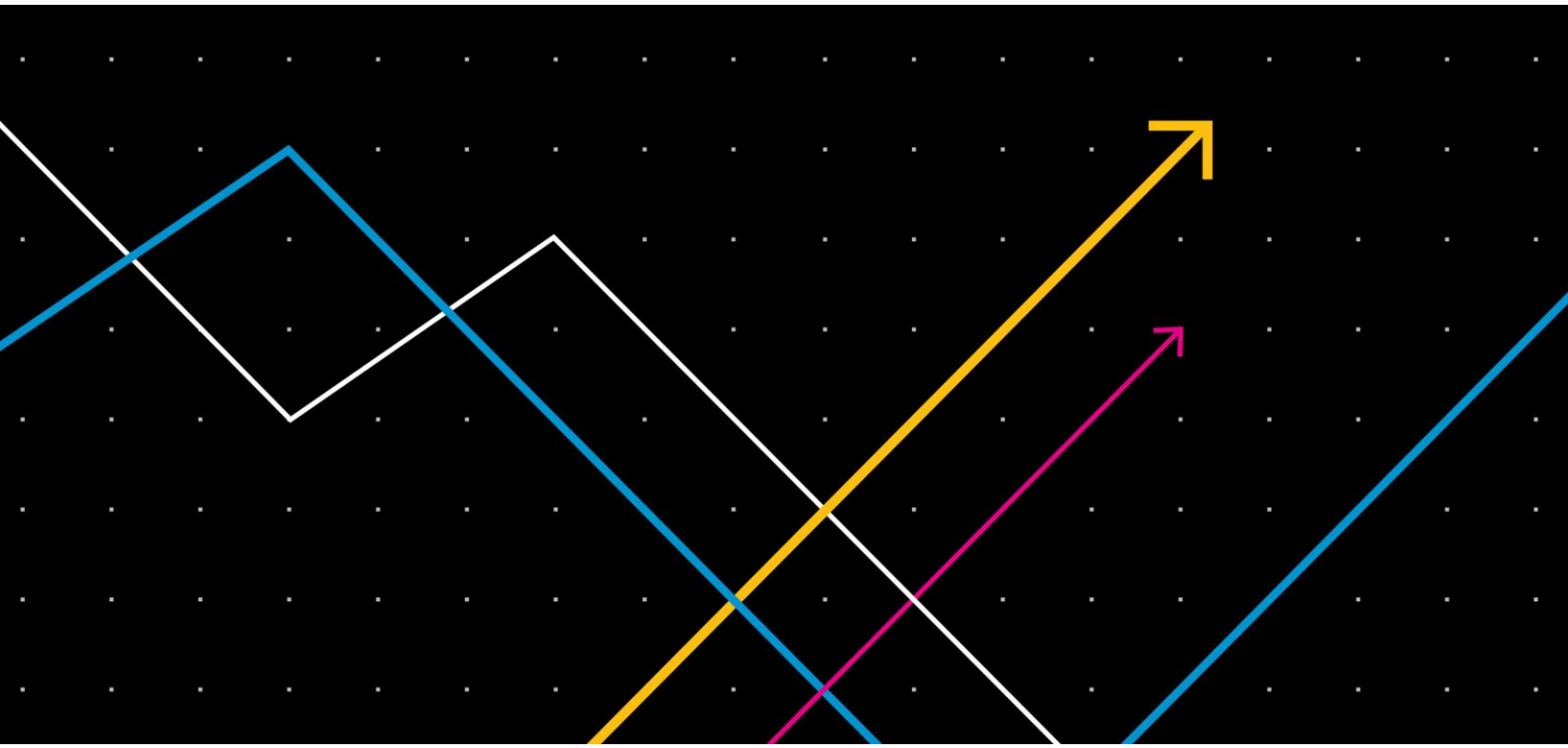


RESEARCH REPORT

# Socioeconomic Disparities in Disabled and Disability-Free Life Expectancy

## Implications for Our Fiscal Future

*Working Paper for US2050*

*Melissa M. Favreault*

*March 2019*

URBAN INSTITUTE · ELEVATE · THE · DEBATE

## Contents

# Acknowledgments

This working paper was made possible by the US2050 project (https://www.pgpf.org/us-2050), supported by the Peter G. Peterson Foundation (PGPF) and the Ford Foundation, under the grant "Socioeconomic Disparities in Healthy Life Expectancy" (grant number 19035). We are grateful to PGPF, Ford, and to all our funders, who make it possible for Urban to advance its mission.

The views expressed are those of the author and should not be attributed to the Urban Institute, its trustees, or its funders. Funders do not determine research findings or the insights and recommendations of Urban experts. Further information on the Urban Institute's funding principles is available at urban.org/fundingprinciples.

I am grateful to participants in sessions at US2050 meetings in June 2018 in Washington, DC and in November 2018 in Florida for helpful comments. I especially thank Charles Blahous and Douglas Elmendorf who provided detailed comments and suggestions as chair and discussant, respectively, of the November session. Susan Collins and I also had a helpful discussion after the session. Charles Blahous further assisted me with many careful and insightful comments on earlier drafts.

For twenty years, Karen E. Smith has been my steadfast partner in developing DYNASIM's content: a system of several hundred complex, interacting longitudinal equations, statistical matches, and tax and benefit calculators. This work would not be possible without her incredibly hard work and unwavering commitment to excellence. Douglas Murray provided programming assistance with the simulations and has been a steady presence since we started rebuilding DYNASIM in the late 1990s. Damir Cosic joined the DYNASIM team in 2015 and has made great contributions to the model since then.

Richard W. Johnson provided helpful comments on an earlier version of this report. He also helped to develop DYNASIM's long-term services and supports model.

Michael E. Chernew, Laura A. Hatfield, and Thomas G. McGuire helped to develop DYNASIM's Medicare model under a grant from the National Institute on Aging (R01AG034417, Principal Investigator: Michael E. Chernew).

# Abstract

**A defining challenge for our times is growing inequality in economic well-being, health, and even life itself. We use the DYNASIM4 microsimulation model to project how disability-free and disabled life expectancy—broken into mildly and severely disabled spells—at older ages vary by socioeconomic characteristics. We then show cumulative experiences with Social Security and Medicare contributions and benefits for older adults from age 51 through death by categories of disabled life expectancy and socio-economic status, highlighting within- and across-group differences.**

The analyses reveal that Social Security and Medicare's insurance functions are especially profound for those in the lower parts of the earnings and education distributions. Those with less education and lower earnings spend fewer years receiving benefits, and far fewer of the receipt years are disability-free. A greater share of their total benefits are paid during spells of severe disability, when their Medicare spending is relatively high. For those with more education and higher earnings, in contrast, needs are less intensive and spread over a longer—and growing—period, though Medicare benefits are still concentrated in periods of significant disability and health needs. Our findings thus underscore the two programs' insurance aspects. This diversity in beneficiaries' experiences has important implications for how policymakers might approach future changes to these programs.

# Socioeconomic Disparities in Disabled Life Expectancy and our Fiscal Future

A defining challenge for our times is growing inequality in economic well-being, health, and even life itself. Although real incomes have grown, health status has improved, and longevity has increased for well-educated Americans, less-advantaged Americans have seen decades of stagnation in income (Kopczuk, Saez, and Song 2010; Piketty and Saez 2007, 2013; Piketty, Saez, and Zucman 2018) and life expectancy (Case and Deaton 2015; Waldron 2007). In the past two years, adult life expectancy in the US has even declined (Arias, Heron, and Xu 2016; Kochanek et al. 2017). Diverging outcomes across the income and skills distribution have important implications for programs that support the aged and disabled, including Social Security, Medicare, and Medicaid (Auerbach et al. 2017; Bosworth, Burtless, and Zhang 2015; National Academies of Sciences, Engineering, and Medicine 2015; Waldron 2013).

Healthy—or active—life expectancy critically affects both the contribution and benefit sides of these programs. Healthy people increasingly work longer (Johnson 2018), making payroll and income tax contributions that bolster government balance sheets and continuing to accumulate wealth that can support them in retirement. They do not rely as much on Social Security Disability Insurance (DI) benefits and require fewer health services, so Medicare, Medicaid, and out-of-pocket expenses for health care are more manageable.

However, poor health and disability, like mortality, earnings, and income, are very unevenly distributed across the population. Those with less education and lower incomes disproportionately feel their burdens. Especially at younger ages, those with limited education or lifetime earnings are much more likely to experience disability than their better-educated, higher-earning counterparts. For example, rates of cognitive impairment are markedly higher for those with less education than those with more (Choi et al. 2018, Crimmins et al. 2018, Freedman et al. 2018, Langa et al. 2016/2017). Crimmins et al. report that at age 65 through 69, mean dementia rates are 13 times higher for men without a high school diploma and 9 times higher for women without a high school diploma than for their same-age peers with a college degree or more.[1] Those most in need of costly health care and long-term services and supports, then, are often least able to afford them (Favreault and Johnson 2018b). Exacerbating this, the US has only a patchwork system for financing long-term services and supports (LTSS). A small share of the population—mostly solidly upper middle class and wealthy people—

purchases private long-term care insurance that will cover at least part of their expenses. Others can receive LTSS from Medicaid, but only after spending down income and assets. In all parts of the income distribution—many including the middle—rely extensively on informal care provided by family members and friends.

Moreover, some recent literature documents some troubling trends surrounding active life expectancy. Some groups that are economically vulnerable throughout their lives are falling further behind in active life expectancy. Freedman, Wolf, and Spillman (2016) found a growing disadvantage for older women relative to older men over the past 30 years, and Freedman and Spillman (2016) report that improvements in active life expectancy have stagnated for some groups, with black women spending much of late life with disabilities. Crimmins, Zhang, and Saito (2016) find that recent overall life expectancy gains have been accompanied by increases in disabled life expectancy, with only those ages 65 and older experiencing greater increase in disability-free life than in disabled life expectancy. Solé-Auró, Beltrán-Sánchez, and Crimmins (2014) find evidence of some widening disparities in disabled and disability-free life expectancy by education for most race-sex groups. Researchers studying trends in cognitive impairment and dementias, including Alzheimer's disease, report that disparities by education remain large. Some studies, however, may provide a small measure of optimism, suggesting that those with less education may be seeing faster improvement than others (Li et al. 2017).

Longer life typically means more years collecting Social Security and Medicare benefits, as well as defined benefit pension benefits. Longer life also means a longer risk period for disability and sickness. For some, disabling conditions may be postponed rather than avoided. As Ghilarducci and Webb (2018) document, people with limited education, unmarried people, and those without pension coverage are more likely to die without ever retiring than their better-educated, married counterparts with pension coverage. They also spend relatively more of their retirement years with disabilities. On the flip side, many of those fortunate enough to have long lives could work past traditional retirement ages, sometimes well past them. Increasingly, those with more education work full-time later in life (Johnson and Wang 2017). However, those with longer lives may face challenges managing their assets, including any defined contribution retirement accounts, in retirement, especially if they retire early. They must plan carefully to conserve enough resources to meet their later-life needs.

As our largest public programs face long-anticipated financing shortfalls, policymakers designing adjustments must grapple with these disparities and both the technical challenges and political tensions that changes are likely to generate. A first step toward developing policies that can balance competing needs in a sustainable way is to more fully understand the magnitudes of differences in retirement and disability experiences across groups—both on average and throughout the distribution.

We use a dynamic microsimulation model, DYNASIM4, to project how healthy and disabled life expectancy—broken into mildly and severely disabled spells—at older ages vary by socioeconomic characteristics. We then show cumulative experiences with Social Security and Medicare for adults from age 51 onward through death (thus including a substantial share of experience with the DI program) and how they vary by total and healthy life expectancy and socioeconomic status, highlighting within- and across-group differences.

Our paper extends earlier DYNASIM work on future Medicare beneficiaries' expected out-of-pocket spending burdens (Hatfield et al. 2016); how the combined effects of Social Security and Medicare benefits and contributions vary by birth cohort, lifetime earnings decile, and age at death (Favreault and Johnson 2018a); and how combined total and out-of-pocket costs of acute care and long-term services and supports vary by duration of disability, age at death, and income quintile (Favreault and Johnson 2018b).

# Previous Literature

This paper builds on several distinct literatures: studies on mortality and morbidity differentials; studies on lifetime treatment by public programs, including studies of Social Security and Medicare progressivity; and studies of lifetime risk and costs of disability, including the risks of needing and using LTSS. We briefly weave together this context, concluding with a discussion on the social determinants of health and mortality.

## Differential Mortality

The academic literature has considered differential mortality for decades (Kitagawa and Hauser 1973), but coverage of this topic has recently surged in more popular outlets. Death differentials may have widened to the point that they have become more conspicuous to the public at large. Leading newspapers now routinely present information about mortality differences in front-page articles and detailed graphics (Irwin and Bui 2016, Kolata 2015). Case and Deaton coined the term "deaths of despair" to describe what they hypothesize to be excess deaths resulting from economic strain (Case and Deaton 2017; Deaton 2017)—though Ruhm (2018) suggests that economic conditions are only loosely related to recent upticks in mortality.

Access to high-quality administrative data and surveys linked to administrative files has recently enabled researchers to conduct important, highly granular work on mortality differentials. Much of this

research compares people in different communities, considering the socioeconomic characteristics of the environment (Chetty et al. 2016; Singh and Siahpush 2006). Such studies find that even people living just a short distance from one another can face dramatically different life expectancies depending on their communities' relative advantages. Other studies, like ours, use measures from household survey data, often matched to earnings and mortality records, or mortality records on their own to describe how mortality differs by individuals' socioeconomic characteristics (Bosworth, Burtless, and Zhang 2015; Cristia 2008, 2009; Cutler et al. 2011; Manton, Stallard, and Corder 1997; Olshansky, et al. 2012; Waldron 2013). Most find that mortality rates decline rapidly as income and educational attainment rises. Some document differences throughout the earnings distribution (Bosworth, Burtless, and Zhang 2015). Others more narrowly compare outcomes for larger groups, for example contrasting the top half with the bottom half (Waldron 2013).

In many of these studies, it is not possible to disentangle whether mortality and socioeconomic status are causally related. There could be, for example, a third variable that affects both socioeconomic status and mortality. A serious health problem or poor health might lead one to pursue less education, to work fewer hours, and also to die sooner. To address this limitation, some researchers examine exogenous events to try to determine whether socioeconomic characteristics like education are causally related to mortality, rather than just correlated. Using information about draft avoidance during the Vietnam war, for example, Buckles et al. (2016) find that college completion led to cumulative mortality reductions of over 25 percent.

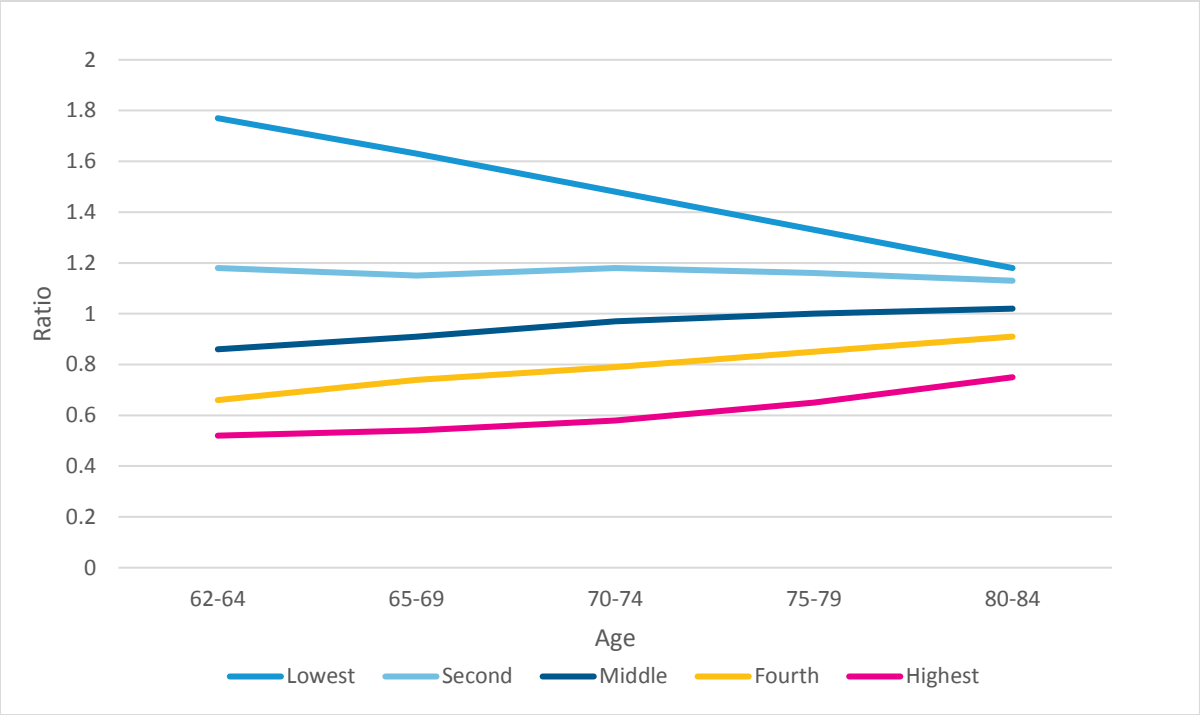
An important aspect of socioeconomic disparities in health status and mortality is that they often differ by age, both before retirement and throughout the retirement years, with differences between higher and lower status groups shrinking at older ages. This compression may reflect differential robustness among survivors: members of the low-status group who survive to the oldest age tend to be the more robust, while members of the high-status group who survive are likely to be more heterogeneous. Likewise, different types of health conditions and limitations, which are differentially related to socioeconomic status, can onset at earlier and later ages. Cohort effects and cohort differentials—for example, those in earlier birth cohorts who failed to complete high school were a less select group than those who failed to complete high school in later cohorts—can also be a factor.

