiwon Lee. "The white working class and voter turnout in US presidential elections, 2004 to 2016." Sociological Science 4 (2017): 656-685.

National Academies of Sciences, Engineering, and Medicine. 2021. *High and Rising Mortality Rates Among Working-Age Adults*. Washington, DC: The National Academies Press. https://doi.org/10.17226/25976.

Novosad, Paul, Charlie Rafkin, and Sam Asher. "Mortality Change among Less Educated Americans." American Economic Journal: Applied Economics 14, no. 4 (2022): 1-34.

Olfson, Mark, Candace Cosgrove, Sean F Altekruse, Melanie M Wall, and Carlos Blanco. "Deaths of Despair: Adults at High Risk for Death by Suicide, Poisoning, or Chronic Liver Disease in the Us." Health Affairs 40, no. 3 (2021): 505-12.

Olshansky, S Jay, Toni Antonucci, Lisa Berkman, Robert H Binstock, Axel Boersch-Supan, John T Cacioppo, Bruce A Carnes, et al. "Differences in Life Expectancy Due to Race and Educational Differences Are Widening, and Many May Not Catch Up." Health affairs 31, no. 8 (2012): 1803-13.

Pierce, Justin R, and Peter K Schott. "The Surprisingly Swift Decline of Us Manufacturing Employment." American economic review 106, no. 7 (2016): 1632-62.

———. "Trade Liberalization and Mortality: Evidence from Us Counties." American Economic Review: Insights 2, no. 1 (2020): 47-63.

Polizzi, Antonino, and Jennifer Beam Dowd. "Working-Age Mortality Is Still an Important Driver of Stagnating Life Expectancy in the United States." Proceedings of the National Academy of Sciences 121, no. 4 (2024): e2318276121.

Preston, Samuel, Yana Vierboom, and Mikko Myrskylä. "Socio-Behavioral Factors Contributing to Recent Mortality Trends in the United States." Demographic Research 51 (2024): 191-214.

Preston, Samuel H, and Irma T Elo. "Are Educational Differentials in Adult Mortality Increasing in the United States?". Journal of aging and health 7, no. 4 (1995): 476-96.

Preston, Samuel H, and Paul Taubman. "Socioeconomic Differences in Adult Mortality and Health Status." Demography of aging 1 (1994): 279-318.

Preston, Samuel H, and Yana C Vierboom. "Excess Mortality in the United States in the 21st Century." Proceedings of the National Academy of Sciences 118, no. 16 (2021): e2024850118.

Rogers, Richard G., Bethany G. Everett, Anna Zajacova, and Robert A. Hummer. "Educational degrees and adult mortality risk in the United States." *Biodemography and social biology* 56, no. 1 (2010): 80-9

Rostron, Brian L, John L Boies, and Elizabeth Arias. "Education Reporting and Classification on Death Certificates in the United States (Vital Health Statistics Series 2, No. 151)." Hyattsville, MD: National Center for Health Statistics (2010).

Ruhm, Christopher J. "Are Recessions Good for Your Health?". The Quarterly journal of economics 115, no. 2 (2000): 617-50.

———. "Health Effects of Economic Crises." Health economics 25 (2016): 6-24.

Sasson, Isaac. "Trends in Life Expectancy and Lifespan Variation by Educational Attainment: United States, 1990–2010." Demography 53, no. 2 (2016): 269-93.

Sasson, Isaac. "Reply to trends in education-specific life expectancy, data quality, and shifting education distributions: A note on recent research." *Demography* 54, no. 3 (2017): 1215-1219.

Sasson, Isaac, and Mark D Hayward. "Association between Educational Attainment and Causes of Death among White and Black Us Adults, 2010-2017." Jama 322, no. 8 (2019): 756-63.

Schwandt, Hannes, Janet Currie, Marlies Bär, James Banks, Paola Bertoli, Aline Bütikofer, Sarah Cattan, et al. "Inequality in Mortality between Black and White Americans by Age, Place, and Cause and in Comparison to Europe, 1990 to 2018." Proceedings of the National Academy of Sciences 118, no. 40 (2021): e2104684118.

Schwandt, Hannes, Janet Currie, Till Von Wachter, Jonathan Kowarski, Derek Chapman, and Steven H Woolf. "Changes in the Relationship between Income and Life Expectancy before and during the Covid-19 Pandemic, California, 2015-2021." JAMA 328, no. 4 (2022): 360-66.

Sorlie, Paul D, and Norman J Johnson. "Validity of Education Information on the Death Certificate." Epidemiology 7, no. 4 (1996): 437-39.

Stuckler, David, Sanjay Basu, Marc Suhrcke, Adam Coutts, and Martin McKee. "The Public Health Effect of Economic Crises and Alternative Policy Responses in Europe: An Empirical Analysis." The Lancet 374, no. 9686 (2009): 315-23.

Sullivan, Daniel, and Till Von Wachter. "Job Displacement and Mortality: An Analysis Using Administrative Data." The Quarterly Journal of Economics 124, no. 3 (2009a): 1265-306.

———. "Average Earnings and Long-Term Mortality: Evidence from Administrative Data." American Economic Review 99, no. 2 (2009b): 133-38.

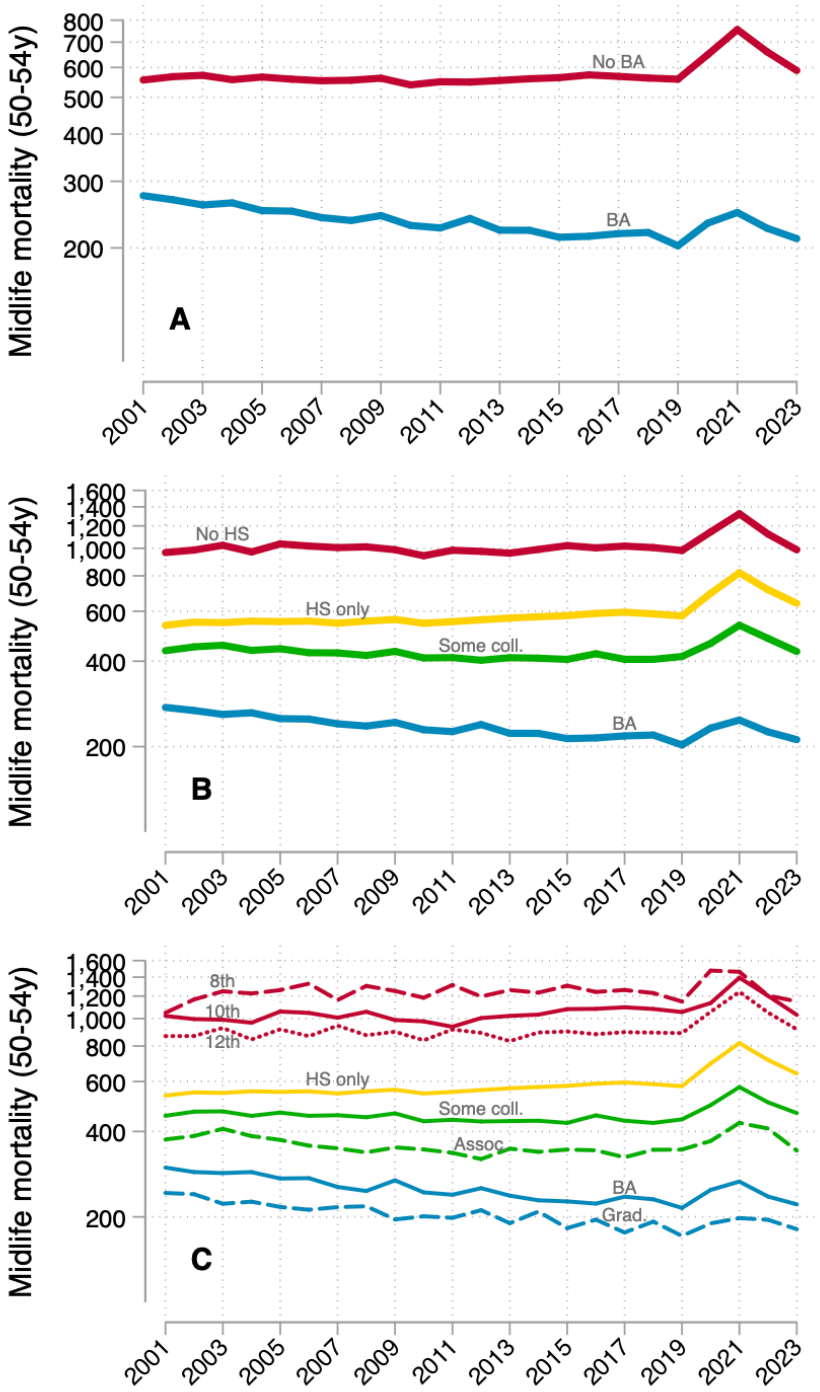
Venkataramani, Atheendar S, Elizabeth F Bair, Rourke L O'Brien, and Alexander C Tsai. "Association between Automotive Assembly Plant Closures and Opioid Overdose Mortality in the United States: A Difference-in-Differences Analysis." JAMA internal medicine 180, no. 2 (2020): 254-62.