Using high-quality data on a sample of retired workers from Social Security Administration data, Bosley, Morris, and Glenn (2018), for example, show that the differential in mortality between lifetime earnings groups narrows with age, and the gaps are narrower for women than for men (figure 1).[2]

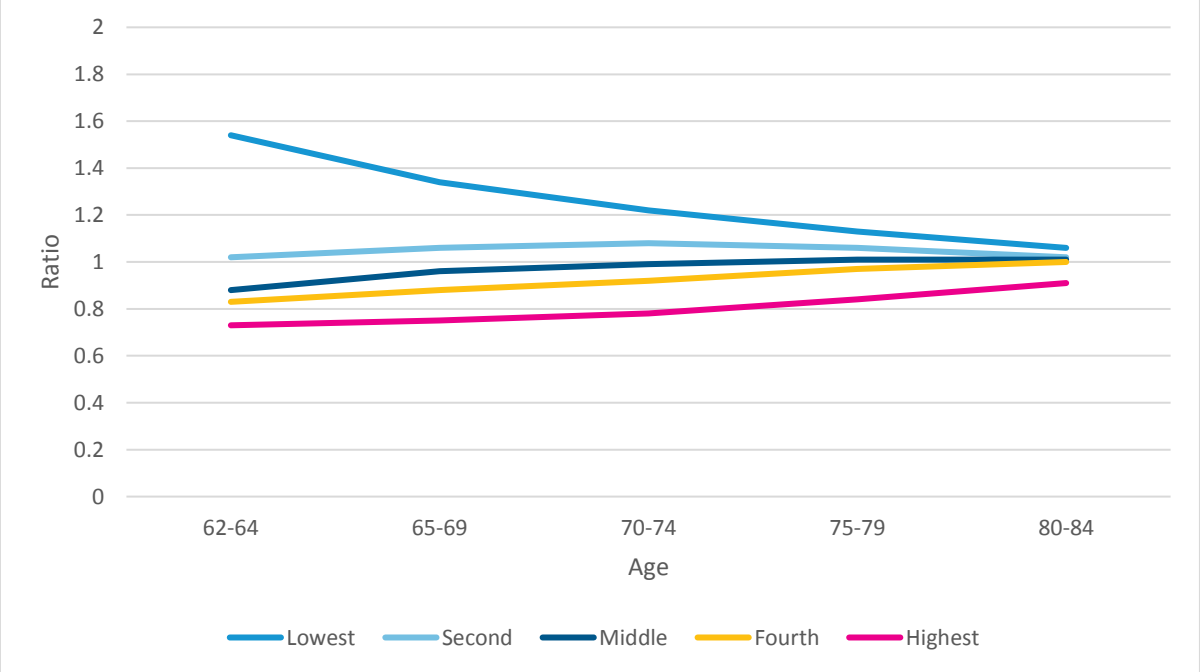
FIGURE 1

**Relative Mortality Ratios for Retired Workers by Age, Sex and Quintile of Lifetime Earnings in 2015**

**Panel 1: Men**




**Panel 2: Women**




**Source:** Bosley, Morris, and Glenn (2018).

**Notes:** The mortality ratio is defined as the ratio of the rates for the lifetime earnings group relative to the average for the entire age-sex group. Lifetime earnings is defined by Average Indexed Monthly Earnings.

For men, for example, the lowest lifetime earners' mortality rates at ages 62 to 64 are nearly 1.8 times higher than the overall average, and the highest lifetime earners have rates that are closer to half the average (0.52 times); at ages 80 to 84, these gaps narrow to 1.18 times the average for those in the lowest quintile and three-quarters the average rate for those at the top (figure 1, panel 1). For women, the differences are consistently smaller than they are for men, but the age pattern is similar (figure 1, panel 2). At ages 62 to 64, those with the lowest lifetime earnings have mortality rates that are roughly fifty percent higher than average (1.53 times), while those in the highest quintile have rates that are about a quarter lower (0.73 times the average). At ages 80 to 84, the gaps narrow to 1.06 times higher mortality for the lowest quintile and 9 percent lower mortality for the highest quintile.

Educational and lifetime earnings differentials are not the only important disparities that shape mortality experiences. Other researchers have isolated the independent effects, net of lifetime earnings or education, of race (Geruso 2012). Similarly, Rendall et al. (2011), highlight differences in mortality between married and nonmarried people net of other characteristics. Different birth cohorts also have different experiences, and socioeconomic differentials vary by cohort (Masters, Hummer, and Powers 2012).

## Social Security and Medicare Progressivity on a Lifetime Basis

At least as far back as the 1960s and 1970s, researchers and analysts have suggested that demographic differentials, such as income differences in life expectancy, could affect Social Security progressivity (Aaron with Spevak 1977; Friedman with Friedman 1962). The question of who benefits most from Social Security and Medicare, important because of the programs' enormous reach, is surprisingly difficult to answer because of the programs' complexity and data limits. Social Security combines many intricate provisions that shape redistribution in various ways that continually shift as the economy and society change. On the tax side, capped payroll taxes and personal income taxes levied on benefits affect the system's progressivity. The share of total earnings subject to the payroll tax shrunk from 1984 through about 2000 as those earners above the payroll tax cap garnered a large share of total earnings, and it has since fluctuated with the business cycle (Board of Trustees, Federal Old-Age and Survivors Insurance and Disability Insurance Trust Fund 2018, page 144). Personal income taxes are taking a larger bite out of benefits because the tax thresholds are not indexed for inflation (Shakin and Seibert 2015). On the benefit side, the program's progressive formula bases benefits on the highest 35 years of earnings. It also awards proportional benefits to spouses and survivors and thus is sensitive to socioeconomic differences in marriage rates (Harrington Meyer 1996; Harrington Meyer et al. 2004). Further, it protects workers with disabilities, and disability prevalence varies inversely with social

status. Finally, it pays benefits in the form of an indexed life annuity, thus disproportionately benefiting longer-lived groups.

One of the first simulation studies on this topic appeared in the late 1970s (Thompson 1976). In the 1980s, Burkhauser and Warlick (1981) proposed methods to disentangle Social Security's insurance annuity from its redistributive aspects. Others subsequently considered the question later that decade (Boskin, et al. 1987, Meyer and Wolff 1987). Other spurts in this literature followed in the 1990s (Caldwell et al. 1999; Coronado, Fullerton, Glass 1999; Favreault 1998; Garret 1995; Wolff 1990), the 2000s (Brown, Coronado, and Fullerton 2006; Cohen, Steuerle, and Carasso 2001; Gustman and Steinmeier 2001; Liebman 2002; Smith, Toder, and Iams 2003), and this decade (Coe et al. 2011; National Academies of Sciences, Engineering, and Medicine 2015).

A full evaluation of this complex literature is beyond our current scope. However, a few salient themes recur despite significant differences in data, analysis periods, methods, and metrics across studies. A first key finding is that differential mortality substantially reduces the progressivity of Social Security's retirement and survivors' components, and that effect may be growing. A second important point about progressivity is that whether an analysis includes or excludes DI benefits shapes conclusions about progressivity because people with less education and lower lifetime earnings are much more likely than others to collect DI benefits (Favreault, Johnson, and Smith 2013). Studies that do not include DI benefits are more likely to note less progressivity than one would anticipate with the progressive formula—or even find regressivity depending on the measure—in Social Security's retirement program, whereas those that account for DI tend to conclude that the overall program treats beneficiaries more proportionately or progressively. A third finding from the literature is that spouse and survivor benefits' distributional effects of are sometimes deemed regressive because they are proportional to worker benefits rather than spouses' and survivors' needs and marriage rates increase with social and economic status.

The literature on Medicare progressivity is arguably sparser than the Social Security literature, but several studies have identified distributional patterns (Bhattacharya and Lakdawalla 2006, National Academies of Sciences, Engineering, and Medicine 2015; Rettenmaier 2012), including for DI beneficiaries (Riley and Rupp 2015). Any studies of Medicare progressivity—like studies of Social Security progressivity—depend on definitions on the benefits side, for example whether one is evaluating Part A on its own, or Parts A, B, and D in combination. Medicare's financing differs significantly by program component, with Part A financed largely by payroll taxes (in 2017, roughly 87 percent from payroll taxes, plus roughly 8 percent from taxation of Social Security benefits), and Parts B and D financed largely by general revenue transfers (71 percent for Part B and 73 percent for Part D in

2017) and beneficiary premiums (27 percent for Part B and 15 percent for Part D) (Boards of Trustees of the Federal Hospital Insurance and Federal Supplementary Medical Insurance Trust Funds 2018). Medicare's uncapped payroll tax, the revenue from part of the tax on Social Security benefits, the additional Medicare tax that applies to earnings of those with higher income, and the general revenue transfers are all progressive (with some components—like additional Medicare tax—especially so), and premiums are income-related. However, longer and increasing average lifespans—plus higher net consumption[3]—among high-income beneficiaries could partially offset the progressive financing when evaluating on a lifetime basis.

## Differentials in Health, Lifetime Risks of Disability, and Disability Costs

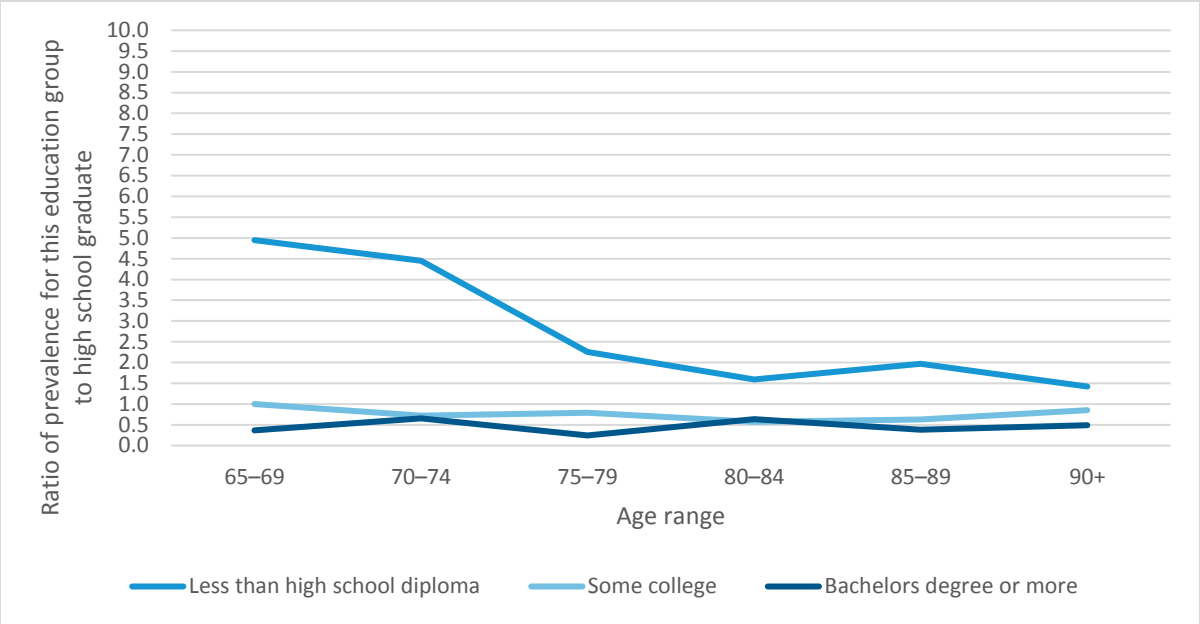
An extensive literature documents how health status and risks of disability differ by socioeconomic status both at a point in time[4] and over a lifetime. An intriguing question is the extent to which, because of their longer lifespans, those with higher status and lower age-specific rates of disability "catch up" to those in lower education and earnings groups as they face risks of poor health and disability over their lifetime. Do those who have lower disability rates at each age but a greater time at risk of becoming disabled—and particularly more time at very advanced ages—end up with lower, higher, or similar life expectancies with disability when these two factors are combined?

Let's start first by examining disability experience at a point in time. Figure 2 depicts how relative dementia rates vary by sex and education. It is taken from a recent study by Crimmins et al. (2018), based on nationally representative data from the Health and Retirement Study. The figure compares dementia rates for each of the age-sex categories with those for the modal group, high school graduates. The patterns resemble the mortality patterns the Bosley, Morris, and Glenn (2018) study shows. Dementia prevalence is much higher for those without a high school diploma, especially at younger ages. At ages 65 to 69, it is about 5 times higher for men and nearly ten times higher for women compared to those with a high school diploma. The education differential narrows at the oldest ages but remains quite large. For those with more than a high school degree, the age pattern is less significant, but rates are generally markedly lower throughout the age distribution. This is especially true for those men and women with at least a bachelor's degree; their dementia rates are consistently about half the rates for high school graduates.

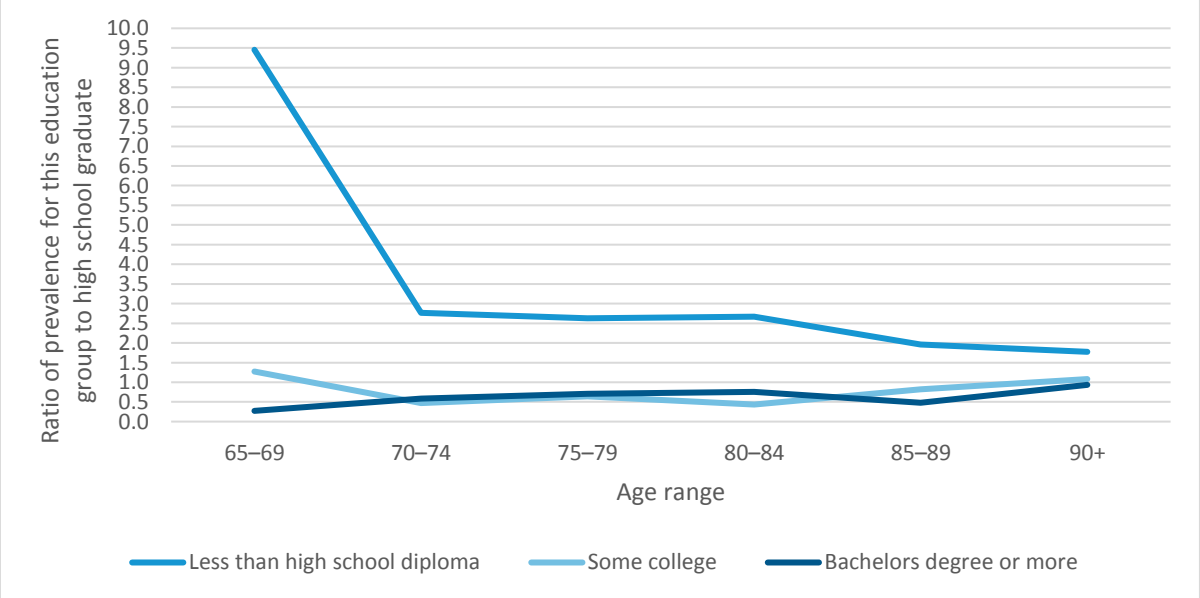
FIGURE 2

**Relative Dementia Ratios by Age, Sex and Education in 2010**

**Panel 1: Men**




**Panel 2: Women**




**Source:** Crimmins et al. (2018).

**Notes:** The ratio is defined as the ratio of the rates for education group relative to the average for high school graduates in the age-sex group.

Crimmins et al. (2018) also project total time cognitively disabled from age 65 and older and from age 85 and older. They estimate that more educated people's longer lives do not translate into

comparable or longer absolute amounts of later life cognitively disabled. People with more education spend less of late life cognitively disabled both in absolute and percentage terms. Lièvre, Alley, and Crimmins (2008) also find this using nationally representative data. Using data from a more select sample, Robitaille et al. (2018) draw similar conclusions: that both total time impaired and percent of time cognitively impaired are higher for people with lower socioeconomic status.

Solé-Auró, Beltrán-Sánchez, and Crimmins (2014) report similar patterns for cumulative disability experiences from ages 60 through 90, where they define disability by presence of any limitations in activities of daily living (ADLs). For the four race-sex-education groups they examine over two periods (mid-1980s to mid-1990s and mid-1990s to mid-2000s), those with higher education, defined as at least a high school diploma, have both longer disability-free periods, higher percentages of disability-free life expectancy, and lower absolute years with disabilities. When they repeat the analyses using finer educational groupings (less than a high school diploma, a high school diploma, and at least some college) and still separating men from women but not differentiating by race, they again find that those with more education have much longer expected periods unimpaired. Those with more education also have higher percentages of life expectancy unimpaired in the later period; in the earlier period, the percentages unimpaired are similar for high school graduates and those with more than high school. In both periods, those with more education sometimes have longer absolute times with disabilities because the greater total life expectancy offsets the lower disability rates. Laditka and Laditka (2016) similarly report expected shares of life disabled by race and education at various ages, similarly focusing on presence of any limitations with ADLs. They show significant percentage differences in health and disabled life expectancy across the race-sex-education groups, leading to very large differences in life expectancy without disabilities. Absolute differences in life expectancies with disabilities are comparable between the more- and less-educated at some ages, and in some cases, the more-educated group can expect to spend more total time disabled because the total life expectancy differences are so large.

## Social Determinants of Health

Many researchers have tried to determine whether there are aspects of being poor—or lower in the status hierarchy more broadly—that directly lead to deleterious health, disability, and mortality outcomes like those we have just described. A growing literature examines the social determinants of health across the life course (Braveman and Gottlieb 2014, McEwen and Gianaros 2010, Woolf and Braveman 2011); this literature considers a wide array of factors, pathways, and potential mechanisms. For example, researchers have explored whether exposure to adverse events or circumstances,

including racism and associated stress, can generate biological changes which in turn can lead to health problems. Determining whether relationships between socioeconomic status and health and mortality are causal—rather than the result of other factors or reverse causality—poses considerable technical challenges. The body of work increasingly relies on sophisticated methods meant to identify causal effects. Researchers in this area often underscore the importance not just of understanding risk factors, but also understanding their antecedents: "the causes of the causes" (Link and Phelan 1995).

# Methods and Data

Our analyses rely primarily on projections from our simulation model. We supplement these projections with historical estimates from household survey data sources.

***Medicare Current Beneficiary Survey***: We use the 2015 and 2016 Cost and Use files from the Medicare Current Beneficiary Survey (MCBS) to document recent health and disability differentials by socioeconomic status. The MCBS is a continuous, in-person survey of a representative national sample of the Medicare population, linked to Medicare claims data. Sponsored by the Office of Enterprise Data and Analytics of the Centers for Medicare and Medicaid Services (CMS) in partnership with the Center for Medicare and Medicaid Innovation, it was designed to aid CMS in administering, monitoring, and evaluating the Medicare programs. The MCBS has been carried out for more than 25 years, encompassing more than one million interviews.

The MCBS includes an extensive set of questions aimed at understanding Medicare beneficiaries' chronic conditions and functional limitations. Because many of those with the most severe disabilities, such as severe cognitive impairment, may be unable or unwilling to answer these sorts of questions, the survey also collects information from proxy respondents (for those in the community) and providers (for those in facilities).

We use the MCBS to compute age-specific prevalence of several disability measures and document how prevalence rates differ by education.

***DYNASIM:*** We use DYNASIM—a dynamic microsimulation model—to project future retirement incomes under current law and proposed alternatives for Social Security, the income tax code, Medicare, Medicaid, Supplemental Security Income (SSI), and other policies. First developed in the 1970s by a team led by Guy Orcutt—recognized as the intellectual founder of microsimulation (Orcutt 1957)—the model was used extensively throughout the 1980s (Orcutt, Caldwell, and Wertheimer 1976), but fell into disuse in the 1990s when funding dried up. It was resurrected in 1999 and has been

under continuous redevelopment ever since. The model has benefited from both direct federal government investments in the model itself and from spillovers from related federal microsimulation efforts, including the Modeling Income in the Near Term data system (Smith and Favreault 2013). In addition to projecting public benefits, the model also projects the accrual of employer benefits, like pensions, and household decisions about how much wealth to accumulate and in what forms (i.e., housing versus financial assets). The model simulates over the 75-year forecasting horizon the Social Security Administration actuaries use in the Trustees report. DYNASIM is well suited for a project like US 2050 that focuses on understanding how ongoing demographic and social changes will shape future well-being. An especially appealing model feature is that it projects full distributions of experiences, not just averages. This is valuable when considering disability, as those with long-term disabilities and high disability-related expenses are often the most economically vulnerable.