Wachter, Till Von. "The Persistent Effects of Initial Labor Market Conditions for Young Adults and Their Sources." Journal of Economic Perspectives 34, no. 4 (2020): 168-94.

Wing, Coady, Kosali Simon, Cong Gian, and Sumedha Gupta. "Labor Market Responses to New Health Risks: Evidence from Death Certificates with Occupation and Industry Information." Paper presented at the 2022 APPAM Fall Research Conference, 2022.

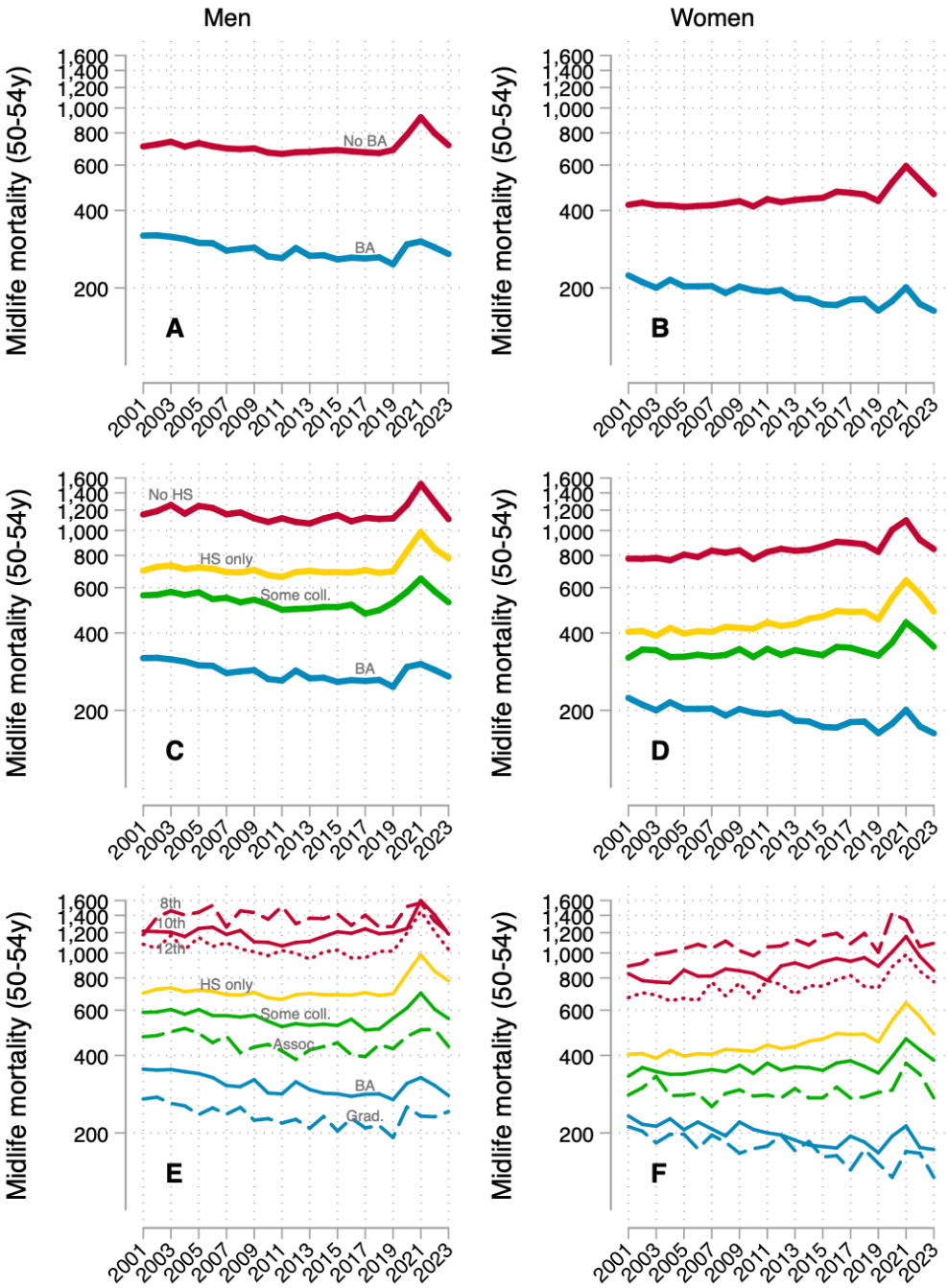
Woolf, Steven H, and Heidi Schoomaker. "Life Expectancy and Mortality Rates in the United States, 1959-2017." Jama 322, no. 20 (2019): 1996-2016.

Fig. 1: Mortality Gaps by Educational Attainment



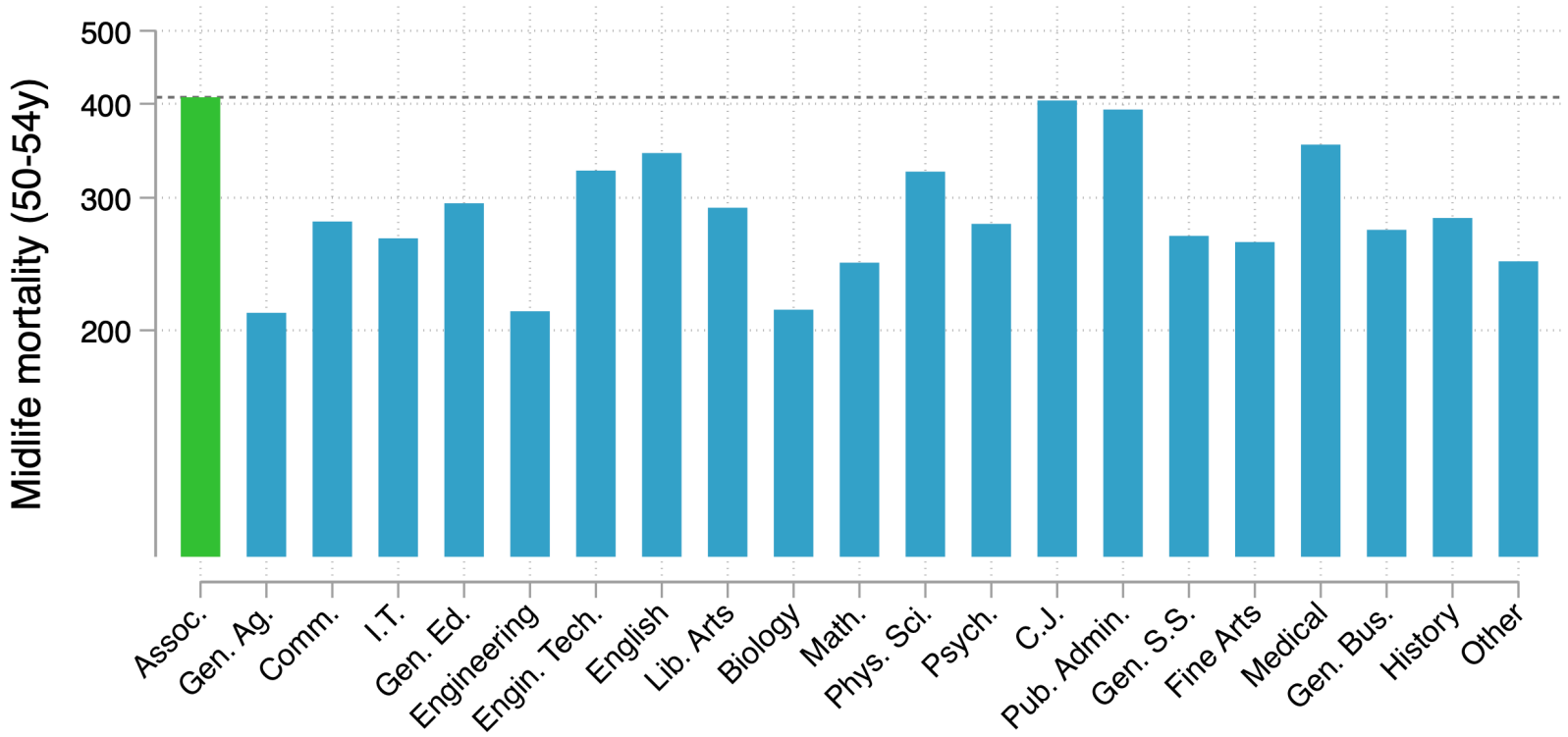
***Note**: Figure 1 shows, on a log scale, probabilities that an individual age 50 to 54 dies in a particular calendar year expressed as deaths per 100,000. All estimates use respondents of the 2000 Decennial Census Longform linked to death records from the Social Security Administration. Every passing year uses incrementally younger cohorts who would have been interviewed at earlier ages. Panel A splits respondents by having a BA or not. Panel B further breaks apart those without a BA, where "some college" includes people with a two-year degree. Panel C further drills down on education, where high school drop-outs are grouped by their highest grade level attended and "graduates" includes any degree higher than a BA. All values are author calculations.*

Fig. 2: Mortality Gaps by Educational Attainment and Sex



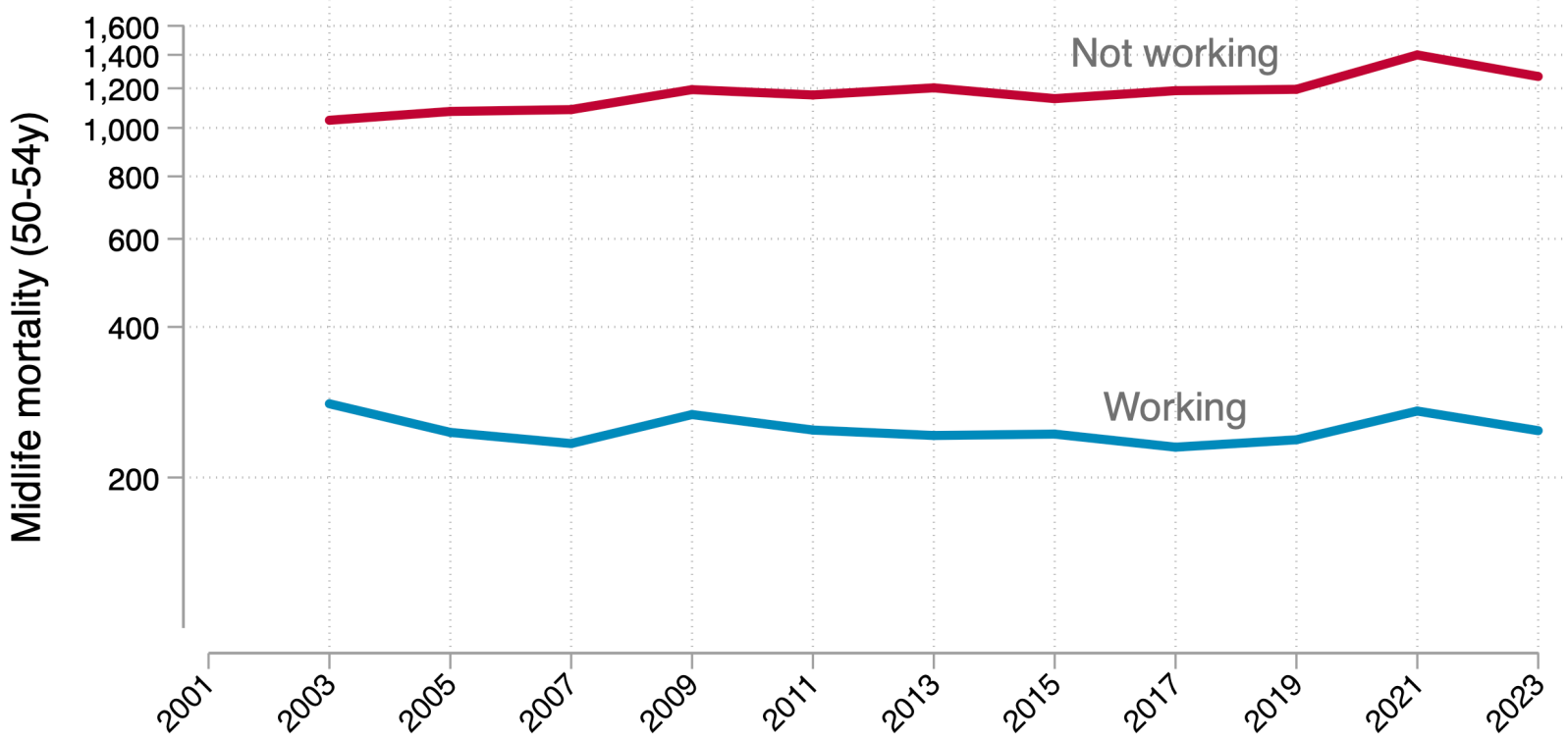
***Note**: Figure 2 shows, on a log scale, probabilities that a man or woman age 50 to 54 dies in a particular calendar year expressed as deaths per 100,000. All estimates use respondents of the 2000 Decennial Census Longform linked to death records from the Social Security Administration. Every passing year uses incrementally younger cohorts who would have been interviewed at earlier ages. Men are shown in Panels A, C, and E; women, Panels B, D, and E. Panels A and B split respondents by having a BA or not. Panels B and D further break apart those without a BA, where "some college" includes people with two-year degrees. Panels C and E further drill down on education, where high school drop-outs are grouped by their highest grade level attended and "grad" includes any degree beyond a BA. All values are author calculations.*