DYNASIM starts with baseline information about a nationally representative population from the Survey of Income and Program Participation (SIPP) from 2004 and 2008. The model "ages" the population year-by-year, simulating demographic and economic events using transition probabilities and rule-based algorithms. The model's aging rules rely on rich longitudinal data and typically include socioeconomic differences—by education, lifetime earnings, and race-ethnicity—when projecting health and mortality. DYNASIM projections capture compositional change in the population for the next seven decades. Many economic and demographic outcomes are calibrated to the intermediate assumptions of the 2018 Social Security Trustees Report, typically on an age-sex basis, with behavioral equations driving differences within age-sex groups. Fuller information about DYNASIM is available elsewhere (Favreault, Smith, and Johnson 2015). We describe below the model components that are most germane to our analyses—the mortality module, health and disability models, and tax and benefit capacities.

## Mortality Models

Our mortality model draws on our earlier collaborative work (Rendall et al. 2011) completed for the Social Security Administration and published work. We generate annual death probabilities separately for children, for those adults who are receiving DI benefits, and those adults not receiving DI. Estimates for DI beneficiaries are based on data from Social Security's administrative records that detail how death rates vary by disability duration (Zayatz 2015).

For those not receiving DI benefits, we estimate separate mortality equations for children, adult men, and adult women, using SIPP data matched to administrative records on lifetime earnings, Social

Security benefit receipt, and death. We pool data from multiple survey years (1996, 2001, 2004, and 2008), yielding sample sizes of roughly 175,000 person-year observations for men and 200,000 person-years for women. We anchored the estimated coefficients to the Social Security actuaries' projections using techniques similar to those Panis and Lillard (1999) developed. The key explanatory variables for capturing socioeconomic differentials in death rates are education dummy variables and the present value of an individual's lifetime earnings accrued to date divided by the cohort-specific average. To capture patterns seen in historical data, such as the declining socioeconomic differentials by age that Figure 1 shows, we include several age-interaction terms, such as the interaction between the present value of lifetime earnings and age. As with many other outcomes in the model, we insure that mortality rates approximate those of the Social Security trustees' intermediate assumptions.[5] This enables users to compare DYNASIM projections of changes to Social Security and Medicare to those projected by Social Security and Medicare actuarial offices on an equal footing.

Our earlier work (Smith et al. 2018) validated the socioeconomic differentials in our cross-sectional age-sex mortality projections against Bosley, Morris, and Glenn (2018)'s estimates.[6] We also document that life expectancies track the Trustees cohort values. These earlier analyses found that our projected income differentials in mortality are lower than those projected by analysts using models estimated from Health and Retirement Study data, including Bosworth, Burtless, and Zhang (2015) and National Academies of Sciences, Engineering, and Medicine (2015). At the same time, they are larger than those projected by the Congressional Budget Office, also using SIPP data.[7] Despite differences with some studies, we retain our specification for the present study given our model's consistency with the age-specific rates Bosley, Morris, and Glenn report in their analyses derived using a large, very high-quality sample. We believe these are possibly the most reliable published data to date.

## Health and Disability Models

DYNASIM's health and disability projections after age 50 consider the *progression* of health change and disability, using a structure that recognizes these processes' dynamic nature; people develop limitations, but sometimes recover. Whether disability onset is sudden or incremental affects one's ability to work or provide personal care and thus one's economic needs. The model, estimated using Health and Retirement Study data, integrates occurrence and duration dependence in health and disability outcomes. The model projects self-reported health status, limitations in ADLs and in instrumental activities of daily living (IADLs), counts of chronic conditions, and cognitive status.[8] We closely compare projections from the historical period to estimates from the MCBS and National Health and Aging Trends Study to identify and resolve any discrepancies.

Our healthcare spending models—which include cost projections for both acute-care and LTSS—account for the close relationship between health status, disability, technological change, and health care spending. They also recognize that income and out-of-pocket cost burdens affect health care spending. Those with more income tend to be healthier, which reduces their healthcare spending, but they are also less financially burdened by their spending, allowing them to purchase higher quality services and more discretionary services and leaving them less likely to skip necessary services. In modeling insurance choices and premiums, DYNASIM recognizes that those with more health problems are more likely to opt for more comprehensive coverage than those who expect to use fewer services. This tendency, known as adverse selection, raises costs and can drive many of those in better health to seek lower-cost insurance alternatives. The model endogenously generates Part B, Medigap, and Medicare Advantage premiums, depending on the population's health status and disability and income distributions.

We calibrate the healthcare projections in this paper to the illustrative scenario of the Medicare actuaries (Shatto and Clemens 2018).[9] We shows the sensitivity of the projections to this choice in one table. DYNASIM currently assumes that projected life expectancy gains in coming decades will be split between healthy and disabled years. This assumption is broadly consistent with the literature (Crimmins, Zhang, and Saito 2016), and model users can modify this assumption as the literature evolves. Historical socioeconomic differentials in disability progression—for example, the transition from having no limitations in one's ability to perform activities of daily living to having one limitation—are assumed to persist, with any changes in our forecasts driven largely by changes in the composition of the population. These compositional changes include population aging and increased education among older adults, though the latter effect has begun to level off.

## Tax and Benefit Models

DYNASIM calculates benefits from Social Security—formally known as Old Age, Survivors, and Disability Insurance (OASDI)—as well as SSI, Medicare, and Medicaid (including the Medicare Savings Programs, which provide beneficiaries with relief from Medicare cost-shares), family out-of-pocket medical expenses, payroll taxes, and federal and state personal income taxes. The model's computer code for cash benefits functions like a caseworker at the Social Security Administration, collecting all relevant information to determine whether an individual qualifies for OASDI or SSI benefits and then computing benefit amounts based on earnings, disability, and marriage histories. Similarly, the computer code acts like tax software, estimating each unit's tax liabilities based on family status and the full array of income sources. The SSI and Medicaid models both integrate state-level differences in

current-law benefit eligibility and generosity and differential take-up among those with higher and lower expected benefits.

With these calculators, DYNASIM simulations of policy changes can show how they affect various outcomes, including any effects due to program interactions. If healthy life expectancy shifts, Medicare cost shares will change, influencing Medicaid eligibility. Social Security benefit rule changes can affect SSI and Medicaid eligibility as well as personal income tax liabilities, as Social Security benefits are sometimes taxable.

When modeling federal and state income tax and spending programs, defining baselines can be challenging. For example, should we use current law as a baseline for projecting Medicaid eligibility and benefits given state discretion in determining program features? Should we hold eligibility criteria and benefit levels constant in nominal dollars, index them to price growth, or index them to wage growth? Under the first two options, the effective value of the thresholds will erode over time (Favreault and Tumlinson forthcoming). We follow the Congressional Budget Office convention for Medicaid forecasting for the aged and assume that states will make up part of the erosion in Medicaid eligibility that would result from following current law rules (CBO 2016). Given that Social Security confronts a looming financing shortfall, we must decide whether to assume the federal government will pay scheduled benefits in full when the program's Trust Fund becomes insolvent, now projected to occur in 2034. Forecasting Medicare also poses challenges, given large, ongoing changes in many factors like employer choices about supplemental insurance, service delivery options, and cost growth. Hatfield and colleagues (2015) document our key Medicare assumptions.

## Measures and Definitions in the Projections

We compute multiple measures of disabled life expectancy. To keep the analyses tractable, our main analyses of Social Security and Medicare redistribution focus on two disability definitions, one for people younger than 65 and another for older adults. Both definitions include only people with long-term, rather than transitory, disabilities. Before age 65 (or age 66 for those who are eligible to claim DI benefits at that age), we define disability as receipt of DI benefits. The Social Security program defines disability as an inability to engage in substantial gainful activity due to a medically determinable physical or psychological impairment that can be expected to either result in death or last for a continuous period of 12 months. At ages 65 and older, we classify people as disabled if they require assistance with at least two ADLs due to an impairment that is expected to last at least 90 days or if they need

substantial supervision for health and safety threats due to severe cognitive impairment. This definition corresponds to the disability standards of the Health Insurance Portability and Accountability Act of 1996 (HIPAA) used to qualify private long-term care insurance plans for tax-exempt status. [10]

We display socioeconomic status using completed education[11] and family lifetime earnings as of age 51.[12] We use cohort-specific quintile breaks for assigning people to quintiles, and comparable tabulations using decile breaks are available upon request.[13] Most of the socioeconomic gradients in disability and mortality outcomes we report persist when we use finer groupings, consistent with earlier findings (Bosworth, Burtless, and Zhang 2015). For example, those with less than an eighth-grade education have worse health and mortality outcomes than those with 12 grades of schooling who did not receive their diploma. Likewise, those in the first decile have significantly worse health and mortality outcomes than those in the second decile. An important aspect of within-quintile variation is that the small share of older adults who do not qualify for Social Security and Medicare benefits are disproportionately concentrated in the lowest decile of the earnings distribution and among the foreign born (Whitman, Reznik, and Shoffner 2011). In most of our projection tabulations, we exclude unauthorized immigrants, people who immigrated to the United States in later life, and those who contributed to Social Security or Medicare but subsequently left the country.

When evaluating programs like Social Security and Medicare, analysts often focus on a core set of metrics that reflect whether program benefits are adequate, affordable (in terms of tax burdens during working life and premiums and cost shares later in life), equitable, and sustainable, and whether they appropriately reward work and savings (Favreault and Steuerle 2012). These metrics often recognize that these programs touch people very early in their lives. A 16-year-old worker on her first job may have Social Security payroll taxes withheld from her paycheck, and some children whose parents are retired, disabled, or deceased may receive Social Security children's benefits at even younger ages. Our analysis includes lifetime contributions to the program but only includes benefits received from age 51 onward. We report scheduled Social Security benefits in the text's main body, but also include projections of payable benefits in a sensitivity analysis in one table.[14]

We use individuals rather than families as our unit of analysis. We express values in inflation-adjusted 2019 dollars, evaluated as of age 51 and discounted using a 2.7 percent real rate of return, consistent with Social Security trustees long-range interest rate assumptions. Our measure of Medicare benefits includes the value of services paid by Medicare, excluding patient deductibles and co-payments.

We focus on the benefit sides of the Social Security and Medicare programs, but also add contributions to the two programs and further describe other government income and health supports (Medicaid and SSI) in one table. When computing the value of payroll taxes, we follow standard assumptions from the economics literature and assume that workers bear the burden of both the employee and employer payroll tax. Because Medicare benefits are partly financed by transfers from the U.S. Treasury, most individuals who eventually receive Medicare benefits help finance these transfers through income taxes they pay throughout their lives. In selected analyses, we thus allocate, on an annual basis, a pro-rata share of the general revenue (GR) transfer to Medicare to those who pay personal income taxes.[15] Many alternative assumptions and allocation approaches are possible, and the presence of both annual and long-range deficits complicates the attribution. Our relatively simple approach is to multiply the share of federal revenue outside of payroll taxes that comes from personal income taxes and divide this product by total personal income tax revenue to generate an estimate of the share of personal income tax revenue that supplements Medicare, now about 12 percent.[16] We compute this historical ratio in each past year because transfers were less significant in earlier years.[17] We then multiply each person's personal income tax, using shared tax for married people, by this fraction to proportionately allocate the general revenue burden to that person in that year.[18] Those with no tax liability in a year do not contribute to Medicare's GR financing. Although stylized, this approximation is preferable to assuming that Medicare beneficiaries do not contribute to this component of the program's finances.

Most of our tables report mean outcomes. Because these projections are uncertain and based on samples, we round in increments of $1,000, $100, or $10 as appropriate to the outcome and statistic. As we are interested in lifetime experiences, we exclude people who immigrated to the United States at older ages or spent only part of their careers in the U.S. work force from most tables.[19]

# Results from Historical Data

Table 1 presents cross-tabulations from the 2015 and 2016 MCBS that illustrate how a range of disability measures vary by age and education at ages 65 and older. We compute prevalence rates for five-year-age ranges—except at ages 90 and above where we pool all people in the sample to maintain adequate sample sizes—because average educational attainment was lower for the older groups than the younger groups and we want to avoid confounding age/cohort and education.

TABLE 1.

**Historical Estimates of Age-Specific Disability Status by Education and Lifetime Earnings or Income Using Alternative Disability Measures**

| | No high school diploma | High school diploma | Some college (include associates degree, vocational training) | Bachelor's degree or higher | Ratio of least educated to most educated |
|---|---|---|---|---|---|
| *Need help with 2 or more ADLs for at least 90 days* | | | | | |
| 65-69 | 0.05 | 0.04 | 0.03 | 0.01 | 4.5 |
| 70-74 | 0.07 | 0.03 | 0.03 | 0.02 | 3.9 |
| 75-79 | 0.09 | 0.03 | 0.04 | 0.02 | 3.9 |
| 80-84 | 0.11 | 0.05 | 0.05 | 0.06 | 1.8 |
| 85-89 | 0.17 | 0.10 | 0.08 | 0.07 | 2.6 |
| 90+ | 0.24 | 0.16 | 0.12 | 0.14 | 1.7 |
| All age 65+ | 0.10 | 0.05 | 0.04 | 0.03 | 3.6 |
| *Need help with 2 or more ADLs* | | | | | |
| 65-69 | 0.05 | 0.05 | 0.03 | 0.01 | 4.0 |
| 70-74 | 0.07 | 0.03 | 0.03 | 0.02 | 4.1 |
| 75-79 | 0.11 | 0.04 | 0.04 | 0.03 | 4.1 |
| 80-84 | 0.12 | 0.06 | 0.06 | 0.06 | 1.8 |
| 85-89 | 0.17 | 0.11 | 0.09 | 0.07 | 2.5 |
| 90+ | 0.25 | 0.17 | 0.13 | 0.15 | 1.6 |
| All age 65+ | 0.11 | 0.05 | 0.04 | 0.03 | 3.6 |
| *Have difficulty with with 2 or more ADLs* | | | | | |
| 65-69 | 0.17 | 0.13 | 0.13 | 0.07 | 2.5 |
| 70-74 | 0.19 | 0.10 | 0.12 | 0.07 | 2.6 |
| 75-79 | 0.22 | 0.12 | 0.14 | 0.11 | 2.0 |
| 80-84 | 0.24 | 0.16 | 0.16 | 0.15 | 1.6 |
| 85-89 | 0.32 | 0.21 | 0.25 | 0.19 | 1.7 |
| 90+ | 0.38 | 0.30 | 0.25 | 0.27 | 1.4 |
| All age 65+ | 0.23 | 0.14 | 0.15 | 0.10 | 2.3 |
| *Need help with 2 or more ADLs for at least 90 days or severely cognitively impaired* | | | | | |
| 65-69 | 0.07 | 0.06 | 0.04 | 0.02 | 3.9 |
| 70-74 | 0.12 | 0.06 | 0.04 | 0.03 | 3.6 |
| 75-79 | 0.14 | 0.08 | 0.08 | 0.06 | 2.5 |
| 80-84 | 0.20 | 0.11 | 0.10 | 0.12 | 1.6 |
| 85-89 | 0.29 | 0.19 | 0.16 | 0.13 | 2.2 |
| 90+ | 0.37 | 0.34 | 0.24 | 0.23 | 1.6 |
| All age 65+ | 0.17 | 0.10 | 0.07 | 0.05 | 3.1 |

**Sources:** Author's tabulations from pooled 2015 and 2016 MCBS.

**Notes:** ADLs used in the computation are as follows: bathing, dressing, eating, toileting, transferring, and walking.

Regardless of the measure we use, disability rates increase steadily with age and decline with education at each age, with rates for those without a high school diploma sometimes as much as four and a half times as high as for those with a bachelor's degree. The gap between those with and without a high school diploma is much larger than the gaps between other groups, both overall and at most ages (i.e., those with a high school diploma are more similar to those with at least some college but no degree). Another important aspect of this table is that for most of the disability measures considered the differences between educational groups tend to decline with age—analogous to the estimated mortality differentials that we saw in figure 1—but are still considerable even in the oldest age ranges.

# Projection Results

## Projected Differentials in Life Expectancy and Disabled Life Expectancy

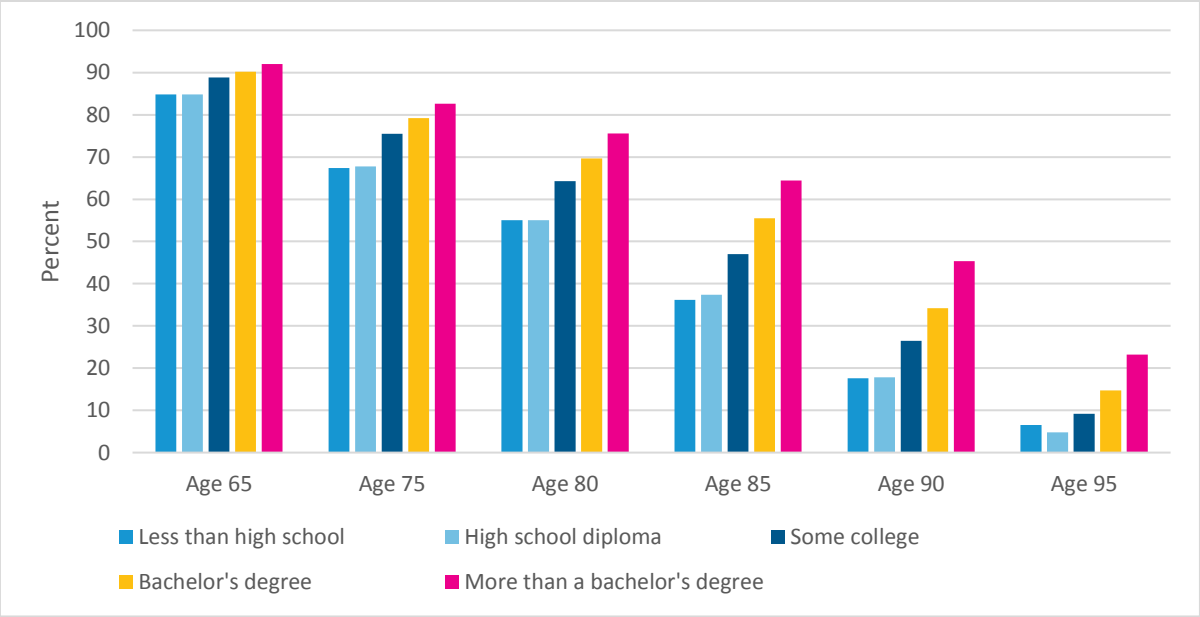
A first important dimension of Social Security and Medicare outcomes is whether one lives long enough to receive benefits from the programs, and, for those who survive, the number of years they can expect to collect. Figure 3A shows the projected percentage of 50-year-old men and women born between 1966 and 1975 who survive to various ages by educational attainment. Roughly 15 percent of men and 10 percent of women who survived to age 50 can expect to die before Medicare's eligibility age (65). Survival is more likely for the more-educated 50-year-olds. Only about 8 percent of men and 3 percent of women with more than a bachelor's degree can expect to die before qualifying for Medicare benefits. Looking at the other end of the survival spectrum, nearly half (45 percent) of men and nearly three quarters (74 percent) of women among these most educated older adults can expect to live to 90, compared with only 18 percent of men and about half (48) percent of women without a high school diploma.