Fig. 3: Mortality Rates by Field of Study



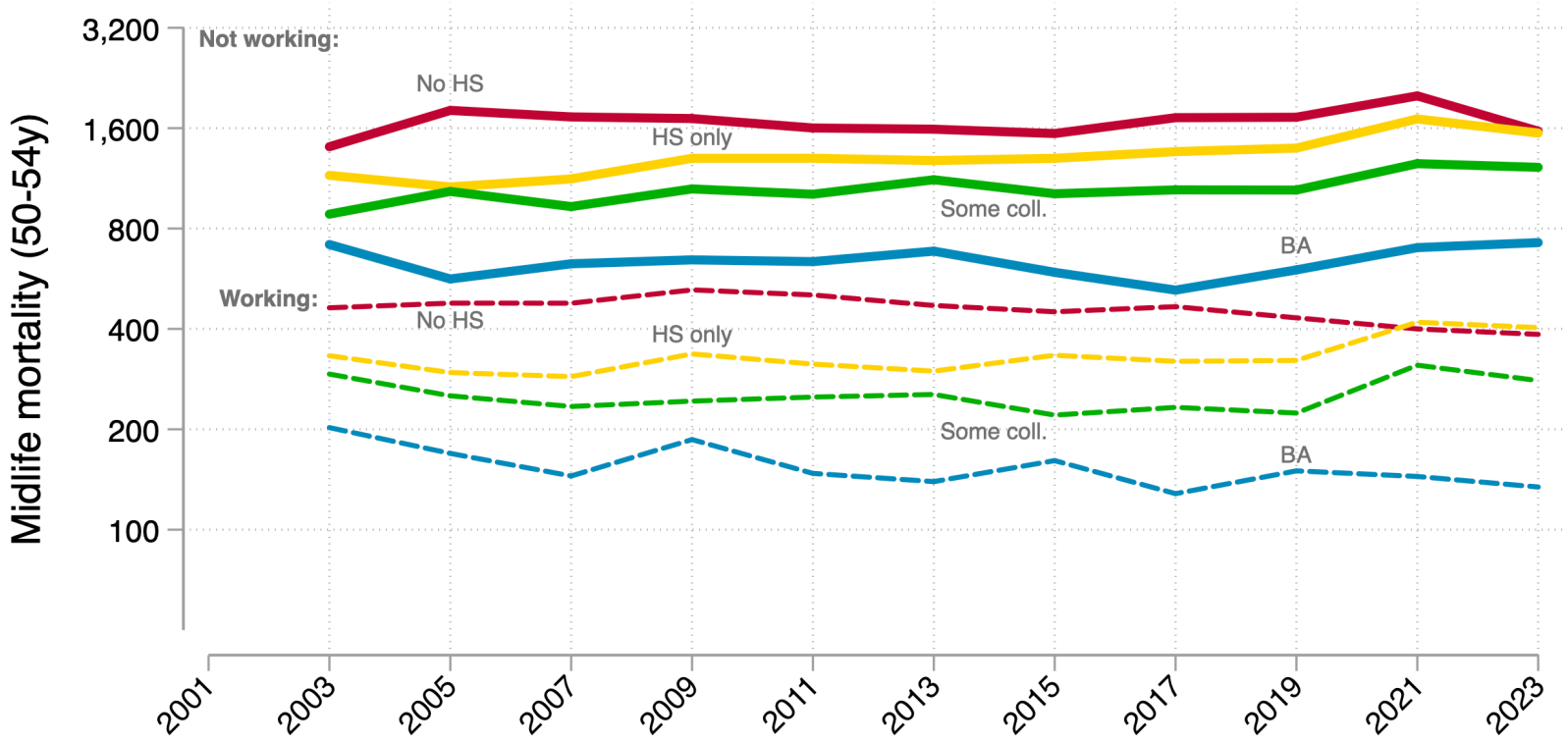
***Note**: Figure 3 shows, on a log scale, the probability that a "representative" individual with a BA ages 50 to 54 dies in a year expressed as deaths per 100,000. All estimates use respondents of the ACS between 2009 and 2018 linked to death records from the Social Security Administration. Probabilities are based on death in the year after interview among those who survive through the year of interview. All years are pooled. Each probability is a prediction from a linear probability model fit via ordinary least squares with fixed effects for race, sex, and interview year in addition to major. With demographic controls in place, the "representative" values for each major are chosen arbitrarily as white men interviewed in 2009. Choosing other demographic baselines would shift the levels of mortality equally for all categories shown. Majors are grouped using two-digit codes from the Census Bureau. Pictured are the most common 19 and "other" capturing the remainder, which accounts for less than 10 percent of college graduates. The probability of death for people with an associates degree is shown for reference on the far left. All values are author calculations.*

Fig. 4: Mortality Rates by Employment Status



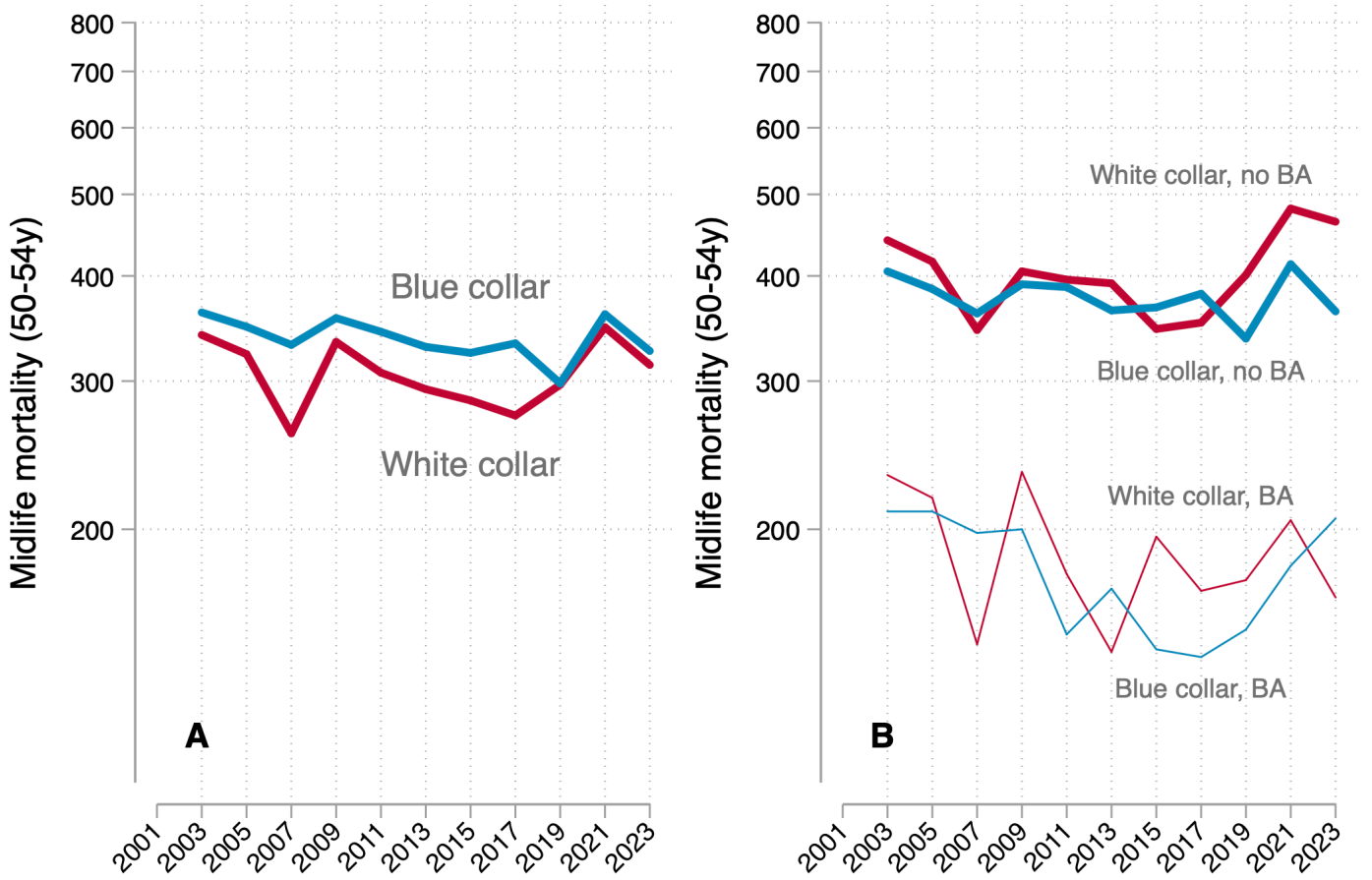
***Note**: Figure 4 shows, on a log scale, probabilities that an individual, employed or not employed, age 50 to 54 dies in a particular calendar year expressed as deaths per 100,000. All estimates use respondents of the ACS between 2001 and 2022 linked to death records from the Social Security Administration. Each probability is based on deaths in the year after interview among those who survive through the year of interview. The probabilities are split by the respondents' employment status. The distinction for not employed includes people both in and out of the labor force (those seeking work and not seeking work, respectively).*