Figure 3B shows the flip side of this—the distribution of age at death among those who survived to age 50, focusing on the comparison between the most and least educated. Less-educated men die in the largest numbers in their seventies and eighties, while their more educated peers die in the largest numbers in their eighties and nineties. A similar pattern holds for women, with even more deaths concentrated in the nineties for the more-educated women.

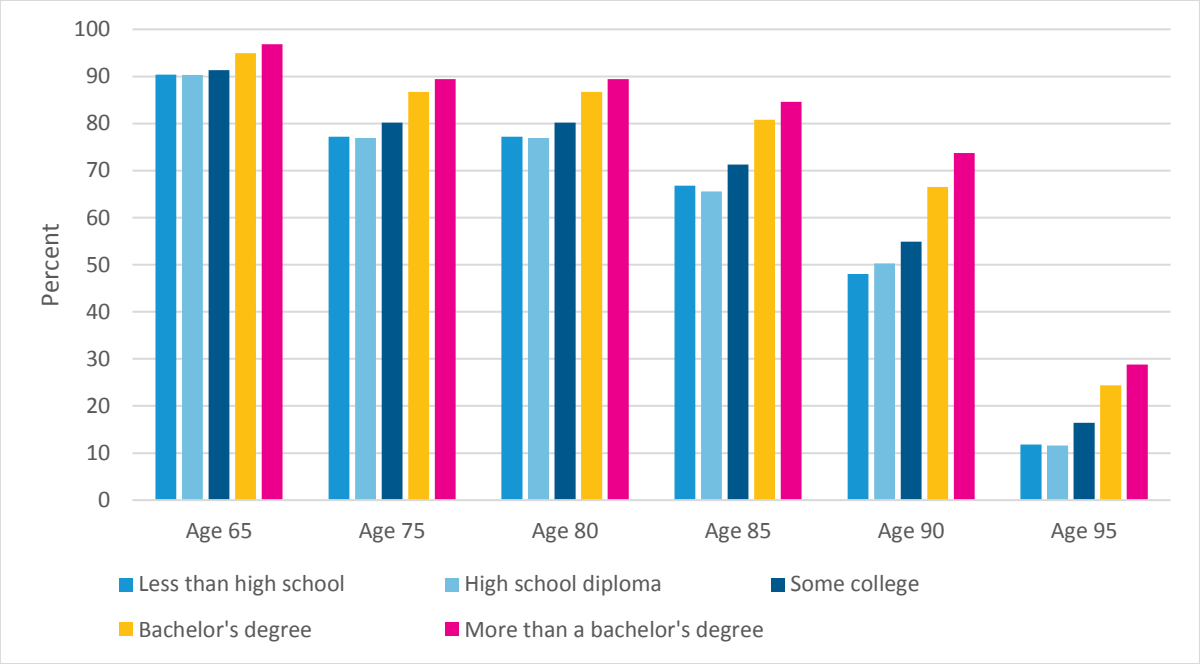
FIGURE 3A

**Share of People Born from 1966 through 1975 who Survived through Age 50 who are Projected to Survive to Selected Ages by Education**

**Panel 1: Men**




**Panel 2: Women**

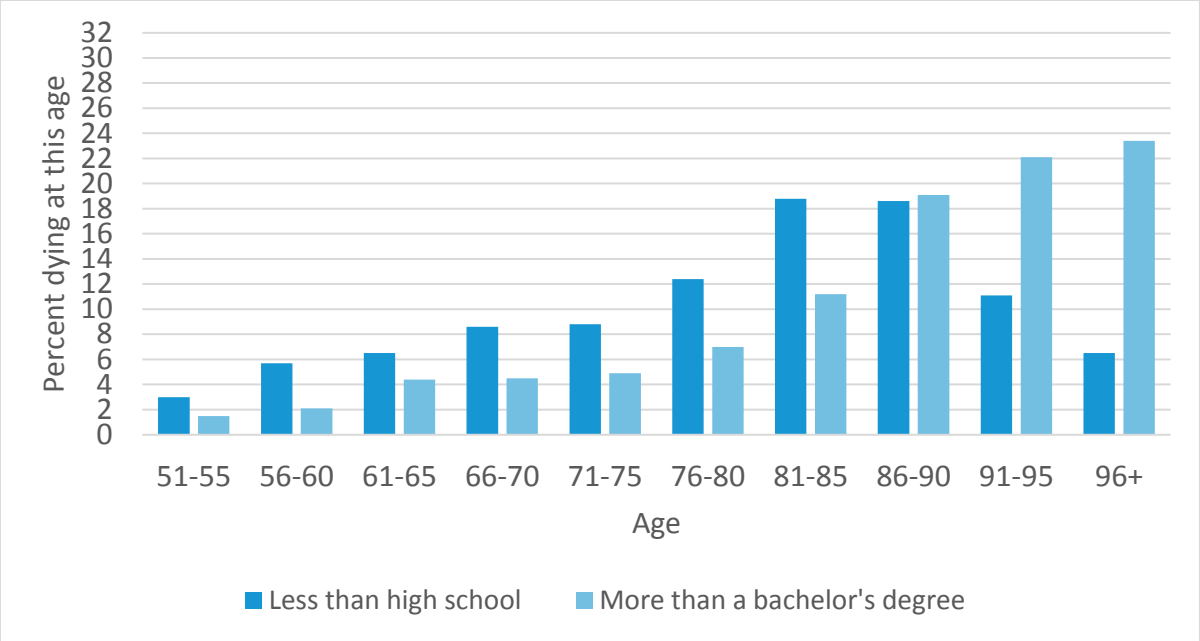



**Source:** Author' calculations from DYNASIM (runid 967, dated: December, 2018).

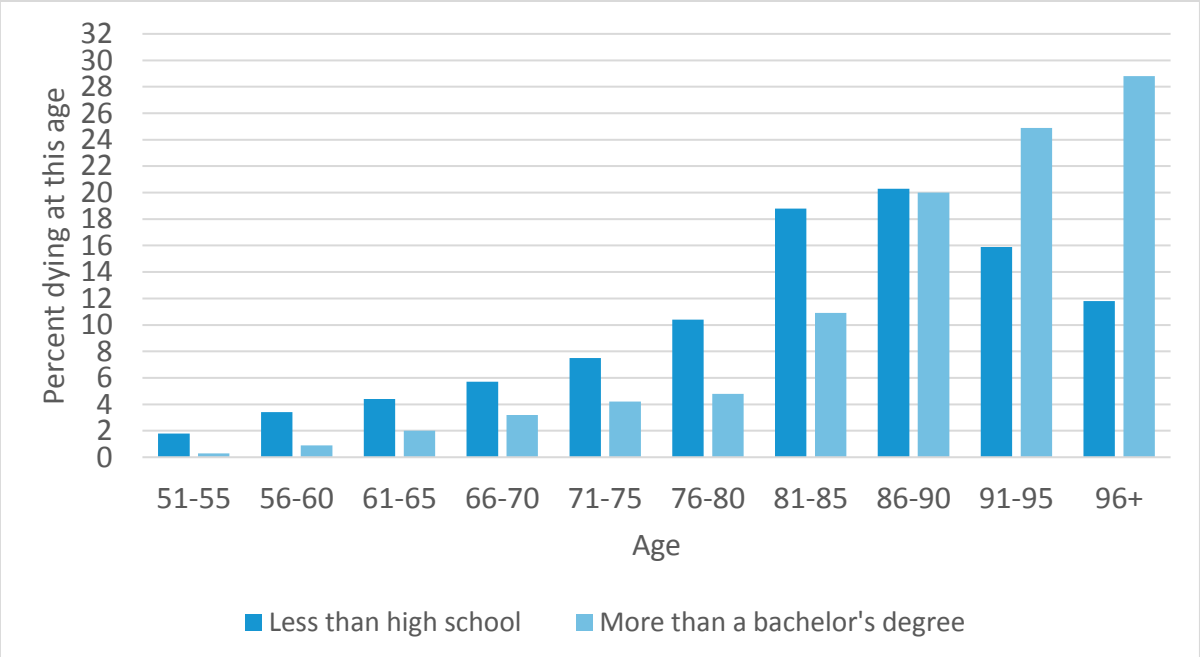
FIGURE 3B

**Distribution of Age of Death for People Born from 1966 through 1975 who Survived through Age 50 by Education**

**Panel 1: Men**




**Panel 2: Women**




**Source:** Author' calculations from DYNASIM (runid 967, dated: December, 2018).

Figure 4 shows the average disabled and disability-free life expectancy by education and then sex and family earnings quintile, focusing on those born from 1966 through 1970, who are 49 to 53 in 2019 and will be 80 to 84 in 2050. Here, the severe disability measure reflects both difficulties with activities of daily living and severe cognitive impairment. Projected total life expectancy and disability-free life expectancy grow with education. Those with more than a college degree are projected to live about a decade longer than their counterparts with less than a high school education, and that entire decade is made up of disability-free years. For both men and women, total life expectancy and disability-free life expectancy are likewise significantly higher for those in the higher earnings quintiles. Those in the lowest earnings quintile have markedly higher absolute amounts of time spent both severely and moderately disabled than the other earnings groups for both men and women. Above the lowest earnings quintile, absolute periods disabled are more comparable across the earnings quintiles, implying that the percentage of time disabled declines with lifetime earnings.

However, these estimates are highly sensitive to the definitions of disability—for example, whether we use "has difficulty" or "needs help measures" for limitations in ADLs. They are also sensitive to thresholds—for example, whether we include those needing help with just one ADL or IADL and the cutoff score we use for cognitive impairment.

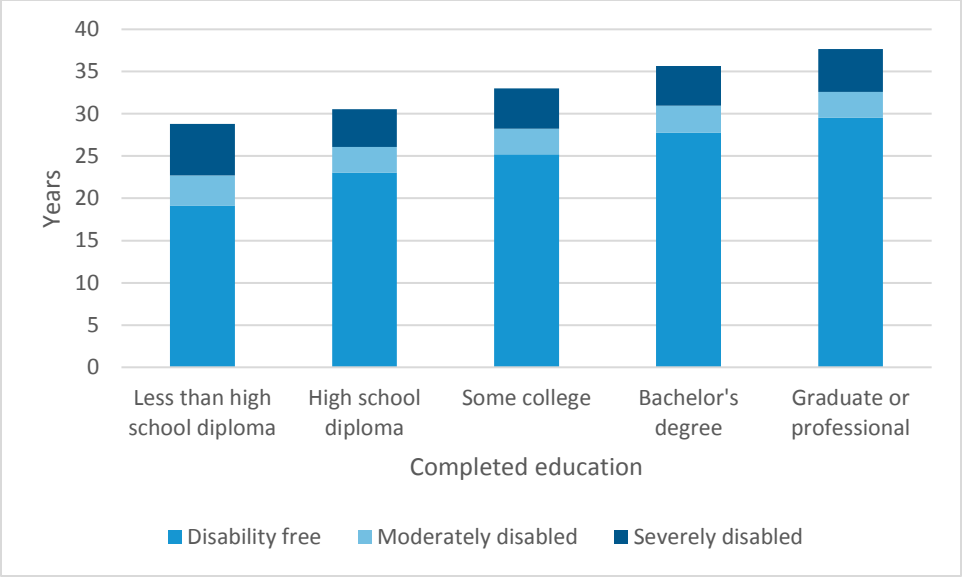
## Social Security, Medicare, and Out-of-Pocket Exposure by Socioeconomic Status and Disability History

Tables 2A, 2B, 3A, and 3B show how experiences with Social Security and Medicare from ages 51 onward for those born between 1966 and 1970 differ by disability status. These adults are in their peak earning years in 2019—ages 49 to 53—and will be in their early 80s in 2050. (A later table presents summary results for cohorts born ten years earlier—1956 to 1960—and ten years later—1976 to 1980—to show outcomes for a broader range of ages.) We classify people using two different measures of socio-economic status: completed education and the quintile of family earnings through age 51. The tables include both people who survive to collect benefits and those who die before claiming Social Security or Medicare.[20]

FIGURE 4

**Disabled and Disability-Free Life Expectancy from Age 51 by Education and Lifetime Earnings and Sex for People Born in 1966-1970, by Severity of Disability**

**Panel 1: Education**




**Panel 2: Sex and Family Lifetime Earnings Quintile**


**Source:** Author' calculations from DYNASIM (runid 967, dated: December, 2018).
**Notes**: Disability durations are sensitive to small changes in definitions.

TABLE 2A

## Average Adult Experiences with Social Security by Disabled Life Expectancy, Education, and Lifetime Earnings for People Born from 1966 to 1970 who Survive until Age 50: DYNASIM Projections

| | | Completed education | | | | | Family earnings quintile (at age 51) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | All | Less than high school diploma | High school diploma | Some college | Bachelor's degree | More than bachelor's degree | Lowest | Second | Middle | Fourth | Highest |
| ***Social Security Benefits (Scheduled, including OASI and DI)*** | | | | | | | | | | | |
| Total amount (both disabled and non-disabled periods) | 237,000 | 121,000 | 188,000 | 234,000 | 307,000 | 351,000 | 120,000 | 187,000 | 224,000 | 283,000 | 360,000 |
| Total years as a beneficiary | 20.7 | 17.3 | 19.5 | 20.9 | 22.2 | 23.7 | 18.5 | 20.1 | 20.3 | 21.3 | 23.0 |
| Average amount per year as a beneficiary | 11,455 | 6,978 | 9,661 | 11,191 | 13,810 | 14,829 | 6,490 | 9,290 | 11,029 | 13,293 | 15,659 |
| Percent of beneficiary years with severe disabilities | 21% | 33% | 24% | 19% | 17% | 16% | 30% | 24% | 20% | 18% | 16% |
| Percent of total benefits paid in years with severe disabilities | 20% | 36% | 26% | 19% | 16% | 15% | 32% | 26% | 21% | 18% | 15% |
| Total amount while not severely disabled | 189,000 | 77,000 | 139,000 | 189,000 | 258,000 | 298,000 | 82,000 | 138,000 | 178,000 | 233,000 | 305,000 |
| Years as a beneficiary without severe disabilities | 16.3 | 11.7 | 14.7 | 16.9 | 18.5 | 19.8 | 12.9 | 15.3 | 16.3 | 17.6 | 19.3 |
| Average amount per year without severe disabilities | 11,574 | 6,609 | 9,430 | 11,217 | 13,984 | 15,073 | 6,362 | 9,049 | 10,927 | 13,276 | 15,770 |
| Total amount while severely disabled | 48,000 | 44,000 | 49,000 | 45,000 | 49,000 | 53,000 | 38,000 | 49,000 | 46,000 | 50,000 | 55,000 |
| Years as a beneficiary with severe disabilities | 4.4 | 5.7 | 4.7 | 4.1 | 3.8 | 3.9 | 5.6 | 4.9 | 4.0 | 3.7 | 3.7 |
| Average amount per year with disabilities | 11,009 | 7,733 | 10,381 | 11,084 | 12,963 | 13,590 | 6,786 | 10,041 | 11,443 | 13,369 | 15,068 |

**Source:** Author's tabulations from DYNASIM4 (runid 967, dated: December, 2018).

**Notes:** All computations in real (2019) dollars. Present values are evaluated as of age 51 using a real discount rate of 2.7 percent, consistent with the Social Security Trustees Report. Family earnings are defined as the average of own and spouse annual earnings when married and one's own earnings in years when unmarried. Quintile breaks are calculated for 5-year birth cohorts. Projected life expectancy with disabilities is defined including only periods with severe disabilities. At ages under 65, we use the Social Security program's disability definitions. At ages 65 and older, we use the HIPAA criteria (see text). Assumes scheduled Social Security benefits. To discourage overly precise interpretation, we round most values.

TABLE 2B

**Average Adult Experiences with Social Security Benefits by Disabled Life Expectancy, Lifetime Earnings, and Sex for People Born from 1966 to 1970 who Survive until Age 50: DYNASIM Projections**

| | Men by family earnings quintile | | | | | Women by family earnings quintile | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Lowest | Second | Middle | Fourth | Highest | Lowest | Second | Middle | Fourth | Highest |
| ***Social Security Benefits (Scheduled, including OASI and DI)*** | | | | | | | | | | |
| Total amount (both disabled and non-disabled periods) | 119,000 | 176,000 | 211,000 | 281,000 | 372,000 | 122,000 | 198,000 | 238,000 | 284,000 | 347,000 |
| Total years as a beneficiary | 16.8 | 17.7 | 17.7 | 19.7 | 21.7 | 19.6 | 22.0 | 22.5 | 22.9 | 24.2 |
| Average amount per year as a beneficiary | 7,092 | 9,960 | 11,914 | 14,286 | 17,167 | 6,237 | 9,016 | 10,582 | 12,423 | 14,351 |
| Percent of beneficiary years with severe disabilities | 33% | 25% | 17% | 16% | 15% | 28% | 22% | 20% | 18% | 16% |
| Percent of total benefits paid in years with severe disabilities | 34% | 29% | 20% | 17% | 15% | 30% | 24% | 22% | 18% | 15% |
| Total amount while not severely disabled | 77,000 | 125,000 | 169,000 | 233,000 | 316,000 | 86,000 | 151,000 | 186,000 | 232,000 | 294,000 |
| Years as a beneficiary without severe disabilities | 11.3 | 13.3 | 14.7 | 16.6 | 18.4 | 14.2 | 17.1 | 17.9 | 18.8 | 20.4 |
| Average amount per year without severe disabilities | 6,826 | 9,377 | 11,489 | 14,079 | 17,174 | 6,078 | 8,846 | 10,379 | 12,367 | 14,426 |
| Total amount while severely disabled | 41,000 | 51,000 | 42,000 | 48,000 | 57,000 | 36,000 | 48,000 | 52,000 | 52,000 | 53,000 |
| Years as a beneficiary with severe disabilities | 5.5 | 4.3 | 3.0 | 3.1 | 3.3 | 5.4 | 4.9 | 4.6 | 4.1 | 3.8 |
| Average amount per year with disabilities | 7,455 | 11,751 | 14,000 | 15,385 | 17,431 | 6,654 | 9,816 | 11,379 | 12,683 | 13,947 |

**Source**: Author's tabulations from DYNASIM4 (runid 967, dated: December, 2018).

**Notes:** All computations in real (2019) dollars. Present values are evaluated as of age 51 using a real discount rate of 2.7 percent, consistent with the Social Security Trustees Report. Family earnings are defined as the average of own and spouse annual earnings when married and one's own earnings in years when unmarried. Quintile breaks are calculated for 5-year birth cohorts. Projected life expectancy with disabilities is defined including only periods with severe disabilities. At ages below 65, we use the Social Security program's disability definitions. At ages 65 and older, we use the HIPAA criteria (see text). Assumes scheduled Social Security benefits. Tabulations exclude late-arriving, unauthorized, and short-term immigrants. To discourage overly precise interpretation, we round most values.

TABLE 3A

## Average Adult Experiences with Medicare by Disabled Life Expectancy, Education, and Lifetime Earnings for People Born from 1966 to 1970 who Survive until Age 50: DYNASIM Projections

| | | Completed education | | | | | Family earnings quintile (at age 51) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | All | Less than high school diploma | High school diploma | Some college | Bachelor's degree | More than bachelor's degree | Lowest | Second | Middle | Fourth | Highest |
| ***Medicare*** | | | | | | | | | | | |
| Total amount (both disabled and non-disabled periods) | 266,000 | 313,000 | 263,000 | 276,000 | 243,000 | 247,000 | 316,000 | 287,000 | 256,000 | 237,000 | 238,000 |
| Total years as a beneficiary | 20.5 | 16.9 | 18.6 | 20.4 | 22.7 | 24.5 | 18.4 | 19.4 | 19.8 | 21.2 | 23.3 |
| Average amount per year as a beneficiary | 13,001 | 18,521 | 14,109 | 13,529 | 10,705 | 10,102 | 17,146 | 14,809 | 12,916 | 11,200 | 10,206 |
| Percent of beneficiary years with severe disabilities | 20% | 32% | 24% | 19% | 16% | 16% | 30% | 24% | 19% | 17% | 15% |
| Percent of total benefits paid in years with severe disabilities | 47% | 58% | 49% | 46% | 41% | 39% | 55% | 50% | 45% | 41% | 40% |
| Total amount while not severely disabled | 142,000 | 132,000 | 135,000 | 149,000 | 143,000 | 150,000 | 143,000 | 144,000 | 142,000 | 139,000 | 142,000 |
| High chronic conditions count and fair or poor health | 18,000 | 23,000 | 19,000 | 17,000 | 15,000 | 17,000 | 20,000 | 22,000 | 20,000 | 14,000 | 15,000 |
| Fewer chronic conditions and excellent to good health | 124,000 | 109,000 | 116,000 | 132,000 | 128,000 | 133,000 | 123,000 | 122,000 | 122,000 | 125,000 | 127,000 |
| Years as a beneficiary without severe disabilities | 16.3 | 11.4 | 14.2 | 16.5 | 19.1 | 20.7 | 13.0 | 14.8 | 16.0 | 17.6 | 19.8 |
| High chronic conditions count and fair or poor health | 1.0 | 1.0 | 1.0 | 0.9 | 0.9 | 1.2 | 0.9 | 1.0 | 1.1 | 0.8 | 1.1 |
| Fewer chronic conditions and excellent to good health | 15.3 | 10.4 | 13.2 | 15.6 | 18.2 | 19.5 | 12.0 | 13.8 | 15.0 | 16.8 | 18.7 |
| Average amount per year without severe disabilities | 9,000 | 11,559 | 9,494 | 9,025 | 7,507 | 7,264 | 11,017 | 9,756 | 8,853 | 7,902 | 7,175 |
| High chronic conditions count and fair or poor health | 18,000 | 23,232 | 18,447 | 18,681 | 16,667 | 14,783 | 21,277 | 22,000 | 18,868 | 16,667 | 14,286 |
| Fewer chronic conditions and excellent to good health | 8,099 | 10,451 | 8,795 | 8,462 | 7,052 | 6,821 | 10,216 | 8,866 | 8,144 | 7,463 | 6,777 |
| Total amount while severely disabled | 124,000 | 181,000 | 128,000 | 127,000 | 100,000 | 97,000 | 173,000 | 143,000 | 114,000 | 98,000 | 96,000 |
| High chronic conditions count and fair or poor health | 23,000 | 39,000 | 23,000 | 23,000 | 18,000 | 15,000 | 30,000 | 26,000 | 22,000 | 16,000 | 19,000 |
| Fewer chronic conditions and excellent to good health | 101,000 | 142,000 | 105,000 | 104,000 | 82,000 | 82,000 | 143,000 | 117,000 | 92,000 | 82,000 | 77,000 |
| Years as a beneficiary with severe disabilities | 4.2 | 5.5 | 4.4 | 3.9 | 3.7 | 3.8 | 5.5 | 4.6 | 3.8 | 3.6 | 3.5 |
| High chronic conditions count and fair or poor health | 0.5 | 0.8 | 0.4 | 0.4 | 0.3 | 0.4 | 0.6 | 0.5 | 0.5 | 0.3 | 0.4 |
| Fewer chronic conditions and excellent to good health | 3.7 | 4.7 | 4.0 | 3.5 | 3.3 | 3.4 | 4.9 | 4.1 | 3.3 | 3.2 | 3.2 |
| Average amount per year with disabilities | 29,736 | 33,029 | 28,959 | 32,648 | 27,397 | 25,526 | 31,743 | 30,952 | 30,159 | 27,451 | 27,195 |
| High chronic conditions count and fair or poor health | 51,111 | 52,000 | 52,273 | 53,488 | 54,545 | 36,585 | 50,847 | 52,000 | 48,889 | 47,059 | 50,000 |
| Fewer chronic conditions and excellent to good health | 27,151 | 30,021 | 26,382 | 30,058 | 24,699 | 24,189 | 29,424 | 28,398 | 27,628 | 25,387 | 24,444 |

**Sources:** Author's tabulations from DYNASIM4 (runid 967, dated: December, 2018).

**Notes:** All computations in real (2019) dollars. Present values are evaluated as of age 51 using a real discount rate of 2.7 percent, consistent with the Social Security Trustees Report. Family earnings are defined as the average of own and spouse annual earnings when married and one's own earnings in years when unmarried. Quintile breaks are calculated for 5-year birth cohorts. Tabulations exclude late-arriving, unauthorized, and short-term immigrants. To discourage overly precise interpretation, we round most values.

TABLE 3B

## Average Adult Experiences with Medicare by Disabled Life Expectancy, Lifetime Earnings, and Sex for People Born from 1966 to 1970 who Survive until Age 50: DYNASIM Projections

| | Men by family earnings quintile | | | | | Women by family earnings quintile | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Lowest | Second | Middle | Fourth | Highest | Lowest | Second | Middle | Fourth | Highest |
| Total amount (both disabled and non-disabled periods) | 284,000 | 258,000 | 221,000 | 204,000 | 223,000 | 342,000 | 316,000 | 292,000 | 275,000 | 257,000 |
| Total years as a beneficiary | 17.0 | 17.5 | 17.6 | 19.9 | 22.3 | 19.6 | 21.2 | 22.0 | 22.7 | 24.5 |
| Average amount per year as a beneficiary | 16,735 | 14,777 | 12,528 | 10,272 | 10,013 | 17,458 | 14,892 | 13,249 | 12,115 | 10,511 |
| Percent of beneficiary years with severe disabilities | 32% | 25% | 17% | 16% | 15% | 28% | 23% | 21% | 18% | 16% |
| Percent of total benefits paid in years with severe disabilities | 57% | 51% | 41% | 38% | 38% | 54% | 49% | 47% | 45% | 42% |
| Total amount while not severely disabled | 124,000 | 126,000 | 130,000 | 127,000 | 138,000 | 159,000 | 162,000 | 154,000 | 152,000 | 148,000 |
| High chronic conditions count and fair or poor health | 17,000 | 21,000 | 20,000 | 11,000 | 14,000 | 23,000 | 23,000 | 19,000 | 16,000 | 17,000 |
| Fewer chronic conditions and excellent to good health | 107,000 | 105,000 | 110,000 | 116,000 | 124,000 | 136,000 | 139,000 | 135,000 | 136,000 | 131,000 |
| Years as a beneficiary without severe disabilities | 11.5 | 13.1 | 14.6 | 16.7 | 19.0 | 14.2 | 16.3 | 17.5 | 18.6 | 20.7 |
| High chronic conditions count and fair or poor health | 0.8 | 1.0 | 1.1 | 0.8 | 1.1 | 1.0 | 1.1 | 1.0 | 0.9 | 1.0 |
| Fewer chronic conditions and excellent to good health | 12.2 | 13.5 | 16.0 | 17.9 | 13.2 | 15.3 | 16.5 | 17.7 | 19.6 | 14.3 |
| Average amount per year without severe disabilities | 10,811 | 9,611 | 8,880 | 7,587 | 7,263 | 11,213 | 9,920 | 8,815 | 8,172 | 7,167 |
| High chronic conditions count and fair or poor health | 20,482 | 22,105 | 18,018 | 14,286 | 13,208 | 22,330 | 21,698 | 19,000 | 17,204 | 16,505 |
| Fewer chronic conditions and excellent to good health | 8,799 | 7,761 | 6,888 | 6,470 | 9,430 | 8,906 | 8,440 | 7,636 | 6,932 | 9,180 |
| Total amount while severely disabled | 161,000 | 132,000 | 91,000 | 77,000 | 85,000 | 183,000 | 154,000 | 137,000 | 123,000 | 109,000 |
| High chronic conditions count and fair or poor health | 34,000 | 26,000 | 19,000 | 13,000 | 15,000 | 27,000 | 27,000 | 25,000 | 19,000 | 24,000 |
| Fewer chronic conditions and excellent to good health | 126,000 | 106,000 | 72,000 | 64,000 | 70,000 | 156,000 | 127,000 | 112,000 | 104,000 | 86,000 |
| Years as a beneficiary with severe disabilities | 5.5 | 4.4 | 3.0 | 3.1 | 3.3 | 5.4 | 4.9 | 4.6 | 4.1 | 3.8 |
| High chronic conditions count and fair or poor health | 0.7 | 0.5 | 0.4 | 0.3 | 0.4 | 0.5 | 0.5 | 0.5 | 0.4 | 0.4 |
| Fewer chronic conditions and excellent to good health | 4.8 | 3.9 | 2.6 | 2.8 | 2.9 | 4.9 | 4.4 | 4.0 | 3.7 | 3.4 |
| Average amount per year with disabilities | 29,273 | 30,345 | 30,333 | 24,679 | 25,994 | 33,826 | 31,493 | 29,978 | 30,000 | 28,684 |
| High chronic conditions count and fair or poor health | 51,515 | 52,000 | 52,778 | 44,828 | 40,541 | 50,943 | 54,000 | 46,296 | 48,718 | 63,158 |
| Fewer chronic conditions and excellent to good health | 26,033 | 27,532 | 27,273 | 22,615 | 24,138 | 31,967 | 28,929 | 27,792 | 28,032 | 25,146 |

**Sources:** Author's tabulations from DYNASIM4 (runid 967, dated: December, 2018).

**Notes:** All computations in real (2019) dollars. Present values are evaluated as of age 51 using a real discount rate of 2.7 percent, consistent with the Social Security Trustees Report. Family earnings are defined as the average of own and spouse annual earnings when married and one's own earnings in years when unmarried. Quintile breaks are calculated for 5-year birth cohorts. Projected life expectancy with disabilities is defined including only periods with severe disabilities. At ages under 65, we use the Social Security program's disability definitions. At ages 65 and older, we use the HIPAA criteria (see text). Assumes scheduled Social Security benefits. Tabulations exclude late-arriving, unauthorized, and short-term immigrants. To discourage overly precise interpretation, we round most values.

Those with the most education—more than a four-college degree—are projected to collect Social Security benefits for 23.7 years on average, 6.4 years longer than those with the least education, who lack a high school diploma and can expect to receive Social Security for 17.3 years (table 2A). For Medicare, the best educated group is projected to receive benefits on average for about 7.6 years more than the least educated group: 24.5 years compared with 16.9 years (table 3A). (Recall that eligible adults who are not collecting DI first qualify for Medicare benefits at age 65, rather than age 62 as for Social Security, and Medicare imposes a two-year waiting period on DI beneficiaries.) Differences in duration of benefit receipt vary somewhat less by family earnings quintiles than by education; those in the top earnings quintile collect Social Security four and a half years longer, on average, than those in the bottom quintile. The earnings differentials are somewhat narrower partly because of differences in gender composition; more unmarried women than unmarried men are in lower quintiles, and women generally live longer than men. Tables 2B and 3B repeat these calculations using both family earnings quintiles and gender to account for this difference.

Time in retirement without disabilities is even less evenly distributed across education and earnings groups than total time in retirement. We project that, compared with people who did not complete high school, people with more than a four-year college degree can expect to spend about eight more years collecting Social Security without disabilities—19.8 years compared with 11.7 (table 2A)—and nearly nine years more on Medicare without disabilities—20.7 years compared to 11.4 (table 3A). Expressing these differences in percentage terms shows that those without a high school diploma can expect to have severe disabilities for about one-third of the time they are collecting Social Security benefits, compared with only about one-sixth of the time for those with a college degree or more. Differences between the lowest and highest earnings quintiles are comparable to the differences by educational attainment.

Lifetime Social Security benefits grow with educational attainment and lifetime earnings. Although OASDI benefits are computed using a progressive benefit formula, so replacement rates fall with additional earnings, total benefits grow with additional contributions through the earnings and benefit base. Average lifetime benefits are 2.9 times as high for people in the top educational group as for those in the bottom educational group ($351,000 versus $121,000) and 3.0 times as high for people in the top earnings quintile as for those in the bottom earnings quintile ($360,000 versus $120,000). These differentials are mostly driven by differences in earnings, not the additional years of payments collected by better-educated, higher-earning beneficiaries; the educational and earnings differentials in average annual Social Security benefits are nearly as large as the differentials in average lifetime benefits (recall that these are present values discounted to age 51, so will differ from annual benefits in the current

period). Because well-educated and high-earning beneficiaries spend less time with severe disabilities than those with less education and less earnings, the differentials are larger when we consider only benefits received while not severely disabled and much smaller when we consider only benefits received when severely disabled. Overall, 20 percent of lifetime Social Security benefits are paid to beneficiaries while experiencing severe disabilities, but this share is higher for less-advantaged beneficiaries for those with more advantages. Beneficiaries who did not complete high school receive 36 percent of their lifetime Social Security benefits while disabled, compared with only 15 percent for those with more than a four-year college degree.

As with Social Security, we also compare Medicare benefits by periods with and without severe disabilities (tables 3A and 3B). We also add a second simple classification within the two disability-status groups, crossing health status with chronic conditions,[21] to try to capture within-group differences given that people with the most significant health care needs are likely to be very high spenders. Some people with disabilities have relatively few other health conditions and some people without disabilities face expensive medical challenges.

Here, the projected patterns differ from what we observe with Social Security. Lifetime benefits are more similar across socioeconomic groups when we consider periods without severe disability, both on a unisex basis (table 3A) and when we view men and women separately (table 3B). Those in lower-status groups are projected to receive more Medicare services while severely disabled than those in higher-status groups: they receive benefits for more years and in the nearer term (so they are discounted less). In percentage terms, those in the lowest education group can expect to spend almost a third (32 percent) of their Medicare years severely disabled, and Medicare will spend nearly three-fifths of their total dollars during these times. Those at the top of both the education and earnings distributions are projected to only spend about 15 percent of their time as a beneficiary with severe disabilities, and these periods will account for about 38 percent of their total Medicare expenses. Within both the disabled and non-disabled groups, annual expenses are projected to be roughly double for those with more significant health care needs due to a combination of poor health and multiple chronic conditions.

Combining the disabled and non-disabled periods, less-educated and lower-earning people are generally projected to receive more Medicare benefits over their lifetime than those with more education and higher earnings, although the relationship is not monotonic and differences in sex composition across the quintiles are a factor (table 3A and 3B). Also, the difference between the highest and lowest earnings and education groups are smaller for Medicare benefit than they are for Social Security, where the advantages are reversed. On a unisex basis, average lifetime Medicare benefits are 27 percent higher for those in the bottom education group than the top education group ($313,000

versus $247,000), and they are 33 percent higher for the bottom earning quintile than the top earning quintile ($316,000 versus $238,000). Differentials are more pronounced when we compare average annual Medicare benefits, because less-advantaged people are covered by Medicare for fewer years than more-advantaged people. Average annual Medicare benefits are 68 percent higher for those in the bottom education group than for those in the top education group ($17,146 versus $10,206). Less-educated and lower-earning people receive more Medicare benefits per year than others because they tend to have many health problems and they tend to receive more intensive services at younger ages than better-educated, higher-earning people, whose later-life spending is significantly reduced when discounted back to age 50.

Table 4 combines Social Security and Medicare benefits for the same cohort born between 1966 and 1970, and figure 5 presents this information graphically. We project that those with the least education and lowest earnings will receive roughly half of their total benefits from the two programs during periods of severe disability, compared to close to a quarter for those people with the highest education and lifetime earnings. Combined Medicare and Social Security benefits are higher for those with more education and higher lifetime earnings, but these differentials are much smaller than the differentials in contributions, due in large part to the progressive funding streams for Medicare especially.

Table 4 also presents sensitivity analyses that describe how our projections of combined Medicare and Social Security experiences might differ if we changed two key assumptions: our decision to use the illustrative scenario (rather than scheduled benefits) for projecting Medicare benefits and our decision to present scheduled rather than payable Social Security benefits.[22]

These sensitivity analyses reveal that the shift from the illustrative scenario to current law for Medicare benefits has similar effects across the education groups and lifetime earnings quintiles.