Fig. 5: Mortality Rates by Employment Status and Educational Attainment



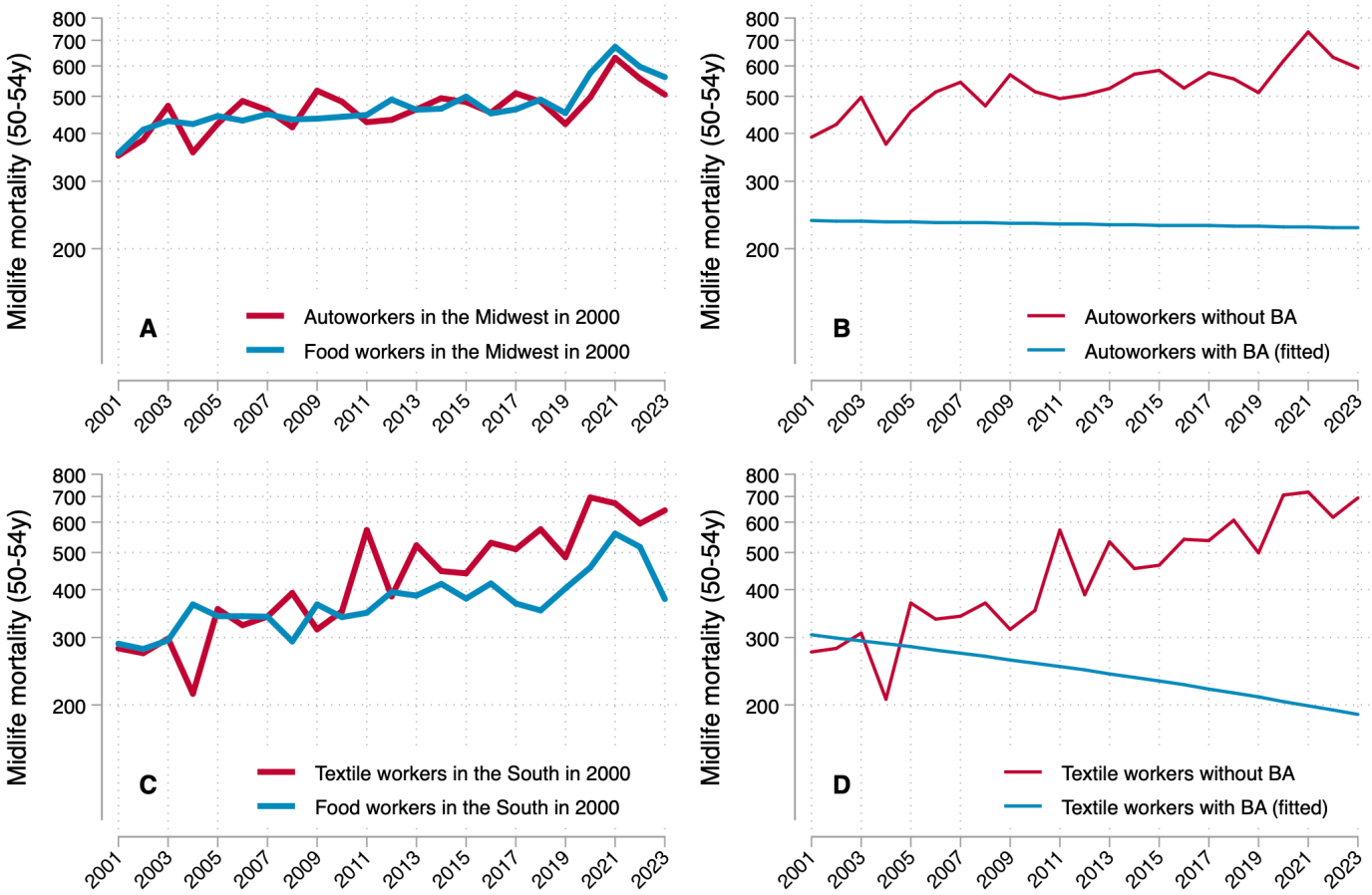
***Note**: Figure 5 shows, on a log scale, probabilities that an individual age 50 to 54 dies in a particular calendar year expressed as deaths per 100,000. All estimates use respondents of the ACS between 2001 and 2022 linked to death records from the Social Security Administration. Each probability is based on deaths in the year after interview among those who survive through the year of interview. The probabilities are split by the respondents' employment status and further by their educational attainment. The distinction for not employed includes people both in and out of the labor force (those seeking work and not seeking work, respectively). The categorization of education is, in order, having no high school diploma, having only a high school diploma, having some college but no four-year degree, and having a four-year degree.*

Fig. 6: Mortality Rates for Working-class Industries by Educational Attainment



Note: *Figure 6 shows, on a log scale, probabilities that an employed man age 50 to 54 dies in a particular calendar year expressed as deaths per 100,000. All estimates use respondents of the ACS between 2001 and 2022 linked to death records from the Social Security Administration. Each probability is based on deaths in the year after interview among those who survive through the year of interview. Panel A splits employed male respondents by whether they worked in "blue collar" industries: manufacturing, construction, utilities, and transportation (i.e., those highlighted in Cherlin (2014)). Panel B splits them further by having or not having a BA.*

Fig. 7: Mortality Rates for Select Manufacturing Sectors



Note: *Figure 7 shows, on a log scale, probabilities that an individual age 50 to 54 associated with a certain sector dies in a particular calendar year expressed as deaths per 100,000. All estimates use respondents of the 2000 Decennial Census Longform linked to death records from the Social Security Administration. Every passing year uses incrementally younger cohorts who would have been interviewed at earlier ages. Panels A and B focus on individuals employed in automobile manufacturing (CODES) in the Midwest Census division in 2000. Panels C and D focus on individuals employed in textile manufacturing (CODES) in the Southern Census region in 2000. Panels A and C, for comparison, show workers in the food processing industry (CODES) in the respective regions. Panels B and D split workers in the focal industries by having or not having a BA. Those with a BA are rare enough that we show fitted values from a linear interpolation, rather than the underlying probabilities, to comply with Census Bureau disclosure rules.*