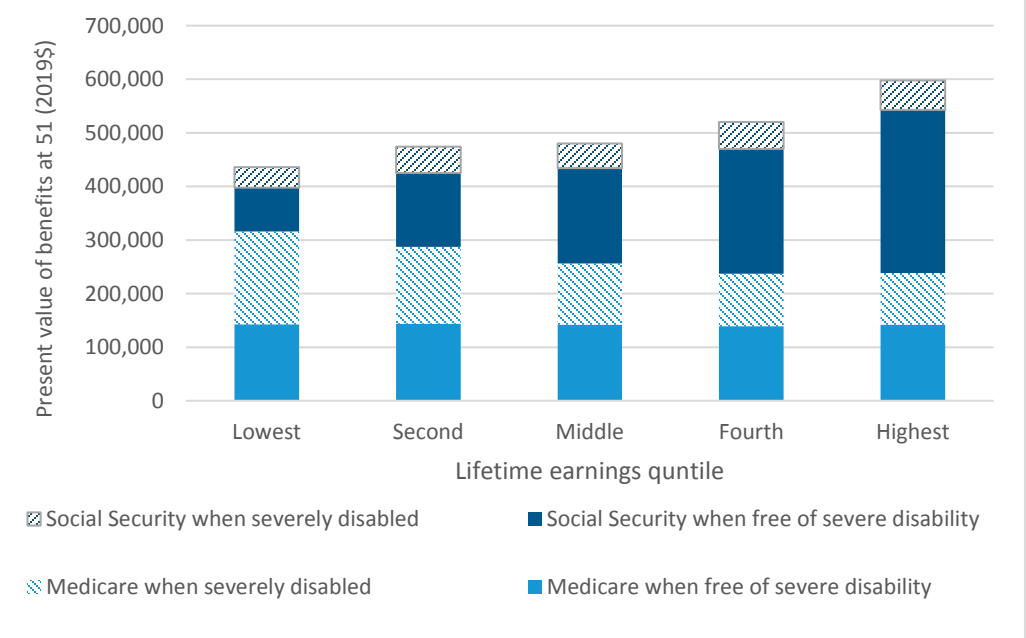
Under the shift to payable Social Security benefits, in contrast, total benefits are more proportionate across education and lifetime earnings groups than under current law scheduled benefits. Those with higher education and lifetime earnings lose more in absolute terms with an across-the-board reduction in future benefits, both because their Social Security benefits are higher, because they are a larger share of their combined Social Security and Medicare benefits, and because they collect Social Security benefits for more years.

When we add in means tested benefits from Medicaid and SSI, which flow disproportionately to those with the least education and the lowest quintile, gaps between the first three quintiles largely disappear (bottom row of table 4). In some cases, people in the lowest quintile and with the least

education have somewhat higher benefits from age 51 onward than those in the second and third quintiles and those with a high school diploma. Those in the fourth and highest lifetime earnings still receive more total benefits. However, they also contribute much more to the programs than their counterparts lower in the lifetime earnings distribution—with contribution levels sensitive to whether one includes an assignment to account for general revenue transfer to Medicare—so the greater benefits they receive due to their longer, healthier lives do not outstrip their contributions. When combined and examined on a life-course basis including disability benefits, Social Security and Medicare act in a progressive way.

FIGURE 5

**Social Security and Medicare Experience from Age 51 to Death with Severe Disabilities and Disability-Free Life Expectancy from Age 51 by Lifetime Earnings and Sex for People Born in 1966-1970**




**Sources:** Author's tabulations from DYNASIM4 (runid 967, dated: December, 2018).
**Notes:** All computations in real (2019) dollars. Present values are evaluated as of age 51 using a real discount rate of 2.7 percent, consistent with the Social Security Trustees Report. Family earnings are defined as the average of own and spouse annual earnings when married and one's own earnings in years when unmarried. Quintile breaks are calculated for 5-year birth cohorts. Assumes scheduled Social Security benefits. Figure excludes late-arriving, unauthorized, and short-term immigrants.

TABLE 4

**Average Combined Adult Experiences with Social Security and Medicare by Disabled Life Expectancy, Education, and Lifetime Earnings for People Born from 1966 to 1970 who Survive until Age 50: DYNASIM Projections**

| | | Completed education | | | | | Family earnings quintile (at age 51) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | All | Less than high school diploma | High school diploma | Some college | Bachelor's degree | More than bachelor's degree | Lowest | Second | Middle | Fourth | Highest |
| ***Combined OASDI and HI Benefits (Scheduled Social Security, Illustrative Scenario for Medicare)*** | 503,000 | 434,000 | 451,000 | 510,000 | 550,000 | 598,000 | 436,000 | 474,000 | 480,000 | 520,000 | 598,000 |
| Periods without severe disabilities | 331,000 | 209,000 | 274,000 | 338,000 | 401,000 | 448,000 | 225,000 | 282,000 | 320,000 | 372,000 | 447,000 |
| Periods with severe disabilities | 172,000 | 225,000 | 177,000 | 172,000 | 149,000 | 150,000 | 211,000 | 192,000 | 160,000 | 148,000 | 151,000 |
| Percent of total incurred during periods with severe disabilities | 34% | 52% | 39% | 34% | 27% | 25% | 48% | 41% | 33% | 28% | 25% |
| ***Sensitivity Analyses*** | | | | | | | | | | | |
| ***Combined OASDI and HI Benefits (Scheduled Social Security, Current Law Scenario for Medicare)*** | 484,000 | 410,000 | 440,000 | 486,000 | 532,000 | 573,000 | 427,000 | 451,000 | 459,000 | 500,000 | 578,000 |
| ***Combined OASDI and HI Benefits (Payable Social Security, Illustrative Scenario for Medicare)*** | 457,000 | 414,000 | 417,000 | 465,000 | 488,000 | 526,000 | 415,000 | 440,000 | 437,000 | 463,000 | 525,000 |
| ***Combined OASDI and HI Contributions (with GR)*** | 555,700 | 145,000 | 285,000 | 415,700 | 957,300 | 1,200,500 | 121,700 | 241,600 | 357,800 | 541,600 | 1,475,000 |
| ***Combined OASDI and HI Contributions (without GR)*** | 520,200 | 141,400 | 273,000 | 393,900 | 887,600 | 1,107,700 | 117,700 | 233,000 | 341,500 | 511,000 | 1,359,800 |
| Social Security (scheduled) | 270,400 | 96,800 | 191,700 | 266,200 | 380,400 | 442,100 | 77,100 | 166,400 | 241,300 | 344,300 | 504,900 |
| Medicare scheduled, including GR transfer | 285,300 | 48,200 | 93,300 | 149,500 | 576,900 | 758,400 | 44,600 | 75,200 | 116,500 | 197,300 | 970,100 |
| Medicare scheduled, excluding GR transfer | 249,800 | 44,600 | 81,300 | 127,700 | 507,200 | 665,600 | 40,600 | 66,600 | 100,200 | 166,700 | 854,900 |
| Medicare scheduled, including GR transfer and premiums | 314,000 | 67,800 | 115,100 | 176,100 | 612,500 | 799,600 | 65,600 | 98,300 | 143,800 | 227,200 | 1,009,200 |
| ***Means-tested Government Assistance*** | | | | | | | | | | | |
| ***Medicaid for the Aged (Just age 65+, discounted to 51)*** | 36,500 | 88,900 | 40,100 | 34,400 | 18,600 | 13,900 | 43,500 | 26,300 | 20,300 | 11,300 | 8,300 |
| *Medicaid LTSS* | 25,000 | 53,100 | 28,300 | 25,400 | 14,200 | 11,300 | 33,300 | 20,100 | 16,500 | 9,100 | 7,700 |
| *Other Medicaid (non-LTSS)* | 13,500 | 42,500 | 14,500 | 11,100 | 5,200 | 3,000 | 13,500 | 7,900 | 4,800 | 2,600 | 8,300 |
| ***SSI*** | 2,510 | 12,120 | 2,580 | 1,120 | 330 | 40 | 9,970 | 2,050 | 980 | 210 | 30 |
| ***Total Federal Spending, including Social Security (scheduled benefits), Medicare (Illustrative scenario), Medicaid, and SSI*** | 542,000 | 535,000 | 494,000 | 546,000 | 569,000 | 612,000 | 489,000 | 502,000 | 501,000 | 532,000 | 606,000 |

**Sources:** Author's tabulations from DYNASIM4 (runid 967, dated: December, 2018).

**Notes:** All computations in real (2019) dollars. Present values are evaluated as of age 51 using a real discount rate of 2.7 percent, consistent with the intermediate assumptions of the Social Security Trustees Report. Family earnings are defined as the average of own and spouse annual earnings when married and one's own earnings in years when unmarried. Quintile breaks are calculated for 5-year birth cohorts. Assumes scheduled Social Security benefits where noted and payable benefits in the designated sensitivity analyses. To discourage overly precise interpretation, we round combined values to the nearest $1,000, most component values (Social Security and Medicare) to the nearest $100, and SSI values to the nearest $10. Tabulations exclude late-arriving, unauthorized, and short-term immigrants.

Table 5 compares Social Security and Medicare benefits for the 1956 to 1960, 1966 to 1970, and 1976 to 1980 birth cohorts. Consistent with the Social Security Trustees intermediate assumptions, life expectancies grow across the cohorts, and benefit receipt periods grow by about a year and a half from the first to the last cohort. Assuming scheduled benefits, the real value of annual lifetime benefits is slated to increase. Medicare benefits increase more quickly than Social Security benefits because health care costs are expected to grow faster than wages and prices on an age-adjusted basis. This growth will not necessarily generate higher replacement rates, however, and out-of-pocket burdens for health care are still expected to grow (Hatfield et al. 2016).[23]

To help shed some light on this issue, table 6 compares out-of-pocket costs for medical services and long-term services and supports for those born in 1966 through 1970. It examines point-of-care costs shares for medical services (required copayments and deductibles) and LTSS (specifically, home care and nursing home care not financed by Medicaid or another source, like private insurance or the veterans' administration) plus Medicare premiums (both part B and part D for those who participate, and part A for the small share who elect to and are required to pay them) and private long-term care insurance premiums for those who purchase private long-term insurance.

The table shows that cost-sharing is projected to increase in absolute terms with education and lifetime earnings. This reflects multiple factors, including the availability of Medicaid, including assistance with cost-shares and premiums through Medicare Savings Programs, especially for those in the lower lifetime earnings quintiles, plus the tendency of those who can better afford it to purchase more comprehensive insurance. Regardless of economic status, projected cost shares are felt most strongly during periods of disability, with about 40 percent of costs borne during these times. This is driven by needs for LTSS; beneficiaries pay premiums more evenly between periods with and without disability.

However, mean burdens do not adequately reflect health care spending burdens, given that there is significant diversity in risks (Hatfield et al. 2016, Jones et al. 2018). For example, some people will never need long-term services and supports, but others will need them for many years (Favreault and Dey 2015). LTSS costs conditional on actually using services are roughly double expected costs for the entire population. Out-of-pocket spending for health care needs are similarly skewed. For those with the most significant uninsured needs, out-of-pocket burdens can amount to a substantial share of lifetime earnings.

TABLE 5

## Average Combined Adult Experiences with Social Security and Medicare by Disabled Life Expectancy, Education, and Lifetime Earnings for People Born from 1956 to 1960, 1966 to 1970, and 1976 to 1980 who Survive until Age 50: DYNASIM Projections

| | | Completed education | | | | | Family earnings quintile (at age 51) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | All | Less than high school diploma | High school diploma | Some college | Bachelor's degree | More than bachelor's degree | Lowest | Second | Middle | Fourth | Highest |
| ***Total Social Security and Medicare Benefits*** | | | | | | | | | | | |
| 1956-60 cohorts (ages 58 to 62 in 2018 and 90 to 94 in 2050) | 426,000 | 395,000 | 398,000 | 428,000 | 457,000 | 509,000 | 385,000 | 398,000 | 413,000 | 441,000 | 491,000 |
| 1966-70 cohorts (ages 48 to 52 in 2018 and 80 to 84 in 2050) | 503,000 | 434,000 | 451,000 | 510,000 | 550,000 | 598,000 | 436,000 | 474,000 | 480,000 | 520,000 | 598,000 |
| 1976-80 cohorts (ages 38 to 42 in 2018 and 70 to 74 in 2050) | 596,000 | 533,000 | 527,000 | 587,000 | 657,000 | 702,000 | 514,100 | 550,500 | 560,300 | 630,000 | 718,500 |
| ***Social Security Benefits (Scheduled, including OASI and DI)*** | | | | | | | | | | | |
| Total amount (both disabled and non-disabled periods), 1956-60 cohorts | 204,000 | 128,000 | 179,000 | 204,000 | 251,000 | 302,000 | 114,000 | 166,000 | 198,000 | 238,000 | 298,000 |
| Total years as a beneficiary, 1956-60 cohorts | 19.9 | 17.3 | 19.2 | 20.3 | 21.1 | 22.4 | 18.1 | 19.7 | 19.8 | 20.3 | 21.4 |
| Percent of beneficiary years with severe disabilities, 1956-60 cohorts | 22% | 34% | 25% | 19% | 18% | 17% | 32% | 24% | 21% | 18% | 17% |
| Percent of total benefits paid in years with severe disabilities, 1956-60 cohorts | 22% | 38% | 27% | 19% | 17% | 15% | 34% | 27% | 22% | 19% | 16% |
| Total amount (both disabled and non-disabled periods), 1966-70 cohorts | 237,000 | 121,000 | 188,000 | 234,000 | 307,000 | 351,000 | 120,000 | 187,000 | 224,000 | 283,000 | 360,000 |
| Total years as a beneficiary, 1966-70 cohorts | 20.7 | 17.3 | 19.5 | 20.9 | 22.2 | 23.7 | 18.5 | 20.1 | 20.3 | 21.3 | 23.0 |
| Percent of beneficiary years with severe disabilities, 1966-70 cohorts | 21% | 33% | 24% | 19% | 17% | 16% | 30% | 24% | 20% | 18% | 16% |
| Percent of total benefits paid in years with severe disabilities, 1966-70 cohorts | 20% | 36% | 26% | 19% | 16% | 15% | 32% | 26% | 21% | 18% | 15% |
| Total amount (both disabled and non-disabled periods), 1976-80 cohorts | 272,000 | 140,000 | 214,000 | 259,000 | 353,000 | 383,000 | 139,000 | 206,000 | 259,000 | 328,000 | 414,000 |
| Total years as a beneficiary, 1976-80 cohorts | 21.3 | 18.3 | 19.9 | 21.2 | 22.9 | 24.3 | 19.3 | 20.5 | 21.0 | 22.2 | 23.4 |
| Percent of beneficiary years with severe disabilities, 1976-80 cohorts | 22% | 31% | 23% | 19% | 20% | 20% | 28% | 24% | 20% | 19% | 18% |
| Percent of total benefits paid in years with severe disabilities, 1976-80 cohorts | 21% | 34% | 25% | 20% | 19% | 19% | 30% | 26% | 22% | 20% | 17% |
| ***Medicare Benefits*** | | | | | | | | | | | |
| Total amount (both disabled and non-disabled periods), 1956-60 cohorts | 222,000 | 267,000 | 219,000 | 224,000 | 206,000 | 207,000 | 271,000 | 232,000 | 215,000 | 203,000 | 193,000 |
| Total years as a beneficiary, 1956-60 cohorts | 19.7 | 16.5 | 18.4 | 19.9 | 22.0 | 23.7 | 18.0 | 19.0 | 19.3 | 20.2 | 21.9 |
| Percent of beneficiary years with severe disabilities, 1956-60 cohorts | 21% | 34% | 25% | 19% | 16% | 16% | 31% | 24% | 21% | 17% | 16% |
| Percent of total benefits paid in years with severe disabilities, 1956-60 cohorts | 46% | 59% | 48% | 42% | 41% | 41% | 56% | 47% | 45% | 41% | 40% |
| Total amount (both disabled and non-disabled periods), 1966-70 cohorts | 266,000 | 313,000 | 263,000 | 276,000 | 243,000 | 247,000 | 316,000 | 287,000 | 256,000 | 237,000 | 238,000 |
| Total years as a beneficiary, 1966-70 cohorts | 20.5 | 16.9 | 18.6 | 20.4 | 22.7 | 24.5 | 18.4 | 19.4 | 19.8 | 21.2 | 23.3 |
| Percent of beneficiary years with severe disabilities, 1966-70 cohorts | 20% | 32% | 24% | 19% | 16% | 16% | 30% | 24% | 19% | 17% | 15% |
| Percent of total benefits paid in years with severe disabilities, 1966-70 cohorts | 47% | 58% | 49% | 46% | 41% | 39% | 55% | 50% | 45% | 41% | 40% |
| Total amount (both disabled and non-disabled periods), 1976-80 cohorts | 324,000 | 393,000 | 313,000 | 328,000 | 304,000 | 319,000 | 375,100 | 344,500 | 301,300 | 302,000 | 304,500 |
| Total years as a beneficiary, 1976-80 cohorts | 21.1 | 17.5 | 19.2 | 20.7 | 23.2 | 24.7 | 19.1 | 19.8 | 20.5 | 22.1 | 23.6 |
| Percent of beneficiary years with severe disabilities, 1976-80 cohorts | 21% | 31% | 23% | 19% | 19% | 19% | 28% | 24% | 20% | 19% | 17% |
| Percent of total benefits paid in years with severe disabilities, 1976-80 cohorts | 47% | 57% | 47% | 46% | 45% | 44% | 53% | 50% | 44% | 43% | 44% |

**Sources:** Author's tabulations from DYNASIM4 (runid 967, dated: December, 2018).

**Notes:** All computations in real (2019) dollars. Present values are evaluated as of age 51 using a real discount rate of 2.7 percent, consistent with the Social Security Trustees Report. Family earnings are defined as the average of own and spouse annual earnings when married and one's own earnings in years when unmarried. Quintile breaks are calculated for 5-year birth cohorts. Assumes scheduled Social Security benefits. To discourage overly precise interpretation, we round combined values to the nearest $1,000. Tabulations exclude late-arriving, unauthorized, and short-term immigrants.

TABLE 6

**Average Combined Adult Experiences with Out-of-Pocket Cost Shares for Medicare and Private Pay LTSS by Disabled Life Expectancy, Education, and Lifetime Earnings for People Born from 1966 to 1970: DYNASIM**

| | | Completed education | | | | | Family earnings quintile (at age 51) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | All | Less than high school diploma | High school diploma | Some college | Bachelor's degree | More than bachelor's degree | Lowest | Second | Middle | Fourth | Highest |
| Out-of-pocket totals | 131,800 | 77,700 | 98,800 | 131,800 | 166,600 | 193,500 | 82,200 | 109,900 | 126,900 | 146,700 | 184,600 |
| Periods without severe disabilities | 80,700 | 44,700 | 64,600 | 82,300 | 102,000 | 112,300 | 50,500 | 68,700 | 80,800 | 89,400 | 108,700 |
| Periods with severe disabilities | 51,100 | 33,000 | 34,200 | 49,500 | 64,600 | 81,200 | 31,700 | 41,200 | 46,100 | 57,300 | 75,900 |
| Percent of total during periods with severe disabilities | 39% | 42% | 35% | 38% | 39% | 42% | 39% | 37% | 36% | 39% | 41% |
| Out-of-pocket point of care cost shares (including acute and LTSS) | 103,100 | 66,800 | 84,700 | 109,700 | 134,700 | 155,300 | 70,400 | 94,100 | 104,700 | 120,500 | 148,400 |
| Periods without severe disabilities | 56,000 | 36,800 | 52,500 | 63,200 | 73,400 | 78,600 | 41,000 | 56,000 | 62,600 | 66,900 | 77,000 |
| Periods with severe disabilities | 47,100 | 28,900 | 31,700 | 46,300 | 61,000 | 76,500 | 28,200 | 37,700 | 41,800 | 53,500 | 71,200 |
| Percent of total during periods with severe disabilities | 46% | 43% | 37% | 42% | 45% | 49% | 40% | 40% | 40% | 44% | 48% |
| Out-of-pocket premiums (Medicare, including supplemental insurance, plus any private long-term care insurance) | 28,700 | 19,600 | 21,800 | 26,600 | 35,600 | 41,200 | 21,000 | 23,100 | 27,300 | 29,900 | 39,100 |
| Periods without severe disabilities | 24,700 | 15,500 | 19,300 | 23,400 | 32,000 | 36,500 | 17,500 | 19,600 | 23,000 | 26,100 | 34,400 |
| Periods with severe disabilities | 4,000 | 4,100 | 2,500 | 3,200 | 3,600 | 4,700 | 3,500 | 3,500 | 4,300 | 3,800 | 4,700 |
| Percent of total during periods with severe disabilities | 14% | 21% | 11% | 12% | 10% | 11% | 17% | 15% | 16% | 13% | 12% |

**Sources:** Author's tabulations from DYNASIM4 (runid 967, dated: December, 2018).

**Notes:** All computations in real (2019) dollars. Present values are evaluated as of age 51 using a real discount rate of 2.7 percent, consistent with the Social Security Trustees Report. Family earnings are defined as the average of own and spouse annual earnings when married and one's own earnings in years when unmarried. Quintile breaks are calculated for 5-year birth cohorts. Table focuses on expenses incurred at ages 51 and older, not counting contributions to employer-sponsored insurance prior to retirement. We round most values to the nearest $100 to discourage excessively precise interpretation. Tabulations exclude late-arriving, unauthorized, and short-term immigrants.