Fig. 8: Mortality Gaps by Educational Attainment Conditional on Employment Characteristics

***Note**: Figure 8 shows, among individuals age 50 to 54, the difference between those with and without a BA in the probability of dying in a given time period (no longer expressed as deaths per 100,000). All estimates use respondents of the ACS between 2001 and 2022 linked to death records from the Social Security Administration. Each difference is based on deaths in the period after interview among those who survive through the period of interview. For visibility, periods are defined as two years in length, such that 2003 represents deaths from 2002 and 2003, and so on. Each difference is a estimated from a linear probability model fit via ordinary least squares, where the coefficient of interest is an indicator for having a BA. The sign of the coefficient is negated so that the vertical axis is the BA less the non-BA rate. The first series is the raw difference (i.e., no other controls). In subsequent series, controls are added (cumulatively): race and age fixed effects; an employment dummy (working or not); industry-cross-occupation fixed effects; and the log of personal wage and salary income. Panel A shows men only; Panel B, women only.*

Tab. 1: Mortality Gaps by Educational Attainment Conditional on Employment Characteristics

	Men			Women		
	Death in 1 year	10 years	20 years	Death in 1 year	10 years	20 years
	(1)	(2)	(3)	(4)	(5)	(6)
Gap between BA and no BA:						
Raw difference in mortality rates:	0.001837	0.0257	0.065	0.001051	0.0161	0.045
	(0.0000462)	(0.000168)	(0.00027)	(0.0000347)	(0.000131)	(0.00021)
Adding demographic controls:	0.001889	0.0270	0.069	0.000906	0.0143	0.041
	(0.0000465)	(0.000168)	(0.00026)	(0.0000349)	(0.000131)	(0.00021)
Adding dummy for employment:	0.001245	0.0209	0.058	0.000618	0.0114	0.035
	(0.0000469)	(0.000169)	(0.00026)	(0.0000352)	(0.000131)	(0.00021)
Adding industry fixed effects:	0.001144	0.0193	0.053	0.000542	0.0100	0.031
	(0.0000534)	(0.000192)	(0.00030)	(0.0000378)	(0.000141)	(0.00023)
Adding occupation fixed effects:	0.000964	0.0156	0.042	0.000581	0.0103	0.030
	(0.0000604)	(0.000217)	(0.00034)	(0.0000426)	(0.000159)	(0.00026)
Adding income control:	0.000755	0.0135	0.038	0.000527	0.0096	0.029
	(0.0000606)	(0.000217)	(0.00034)	(0.0000427)	(0.000159)	(0.00026)
Interacting industry and occupation:	0.000758	0.0135	0.038	0.000531	0.0097	0.029
	(0.0000618)	(0.000222)	(0.00034)	(0.0000433)	(0.000162)	(0.00026)
Obs.	6,866,000	6,866,000	6,866,000	7,169,000	7,169,000	7,169,000
Dep. var. mean	0.0034	0.047	0.12	0.0020	0.029	0.08

***Note**: Table 1 shows, among individuals age 50 to 54, the difference between those with and without a BA in the probability of dying in a given window (no longer expressed as deaths per 100,000). All estimates use respondents of the 2000 Decennial Census Longform linked to death records from the Social Security Administration. Each difference is a estimated from a linear probability model fit via ordinary least squares, where the coefficient of interest is an indicator for having a BA. The sign of the coefficient is negated so that the reported difference is the BA less the non-BA rate. The first row is the raw difference (i.e., no other controls). In subsequent rows, controls are added (cumulatively): race and age fixed effects; an employment dummy (working or not); industry fixed effects; occupation fixed effects; the log of personal wage and salary income; and industry-cross-occupation fixed effects. Depending on the column, the death window is, in order, 1, 10, or 19 (equivalently, death by the end of 2001, 2010, and 2019). The first three columns describe men only; the latter three, women only.*

Can Job Opportunities Account for the Mortality Gaps by Educational Attainment in the United States?

Submission to "Beyond Deaths of Despair: New Research on the Health and Well-being of Low and Moderately Educated Americans"

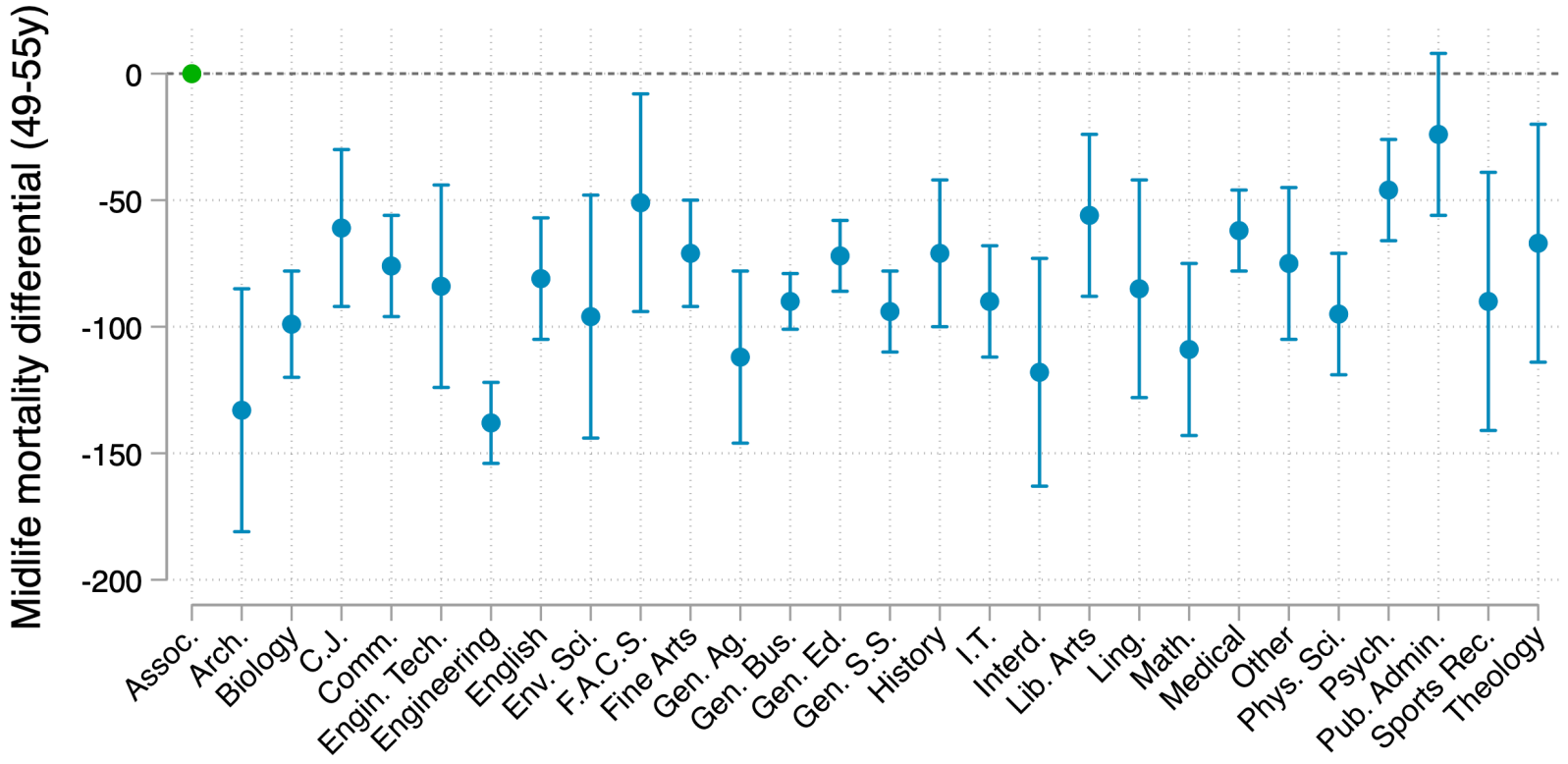
Online Appendix

Sam Arenberg University of Houston
Sam Stripling Texas A&M University

We study one of the most popular but least understood explanations for the increasingly stark advantage in longevity that highly educated Americans possess over their low and moderately educated peers: Job opportunities. Linking millions of rich household surveys to administrative death records, we first show mortality rates over time by granular levels of education, including the first estimates of mortality by college major. We confirm, in these novel data, that recent gains appear reserved for four-year-college graduates and show that even majors with relatively low earnings potential have lower mortality rates than people with an associates degree. We then plot mortality rates for various conceptions of a working class, such as men in manufacturing or other blue-collar industries, to see if the modern ails of less educated Americans bear heavily on them. We find no evidence, however, that a traditional working class is faring significantly worse than everyone else in terms of longevity. Finally, we estimate mortality gaps that are conditional on industry, occupation, income, and other labor market outcomes to more formally quantify the extent to which job opportunities can explain the growing chasm. These factors can explain a substantial portion of the educational divide, but most of that account lies in the fact that highly educated Americans are much more likely than low and moderately educated Americans to have a job at all.

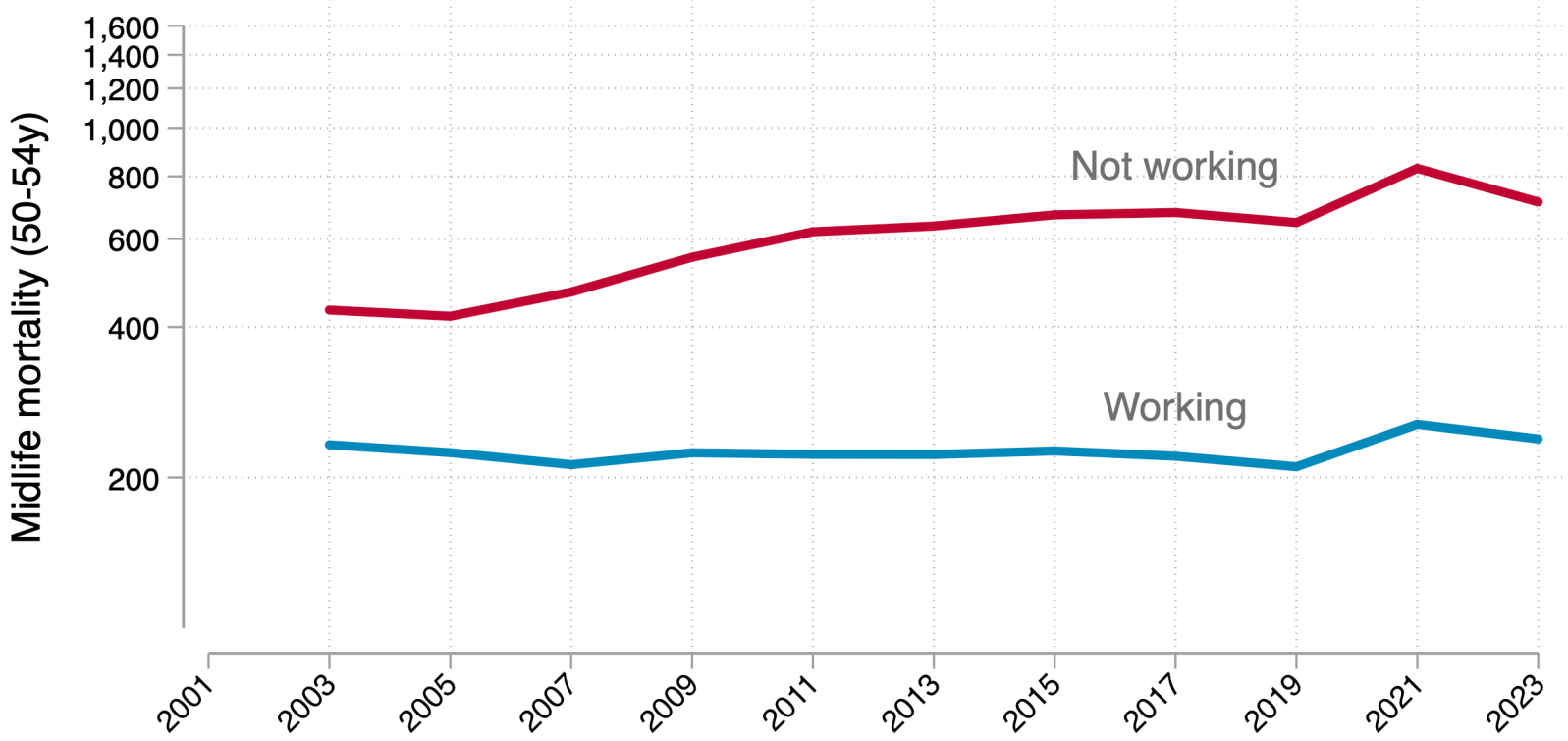
Disclaimer: Any views expressed are those of the authors and not those of the U.S. Census Bureau. The Census Bureau has reviewed this data product to ensure appropriate access, use, and disclosure avoidance protection of the confidential source data used to produce this product. This research was performed at a Federal Statistical Research Data Center under FSRDC Project Number 2603. (CBDRB-FY25-P2603-R11873/12193/12623)