# Caveats

All projections simplify the world and depend on assumptions. When testing hypotheses, high-quality data on observed historical experiences are a preferred source, especially when one is interested in understanding long-range experiences. Unfortunately, we cannot answer the types of questions we pose here with historical data. Too much of the experience lies in the future, and even our information about the past is incomplete. For example, Medicare and Medicaid claims data have become less complete as more beneficiaries are served through managed care plans and researchers must learn how best to combine information for fee-for-service records and encounter data. So we must use a combination of historical and projected data, employing the best judgment of the research community about what to assume about the future.

In this case, we calibrate projections to the Social Security trustees' intermediate demographic and economic assumptions and the excess health care cost growth assumptions from the illustrative scenario from CMS (Shatto and Clemens 2018); the sensitivity analyses in table 4 provide the projections for current law Medicare benefits. Technical panels regularly review the assumptions and methods used in both the Social Security and Medicare Trustees reports (2015 Technical Panel on Assumptions and Methods, 2017 Medicare Technical Panel), and public trustees help set the assumptions. We also generally assume that the future will broadly resemble the present, after accounting for population composition, including the distribution of the population by age, sex, and education. Some of the more challenging and controversial assumptions we must make surround trends in mortality, disability, and cognitive impairment. The literature in many of these areas is divided. For example, many recent studies of trends in cognitive impairment based on nationally representative data suggest modest but significant declines in age-specific prevalence of dementia in recent years (Freedman et al. 2018, Hudomiet, Hurd, and Rohwedder 2018, Langa et al. 2016, Stallard and Tashin 2016), but other studies based on community data are less sanguine (Hebert et al. 2010).

Some of our projections differ from others in the literature. Although our combined Social Security and Medicare projections—plus our Medicaid and SSI projections, not shown in the current draft—are generally broadly qualitatively consistent with those presented in National Academies of Sciences, Engineering, and Medicine (2015), a few noteworthy differences emerge.[24] Projected Medicare benefits differ between the studies—with DYNASIM's projected benefits for lower-earning men and women higher than in the prior study and for moderate and higher-earning men and the highest earnings women significantly lower. DYNASIM's Social Security benefits are lower for men and higher for

women. Differing assumptions about the future course of mortality levels by gender and across income quintiles appear to drive the differences.[25]

An important component of these projections is that the underlying micro-dynamic estimates are sensitive to definitions and measurement. As table 1 shows, small differences in disability concepts and question wording can significantly change prevalence rates and expected disability durations, and different surveys report markedly different disability rates (Freedman et al. 2013). Aspects of the surveys, like their sampling frameworks, can explain many of these differences. Moreover, many disability spells may be short, so measurement challenges arise when using surveys like the Health and Retirement Study, which interviews respondents every two years and thus may miss some transitions (Wolf and Gill 2009). Similarly, projections are sensitive to factors such as the age at which one evaluates outcomes, the discount rate one uses, how one measures status and assigns people to quintiles, how one treats outliers, and so forth.

# Conclusions

Social Security and Medicare outcomes differ systematically by socioeconomic status. In some respects, they look like different programs for well-off people than for people with fewer economic advantages. One group of beneficiaries needs their benefits as early and as intensively as possible in retirement, and even prior to retirement age. A second group needs to spread their benefits out over a much longer period, given the likelihood that they will live into their 90s and even beyond. They will spend much more time in reasonably good health without significant disabilities, and many can reduce their risk of outliving their income and assets by working longer.

There is nonetheless significant diversity within all economic groups. Some well-educated people will be afflicted by early onset Alzheimer's disease or injured in accidents; many have poor health habits that will lead to chronic conditions. Some lower-income people are the picture of health, with excellent health habits, and happy, healthy lives through their 90s.

One challenge for policymakers working to place these programs on a more sustainable fiscal path is to recognize and account for these diverse needs and uses of the programs. Many program changes will likely need to be carefully targeted so that they maintain and even enhance work incentives for those who are able to remain in the workforce—a period that is likely to grow for many—while also maintaining protections for those whose disabilities have left them economically vulnerable.

# Notes

[1] At ages 90 and older, the corresponding differentials between the least and most educated drop to 2.9 to one for men and 1.9 to one for women.

[2] The lifetime earnings measure they use is average indexed monthly earnings (AIME). Importantly, the study focuses on retired workers. Accordingly, their analyses do not include older adults receiving benefits solely as spouses and survivors—disproportionately older women in earlier birth cohorts.

[3] Regression analyses indicate that those with higher incomes purchase more care than those with lower incomes net of age, health status and conditions, disability, and year of death (reported in Favreault and Johnson 2018a).

[4] Goldman and Smith (2011), for example, consider the educational gradient in health status for adults ages 40 to 64 and how it has changed over time. They find a strong educational gradient in poor health and in disease prevalence, specifically considering arthritis, diabetes, heart disease, hypertension, and lung diseases. They also find that this gradient increased from the late 1970s through the mid-2000s.

[5] When they do not line up precisely, we apply scalar adjustments to the computed probabilities on an age–sex basis, with separate groups for infants and then progressively smaller groups as death rates increase (young people and adults age 1 through 51 are one group, we then use 10-year age groups at ages 65 to 74 and 75 to 84, 5-year age groups at ages 85 to 89, 90 to 94, and 95 to 99, and then a single category for those ages 100 and older). For most age ranges, the adjustment factors are close to one.

[6] We have likewise validated DYNASIM's projections of total incomes in 2012 against historic data reported by Bee and Mitchell (2017) and determined that DYNASIM does not underreport pensions and retirement accounts, unlike some household surveys like the Current Population Survey and American Communities Survey.

[7] See discussion in National Academies of Sciences, Engineering, and Medicine (2015), which we confirmed in follow-up correspondence with analysts at CBO.

[8] Details of the model of cognitive impairment are available in Favreault and Johnson (forthcoming).

[9] The illustrative scenario addresses concerns that the provider payment rates under current law, while reasonable in the short-term, may not be sustainable over the long-term. Under the illustrative scenario, projected costs are higher than under current law, with the difference growing over time. Considering total Medicare spending (Parts A, B, and D), Shatto and Clemens (2018) report that projected costs for the illustrative scenario would be approximately a half a percent higher in 2030, four percent higher in 2040, 11 percent higher in 2050, 19 percent higher in 2060, 27 percent higher in 2070, and 35 percent higher in 2080.

[10] The ADLs the statute enumerates are eating, toileting, transferring, bathing, dressing, and continence.

[11] We use education categories because they are more intuitive to lay readers than, say, cohort-specific education percentiles using total years of schooling. Percentiles can be somewhat uneven because of clustering at certain points (high school diploma and college degree). However, an important advantage of percentiles is that they allow one to more readily account for cross-cohort change—and thus differential selection in the lowest education group—as Bound and colleagues (2015) discuss.

[12] Family earnings are defined as the average of one's own and one's spouse's earnings in years in which one is married and one's own earnings in years in which one is single.

[13] By way of context, researchers at the Census Bureau (Fontenot, Semega, and Kollar 2018) report estimated current (2017) mean income for each of the census income quintiles is as follows: $13,258, $35,401, $61,564, and $99,030 $221,846. The mean for the top five percent is $385,289. Quintile breaks are: $24,638 (lowest), $47,110 (between second and third), $77,552 (between third and fourth), and $126,855 (between fourth and highest).

[14] The term "payable" Social Security benefits refers to those benefits that the program can cover with current law revenues from 2034 and onward, the point when the actuaries project that the Social Security Trust Funds will be exhausted.

[15] Some incidence studies allocate administrative expenses to households receiving Medicare of Social Security benefits (Congressional Budget Office 2013), but we do not do that in these analyses.

[16] Sensitivity analyses could explore this assumption's importance by using alternative specifications.

[17] In earlier years, this share was much lower—less than one percent for the first five years of the program—and then it steadily increased. The 2006 addition of Part D benefits was one contributing factor, but clearly just one of many.

[18] This metric is currently left-censored at the first year in which DYNASIM projects personal income taxes using all relevant income components. For earlier years, we compute tax liability less precisely based on earnings of a person and his/her spouse if married. (Earnings histories are statistically matched to all members of the sample.)

[19] We specifically exclude unauthorized immigrants, those arriving in the United States after age 51, and those arriving before age 51 who spend less than 10 years in the U.S.

[20] These would include both people who died before reaching these programs eligibility ages (62 for Social Security, 65 for Medicare) and those who survived but had not yet elected to claim their benefits.

[21] Specifically, within each of the two disability groups we differentiate those reporting fair or poor health (out of a five-group classification ranging from excellent, very good, good, fair or poor) as well as multiple chronic conditions with all others. Future work could use a more complex multivariate index, as in our prior analyses (Johnson, Favreault, and Mommaerts 2009).

[22] Many additional combinations of sensitivity analyses are of course feasible. We hope to explore some in future work.

[23] For example, the constraint that Medicare Part B premiums are set to cover 25 percent of total part B costs should place upward pressure on out-of-pocket spending burdens as health care costs rise faster than incomes.

[24] When comparing our projections with those estimates presented in the report in separate analyses not shown here, we try to make as many factors consistent as possible, for example, using the same analysis years, analysis birth cohorts, and so forth.

[25] For example, in the National Academies of Sciences, Engineering, and Medicine (2015) analyses, men's and women's projected mortality experience appear to converge far more rapidly than the Trustees' intermediate assumptions, on which the DYNASIM projections are based, would imply. Also, in the National Academies projections, women's projected life expectancy increases markedly and discontinuously when one moves from the fourth to fifth income quintiles—by 8.8 years, compared to increases of 1.4 years when moving from the lowest to second quintile, 2.7 years when moving from the second to middle quintile, and 0.7 years when moving from the middle to the fourth quintile

(see figure S-2). For men, life expectancy gains across the quintiles are 2.2 years when moving from the lowest to second quintile, 5.1 years when moving from the second to middle quintile, 4.4 years when moving from the middle to the fourth quintile, and 1.0 years when moving from the fourth to the highest quintile (see figure S-1). DYNASIM's projected socioeconomic differentials in mortality are not as large and are less variable across quintiles.

# References


Aaron, H. with the assistance of P. Spevak. 1977. "Demographic Effects on the Equity of Social Security Benefits." In M. S. Feldstein and R. P. Inman, Editors. The Economics of Public Services: Proceedings of a Conference Held at the International Economic Association at Turin, Italy. London: MacMillan.

Arias, E., M. Heron, and J. Xu. 2016. United States Life Tables, 2012. *National Vital Statistics Reports* 65(8): 1–64. https://www.cdc.gov/nchs/data/nvsr/nvsr65/nvsr65_08.pdf.

Auerbach, A. J., K. K. Charles, C. C. Coile, W. Gale, D. Goldman, R. Lee, C. M. Lucas, P. R. Orszag, L. M. Sheiner, B. Tysinger, D. N. Weil, J. Wolfers, and R.Wong. 2017. How the growing gap in life expectancy may affect retirement benefits and reforms. *The Geneva Papers on Risk and Insurance-Issues and Practice* 42: 475–499.

Bee, A. and J. Mitchell. 2017. "Do Older Americans Have More Income Than We Think?" SESHD Working Paper #2017-39. Census Bureau.

Bhattacharya, J. and D. Lakdawalla. 2006. "Does Medicare Benefit the Poor?" *Journal of Public Economics* 90: 277–292.

Board of Trustees, Federal Old-Age and Survivors Insurance and Disability Insurance Trust Funds. 2018. *2018 Annual Report of the Board of Trustees of the Federal Old-Age and Survivors Insurance and Disability Insurance Trust Funds*. Washington, DC: Author.

Boards of Trustees of the Federal Hospital Insurance and Federal Supplementary Medical Insurance Trust Funds. 2018. *2018 Annual Report of the Boards of Trustees of the Federal Hospital Insurance and Federal Supplementary Medical Insurance Trust Funds*. Washington, DC: Author.

Boskin, M. J., L. J. Kotlikoff, D. J. Puffert, and J. B. Shoven. 1987. "Social Security: A Financial Appraisal across and within Generations." *National Tax Journal* 40(3): 19–34.

Bosley, T., M. Morris, and K. Glenn. 2018. *Mortality by Career-Average Earnings Level*. Actuarial Study No. 124. Social Security Administration Office of the Chief Actuary. https://www.ssa.gov/OACT/NOTES/pdf_studies/study124.pdf.

Bosworth, B., G. Burtless, and K. Zhang. 2015. Later Retirement, Inequality in Old Age, and the Growing Gap in Longevity between Rich and Poor. Washington, DC: Brooking Institution.

Bound, J., A. T. Geronimus, J. M. Rodriguez, and T. A. Waidmann. 2015. "Measuring Recent Apparent Declines in Longevity: The Role of Increasing Educational Attainment." *Health Affairs* 34(12): 2167–2173.

Braveman, P. and L. Gottlieb. 2014. "The Social Determinants of Health: It's Time to Consider the Causes of the Causes." *Public Health Rep.* 129(Suppl 2): 19–31. doi: 10.1177/00333549141291S206: 10.1177/00333549141291S206

Brown, J. R., J. L. Coronado, and D. Fullerton. 2006. "The Progressivity of Social Security." Cambridge, MA: National Bureau of Economic Research Retirement Research Center.

Buckles, K., A. Hagemann, O. Malamud, M. S. Morrill, and A. K. Wozniak. 2016. "The Effect of College Education on Mortality." *Journal of Health Economics* 50: 99–114.

Burkhauser, R. V. and J. L. Warlick. 1981. "Disentangling the Annuity from the Redistributive Aspects of Social Security in the United States." *Review of Income and Wealth* 27: 401–421.

Caldwell, S. B., M. M. Favreault, A. Gantman, J. Gokhale, T. Johnson, and L. J. Kotlikoff. 1999. "Social Security's Treatment of Postwar Americans." In J. M. Poterba, editor, *Tax Policy and the Economy, 13*. Cambridge, MA: MIT Press, National Bureau of Economic Research.

Case, A. and A. Deaton. 2015. "Rising Morbidity and Mortality in Midlife among White Non-Hispanic Americans in the 21st Century." *Proceedings of the National Academy of Sciences of the United States of America* 112(49): 15078–83. http://www.pnas.org/content/112/49/15078.

Chetty, R., M. Stepner, S. Abraham, S. Lin, B. Scuderi, N. Turner, A. Bergeron, and D. Cutler. 2016. "The Association Between Income and Life Expectancy in the United States, 2001-2014." *JAMA* 315(16): 1750–1766. doi:10.1001/jama.2016.4226.

Choi, H., R. F. Schoeni, L. G. Martin, and K. M. Langa. 2018. "Trends in the Prevalence and Disparity in Cognitive Limitations of Americans 55–69 Years Old." *Journals of Gerontology: Social Sciences* 73(S1): S29–S37. doi:10.1093/geronb/gbx155

Coe, N. B., Z. Karamcheva, R. Kopcke, and A. H. Munnell. 2011. "How Does the Personal Income Tax Affect the Progressivity of OASI Benefits?" Working Paper 2011-21. Chestnut Hill, MA: Center for Retirement Research at Boston College.

Cohen, L., E. Steuerle, and A. Carasso. 2001. "Social Security Redistribution by Education, Race, and Income: How Much and Why?" Paper prepared for the third annual conference of the Retirement Research Consortium, Washington, D.C.

Congressional Budget Office. Congress of the United States. 2016. *The 2016 Long-Term Budget Outlook*. Washington, DC.

_____. 2014. "The Distribution of Household Income and Federal Taxes, 2011." Washington, DC.

Coronado, J. L., D. Fullerton, T. Glass. 1999. "Distributional Impacts of Proposed Changes to the Social Security System." In J. Poterba, editor, *Tax Policy and the Economy*, Volume 13: 149–186.

Crimmins, E. M., M. D. Hayward, A. Hagedorn, Y. Saito, and N. Brouard. 2009. "Change in Disability-Free Life Expectancy for Americans 70 Years Old and Older." *Demography* 46(3): 627–43.

Crimmins, Eileen M., Yasuhiko Saito, Jung Ki Kim, Yuan S. Zhang, Isaac Sasson, and Mark D. Hayward. 2018. "Educational Differences in the Prevalence of Dementia and Life Expectancy with Dementia: Changes from 2000 to 2010." *Journals of Gerontology: Social Sciences* 73(S1): S20–S28. doi:10.1093/geronb/gbx135

Crimmins, E. M., Y. Zhang, and Y. Saito. 2016. "Trends Over 4 Decades in Disability-Free Life Expectancy in the United States." *AJPH* 106(7): 1287–1293.

Cristia, J. P. 2007. "The Empirical Relationship Between Lifetime Earnings and Mortality." August 2007–11. Working Paper Series Washington, DC: Congressional Budget Office.

_____. 2009. "Rising Mortality and Life Expectancy Differentials by Lifetime Earnings in the United States." *Journal of Health Economics* 28(5): 984–95. doi: 10.1016/j.jhealeco.2009.06.003. Epub 2009 Jun 13. Also Inter-American Development Bank. Working paper number 665. https://publications.iadb.org/bitstream/handle/11319/1637/Rising%20Mortality%20and%20Life%20Expectancy%20Differentials%20by%20Lifetime%20Earnings%20in%20the%20United%20States.pdf?sequence=1&isAllowed=y

Cutler, D. M., F. Lange, E. Meara, S. Richards-Shubik, and C. J. Ruhm. 2011. "Rising Educational Gradients in Mortality: The Role of Behavioral Risk Factors." *Journal of Health Economics* 30(6): 1174–1187.