App. Fig. 1: Mortality Rates by Field of Study



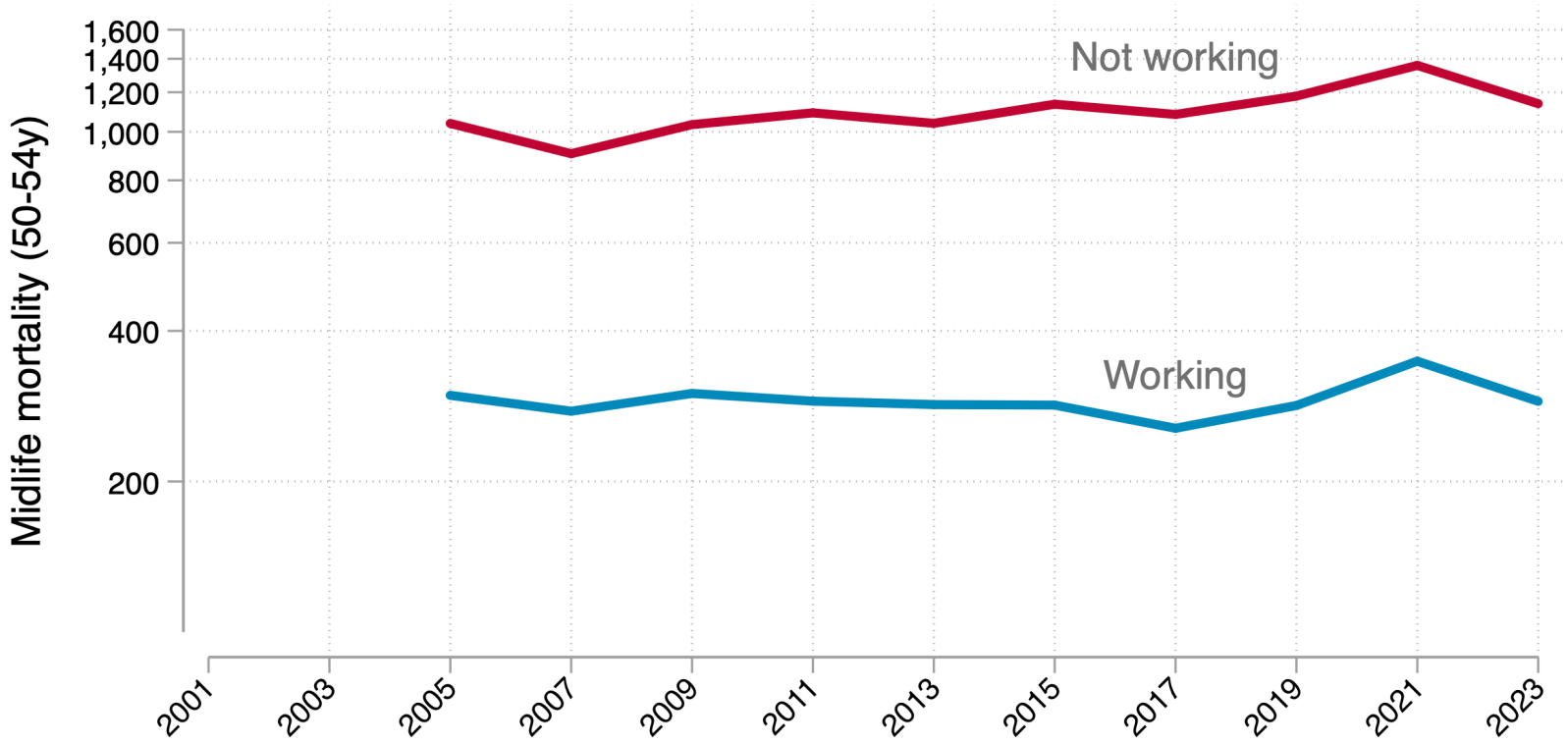
***Note**: Building on Figure 3, Appendix Figure 1 shows the estimated differences in the mortality rates, expressed as deaths per 100,000, of a given major relative to an associates degree (dots) as well as the associated 95-percent confidence intervals for that difference (capped bars). See Figure 3 for additional detail. For precision, we expand the age window slightly to ages 49 through 55.*

App. Fig. 2: Mortality Rates by Employment Status, Lagged Responses



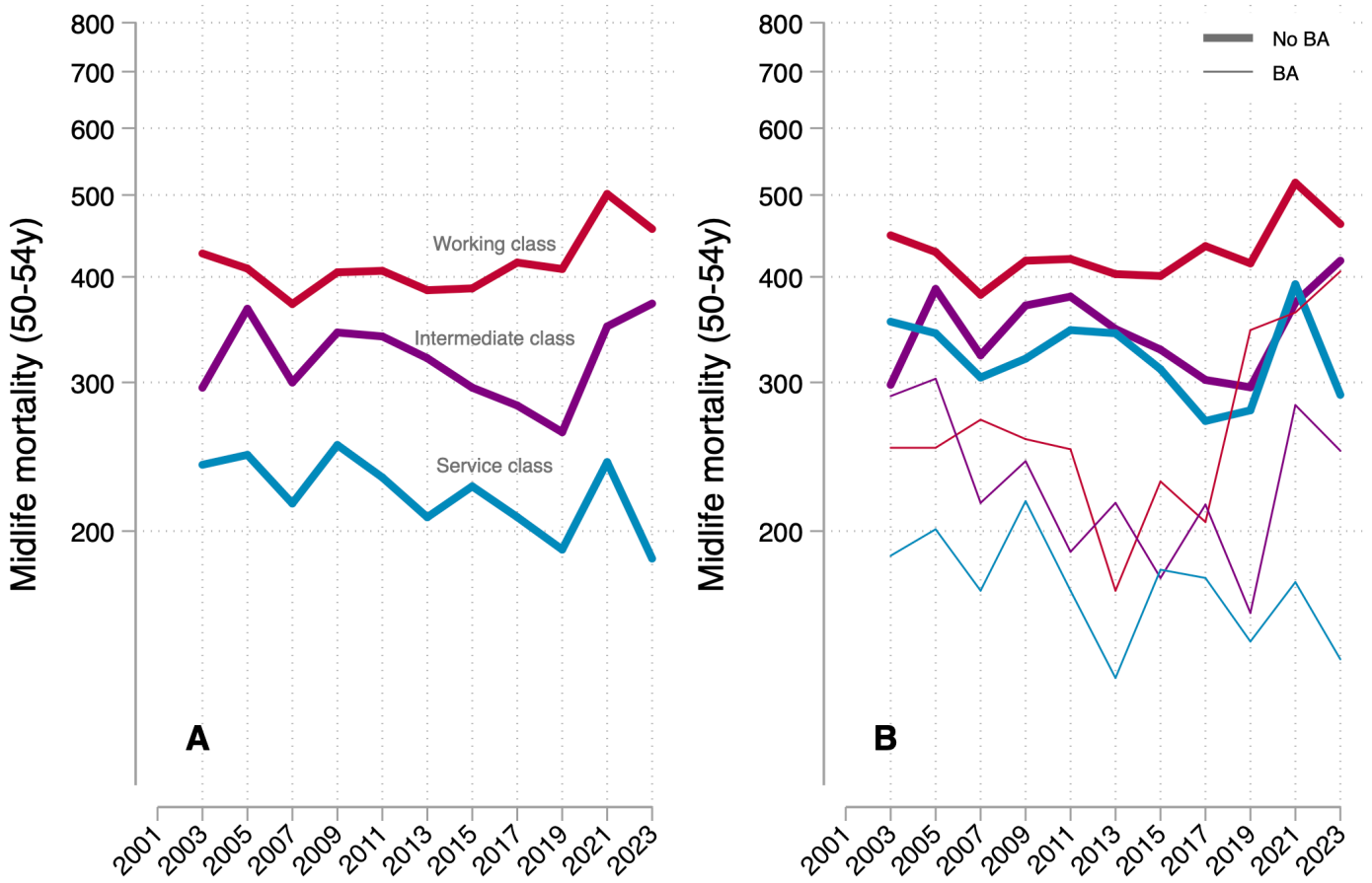
***Note**: Building on Figure 4, Appendix Figure 2 shows, on a log scale, probabilities that an individual, employed or not employed, age 50 to 54 dies in a particular calendar year expressed as deaths per 100,000, but each probability is now based on deaths three years after interview among those who survive those three years. See Figure 4 For additional detail.*

App. Fig. 3: Mortality Rates by Employment Status, Non-disabled Only



***Note**: Building on Figure 4, Appendix Figure 3 shows, on a log scale, probabilities that an individual, employed or not employed, age 50 to 54 dies in a particular calendar year expressed as deaths per 100,000, but we now drop individuals who reported having a disability when they were interviewed.*

App. Fig. 4: Mortality Rates for Goldthorpe Class Schema by Educational Attainment



***Note**: Appendix Figure 4 shows, on a log scale, probabilities that an employed man age 50 to 54 dies in a particular calendar year expressed as deaths per 100,000. All estimates use respondents of the ACS between 2001 and 2022 linked to death records from the Social Security Administration. Each probability is based on deaths in the year after interview among those who survive through the year of interview. Panel A splits employed male respondents by whether they worked in "service class" occupations, "intermediate class" occupations, or "working class" occupations. The definitions are taken from a categorization of occupations that traces back to Erikson, Goldthorpe, & Portocarero (1979). Panel B splits them further by having or not having a BA.*