Duggan, J. E., R. Gillingham, and J. S. Greenlees. 1993. "Returns Paid to Early Social Security Cohorts." *Contemporary Policy Issues* XI: 1–13.

Favreault, M. M. 1998. "Whose Safety Net? Social Security, Life Course Processes, and Inequality in the United States." Ph.D. Dissertation, Cornell University.

Favreault, M. M., and R. W. Johnson. 2018a. "How Would Social Security Changes Affect Medicare Costs and Seniors' Out-of-Pocket Spending? A Microsimulation Analysis." Working Paper, Center for Retirement Research at Boston College.

Favreault, M. M., and R. W. Johnson. 2018b. "Long-Term Services and Supports and Economic Security in Retirement: Implications for Social Security and SSI Policymaking." Working Paper, Center for Retirement Research at Boston College.

Favreault, M. M., R. W. Johnson, and K. E. Smith. 2013. "How Important is Social Security Disability Insurance to U.S. Workers?" Program on Retirement Policy Brief 36. Washington, DC: Urban Institute.

Favreault, M. M., K. E. Smith, and R. W. Johnson. 2015. *The Dynamic Simulation of Income Model (DYNASIM): An Overview*. Washington, DC: The Urban Institute. https://www.urban.org/sites/default/files/publication/67366/2000391-The-Dynamic-Simulation-of-Income-Model-DYNASIM-%20An-Overview.pdf.

Favreault, M. M. and C. E. Steuerle. 2012. "Measuring Social Security Proposals by More than Solvency: Impacts on Poverty, Progressivity, Horizontal Equity, and Work Incentives." Working Paper #2012-15, Center for Retirement Research at Boston College.

Favreault, M. and A. Tumlinson. 2019 (forthcoming). "How Much is this Going to Cost?: Inviting the Math Club to the Table." *Generations*.

Fontenot, K. R., Semega, J. L., and M. A. Kollar. 2018. *Income and Poverty in the United States: 2017*. U.S. Census Bureau, Current Population Reports, P60-263. Washington, DC: U.S. Government Printing Office.

Freedman, V. A., J. D. Kasper, B. C. Spillman, and B. L. Plassman. 2018. "Short-Term Changes in the Prevalence of Probable Dementia: An Analysis of the 2011–2015 National Health and Aging Trends Study."

Freedman, V. A., and B. C. Spillman. 2016. "Active Life Expectancy in the Older US Population, 1982-2011: Differences Between Blacks and Whites Persisted." *Health Affairs* 35(8): 1351–58.

Freedman, V. A., B. C. Spillman, P. M. Andreski, J. C. Cornman, E. M. Crimmins, E. Kramarow, J. Lubitz, L. G. Martin, S. S. Merkin, R. F. Schoeni, T. E. Seeman, and T. A. Waidmann. 2013. "Trends in Late-Life Activity Limitations in the United States: An Update from Five National Surveys." *Demography* 50(2): 661–71.

Freedman, V. A., D. A. Wolf, and B. Spillman. 2016. "Disability-Free Life Expectancy over 30 Years: A Growing Female Disadvantage in the US Population." American Journal of Public Health 106(6): 1079–85.

Friedman, M. with the assistance of R. D. Friedman. 1962. *Capitalism and Freedom*. Chicago: University of Chicago Press.

Garret, D. M. 1995. "The Effects of Differential Mortality Mortality Rates on the Progressivity of Social Security." *Economic Inquiry* 33(3): 457–475.

Geruso, M. 2012. "Black White Disparities in Life Expectancy: How Much Can the Standard SES Variables Explain?" *Demography* 49(2): 553–574.

Ghilarducci, T. and A. Webb. 2018. "The Distribution of Time in Retirement: Evidence from the Health and Retirement Survey *Work." Aging and Retirement* 4(3): 251–261. doi:10.1093/workar/way001

Goldman, D. and J. P. Smith. 2011. "The Increasing Value of Education to Health." *Social Science and Medicine* 72 (10): 1728–37.

Gustman, A. L., and T. L. Steinmeier. 2001. "How Effective Is Redistribution under the Social Security Benefit Formula?" *Journal of Public Economics* 82(1): 1–28.

Harrington Meyer, M. 1996. "Making Claims as Workers or Wives: The Distribution of Social Security Benefits." *American Sociological Review* 61(3): 449–465.

Harrington Meyer, M., D. A. Wolf, and C. L. Himes. 2004. "Linking Benefits to Marital Status: Race and Diminishing Access to Social Security Spouse and Widow Benefits in the U.S." Center for Retirement Research at Boston College. WP #2004-05. http://www.bc.edu/centers/crr/wp_2004-05.shtml.

Hatfield, L., M. M. Favreault, T. G. McGuire, and M. E. Chernew. 2016. "Modelling Health Care Spending Growth of Older Adults." *Health Services Research*.

____. 2016. "Appendix to Long-term Health Care Spending Growth Will Burden Low-Income Medicare Beneficiaries."

Hebert, L. E., J. L. Bienias, N. T. Aggarwal, R. S. Wilson, D. A. Bennett, R. C. Shah, and D. A. Evans. 2010. "Change in risk of Alzheimer Disease over Time." *Neurology* 75: 786–791. doi:10.1212/WNL.0b013e3181f0754f.

Irwin, N. and Q. Bui. 2016. "The Rich Live Longer Everywhere. For the Poor, Geography Matters." *New York Times*. The Upshot. https://www.nytimes.com/interactive/2016/04/11/upshot/for-the-poor-geography-is-life-and-death.html.

Johnson, R. W. 2018. "Delayed Retirement and the Growth in Income Inequality at Older Ages." Washington, DC: Urban Institute. https://www.urban.org/sites/default/files/publication/96241/delayed_retirement_and_the_growth_in_income_inequality_at_older_ages.pdf.

Johnson, R. W., M. M. Favreault, and C. Mommaerts. 2009. "Work Ability and the Social Insurance Safety Net in the Years Prior to Retirement." Working Paper #2009-28, Center for Retirement Research at Boston College.

Johnson, R. W., and Claire Wang. 2017. Educational Differences in Employment at Older Ages. Washington, DC: Urban Institute. https://www.urban.org/sites/default/files/publication/92231/educational_differences_in_employment_at_older_ages.pdf

Jones, J. B., M. De Nardi, E. French, R. McGee, and J. Kirschner. 2018. "The Lifetime Medical Spending of Retirees." Working Paper 24599. Cambridge, MA: National Bureau of Economic Research Retirement Research Center.

Kitagawa, E. M. and P. M. Hauser. 1973. *Differential Mortality in the United States: A Study in Socioeconomic Epidemiology*. Cambridge, MA: Harvard University Press.

Kochanek, K. D., S. L. Murphy, J. Xu, and E. Arias. 2017. "Mortality in the United States, 2016." NCHS Data Brief, no 293. Hyattsville, MD: National Center for Health Statistics. https://www.cdc.gov/nchs/data/databriefs/db293.pdf.

Kolata, G. 2015. "Death Rates Rising for Middle-Aged White Americans, Study Finds." *New York Times*. November 2. https://www.nytimes.com/2015/11/03/health/death-rates-rising-for-middle-aged-white-americans-study-finds.html

Kopczuk, W., E. Saez, and J. Song. 2010. "Earnings Inequality and Mobility in the United States: Evidence from Social Security Data since 1937." *Quarterly Journal of Economics* 125(1): 91–128.

Laditka, J. N., and S. B. Laditka. 2016. "Associations of Educational Attainment with Disability and Life Expectancy by Race and Gender in the United States: A Longitudinal Analysis of the Panel Study of Income Dynamics." *Journal of Aging and Health* 28(8): 1403–25.

Langa, K. M., E. B. Larson, E. M. Crimmins, J. D. Faul, D. A. Levine, M. U. Kabeto, and D. R. Weir. 2016. "A Comparison of the Prevalence of Dementia in the United States in 2000 and 2012." *JAMA Intern Med. 2017*;177(1): 51–58 Published online November 21, 2016. doi:10.1001/jamainternmed.2016.6807.

Liebman, J. B. 2002. "Redistribution in the Current U.S. Social Security System." In M. Feldstein and J. B. Liebman, editors. *The Distributional Aspects of Social Security and Social Security Reform*. Chicago: University of Chicago Press.

Lièvre, A., D. Alley, and E. M. Crimmins. 2008. "Educational Differentials in Life Expectancy with Cognitive Impairment among the Elderly in the United States." *Journal of Aging and Health* 20(4): 456–77.

Link, B. G. and J. Phelan. 1995. "Social Conditions as Fundamental Causes of Disease." *Journal of Health and Social Behavior*, Extra Issue: Forty Years of Medical Sociology: The State of the Art and Directions for the Future 80–94.

Manton, K. G., E. Stallard, and L. Corder. 1997. "Education-Specific Estimates of Life Expectancy and Age-Specific Disability in the U.S. Elderly Population: 1982-1991." *Journal of Aging and Health* 9(4): 419–450.

Masters, Ryan K., Robert A. Hummer, and Daniel A. Powers. 2012. "Educational Differences in U.S. Adult Mortality: A Cohort Perspective." *American Sociological Review* 77(4): 548–572.

Meyer, C. W. and N. L. Wolff. 1987. "Intercohort and Intracohort Redistribution under Old Age Insurance: The 1962-1972 Retirement Cohorts." *Public Finance Quarterly* 15(3): 259–281.

McEwen, B. S., and P. J. Gianaros. 2010. "Central role of the brain in stress and adaptation: Links to socioeconomic status, health, and disease." *Ann N Y Acad Sci.* 1186: 190–222. doi:10.1111/j.1749-6632.2009.05331.x.

National Academies of Sciences, Engineering, and Medicine. 2015. *The Growing Gap in Life Expectancy by Income: Implications for Federal Programs and Policy Responses.* Committee on the Long-Run Macroeconomic Effects of the Aging U.S. Population-Phase II. Committee on Population, Division of Behavioral and Social Sciences and Education. Board on Mathematical Sciences and Their Applications, Division on Engineering and Physical Sciences. Washington, DC: The National Academies Press.

Olshansky, S. J., T. Antonucci, L. Berkman, R. H. Binstock, A. Boersch-Supan, J. T. Cacioppo, B. A. Carnes, L. L. Carstensen, L. P. Fried, D. P. Goldman, J. Jackson, M. Kohli, J. Rother, Y. Zheng and J. Rowe. 2012. "Differences in Life Expectancy Due to Race and Educational Differences Are Widening, and Many May Not Catch Up." *Health Affairs* 31(8): 1803–1813. 10.1377/hlthaff.2011.0746

Orcutt, G. H. 1957. "A New Type of Socio-Economic System." *Review of Economics and Statistics* 39: 116–123.

Orcutt, G. H., S. Caldwell, and R. Wertheimer II. 1976. *Policy Exploration through Microanalytic Simulation*. Washington, DC: Urban Institute Press.

Panis, C., and L. Lillard. 1999. "Near Term Model Development." Final Report, SSA Contract No. 600-96-27335. Santa Monica, CA: RAND.

Piketty, T., and E. Saez. 2007. "Income and Wage Inequality in the United States, 1913–2002." In *Top Incomes over the Twentieth Century: A Contrast between European and English-Speaking Countries*, edited by A. B. Atkinson and T. Piketty (141–225). New York: Oxford University Press.

____. 2013. "Top Incomes and the Great Recession: Recent Evolutions and Policy Implications." *IMF Economic Review* 61(3): 456–78.

Piketty, T., E. Saez, and G. Zucman. 2018. "Distributional National Accounts: Methods and Estimates for the United States." *Quarterly Journal of Economics* 133(2): 553–609. doi:10.1093/qje/qjx043.

Rendall, M. S., M. M. Weden, M. M. Favreault, and H. Waldron. 2011. "The Protective Effect of Marriage for Survival: A Review and Update." *Demography* 48(2): 481–506.

Rettenmaier, A. J. 2012. "The Distribution of Lifetime Medicare Benefits, Taxes and Premiums: Evidence from Individual Level Data." *Journal of Public Economics* 96 (9-10): 760–772.

Riley, G. F. and K. Rupp. 2015. "Cumulative Expenditures under the DI, SSI, Medicare, and Medicaid Programs for a Cohort of Disabled Working-Age Adults." *Health Services Research* 50(2): 514–536.

Robitaille, A., A. van den Hout, R. J. M. Machado, D. A. Bennett, I. Cuki, I. J. Deary, S. M. Hofera, E. O. Hoogendijk, M. Huisman, B. Johansson, A. V. Koval, M. van der Noordt, A. M. Piccinin, J. J. M. Rijnhart, A. Singh-Manoux, J. Skoog, I. Skoog, J. Starre, L. Vermunt, S. Clouston, G. Muniz Terrera. 2018. "Transitions across Cognitive States and Death among Older Adults in Relation to Education: A Multistate Survival Model Using Data from Six Longitudinal Studies." *Alzheimer's & Dementia* 14: 462–472.

Ruhm, C. J. 2018. "Deaths of Despair or Drug Problems?" NBER Working Paper No. 24188. Cambridge, MA: National Bureau of Economic Research Retirement Research Center.

Shakin, J. and K. Seibert. 2015. "The Taxation of Social Security Benefits." Washington, DC: U.S. Congressional Budget Office.

Shatto, J. D. and M. K. Clemens. 2018. "Projected Medicare Expenditures under an Illustrative Scenario with Alternative Payment Updates to Medicare Providers." Office of the Actuary. Baltimore, MD: Center for Medicare and Medicaid Services. https://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/ReportsTrustFunds/Downloads/2018TRAlternativeScenario.pdf.

Singh, G. K. and M. Siahpush. 2006. "Widening socioeconomic inequalities in US life expectancy, 1980–2000." *International Journal of Epidemiology* 35: 969–979.

Smith, K. E., and M. M. Favreault. 2013. A Primer on Modeling Income in the Near Term, Version 7 (MINT7). Washington, DC: Urban Institute. https://www.urban.org/sites/default/files/publication/22116/413131%20-%20A-Primer-on-Modeling-Income-in-the-Near-Term-Version-MINT-.pdf.

Smith, K. E., M. Favreault, D. Cosic, and R. Johnson. 2018. *DYNASIM4 Validation Report: Comparing DYNASIM4 Outcomes with Administrative Data, Government Forecasts, and Scholarly Literature*. Report to the Department of Labor. Washington, DC: The Urban Institute.

Smith, K. E., M. Favreault, D. Cosic, and A. Williams. 2018. "How Well Does DYNASIM4 Project Retirement Income? Comparisons with Administrative Data." Report to the Department of Labor. Washington, DC: The Urban Institute.

Smith, K., E. Toder, and H. Iams. 2003. "Lifetime Distributional Effects of Social Security Retirement Benefits." *Social Security Bulletin* 65(1): 33–61.

Social Security Administration, Office of the Chief Actuary. 2018. "Summary of Provisions that Would Change the Social Security Program." September 13. Baltimore, MD. Available at: http://www.ssa.gov/oact/solvency/provisions/summary.pdf.

Solé-Auró, A., H. Beltrán-Sánchez, and E. M. Crimmins. 2014. "Are Differences in Disability-Free Life Expectancy by Gender, Race, and Education Widening at Older Ages?" *Population Research and Policy Review* 34(1): 1–18. doi:10.1007/s11113-014-9337-6.

Thompson, L. H. 1976. "Intracohort Redistribution in the Social Security Retirement Program." *Proceedings of the Business and Economic Statistics Section, American Statistics Association*: 146–155.

2015 Technical Panel on Assumptions and Methods. 2015. *Report to the Social Security Advisory Board*. http://www.ssab.gov/Portals/0/Technical%20Panel/2015_TPAM_Final_Report.pdf?ver=2015-09-24-113145-693.

2017 Medicare Technical Panel. 2017. *Review of Assumptions and Methods of the Medicare Trustees' Financial Projections Final Report*. https://aspe.hhs.gov/system/files/pdf/257821/MedicareTechPanelFinalReport2017.pdf.

Waldron, H. 2007. "Trends in Mortality Differentials and Life Expectancy for Male Social Security–Covered Workers, by Socioeconomic Status." *Social Security Bulletin* 67(3): 1–28.

_____. 2013. "Mortality Differentials by Lifetime Earnings Decile: Implications for Evaluations of Proposed Social Security Law Changes." *Social Security Bulletin* 73(1): 1–37.

Whitman, K., G. L. Reznik, and D. Shoffner. 2011. "Who Never Receives Social Security Benefits?" *Social Security Bulletin* 71(2): 17–24.

Wolf, D. A. and T. M. Gill. 2009. "Modeling Transition Rates Using Panel Current-Status Data: How Serious is the Bias?" *Demography* 46(2): 371–386.

Wolff, E. N. 1990. "Social Security Annuities and Transfers: Distributional and Tax Implications." In D.B. Papadimitriou and E. N. Wolff, eds. *Poverty and Prosperity in the USA in the Late Twentieth Century*. New York: St. Martin's Press.

Woolf, S. H. and P. Braveman. 2011. "Where Health Disparities Begin: The Role of Social and Economic Determinants—And Why Current Policies May Make Matters Worse." *Health Affairs* 30(10): 1852–1859. 10.1377/hlthaff.2011.0685

Zayatz, T. *Social Security Disability Insurance Program Worker Experience*. Social Security Administration, Office of the Chief Actuary. Actuarial Study No. 123. Baltimore, MD.

# About the Author

**Melissa Favreault** is a senior fellow in the Income and Benefits Policy Center at the Urban Institute, where her work focuses on the economic well-being and health status of older Americans and individuals with disabilities. She studies social insurance and social assistance programs and has written extensively about Medicaid, Medicare, Social Security, and Supplemental Security Income. She evaluates how well these programs serve Americans today and how various policy changes and ongoing economic and demographic trends could alter outcomes for future generations. Much of her research relies on dynamic microsimulation, distributional models that she develops to highlight how educational and economic advantages shape financial outcomes, disability trajectories, health care needs, and longevity. She has a special interest in the economic risks that people face over their lives. Favreault earned her BA in political science and Russian from Amherst College, and her MA and PhD in sociology from Cornell University.

## Statement of Independence

The Urban Institute strives to meet the highest standards of integrity and quality in its research and analyses and in the evidence-based policy recommendations offered by its researchers and experts. We believe that operating consistent with the values of independence, rigor, and transparency is essential to maintaining those standards. As an organization, the Urban Institute does not take positions on issues, but it does empower and support its experts in sharing their own evidence-based views and policy recommendations that have been shaped by scholarship. Funders do not determine our research findings or the insights and recommendations of our experts. Urban scholars and experts are expected to be objective and follow the evidence wherever it may lead.