The Distribution of Time in Retirement: Evidence From the Health and Retirement Survey

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ABSTRACT

This is the first study to investigate the distribution of retirement time. We apply hot-deck imputation to Health and Retirement Study data to construct a synthetic sample of people who lived natural human life spans to measure their duration of time between withdrawing from the labor force and death. Men are more likely than women to die without retiring and Blacks and women with low educational attainment have shorter retirements and spend larger shares of their retirement time needing assistance with one or more activities of daily living (ADLs). We also find defined benefit pensions offset the negative impact of male low socioeconomic status how much time is spent in retirement needing assistance with ADLs impaired. Some groups with shorter than average life spans cannot entirely compensate by retiring early. In the United States, access to retirement time is unequally distributed and may become more unequal as pension wealth and longevity inequalities increase.

This is the first study to identify inequality in retirement time—the duration of time between withdrawing from the labor force and death, the amount of time retirees spend in retirement sick, and the probability of dying while working and never retiring.

Retirement is a period after a lifetime of work when people exercise greater control over the pace and content of their time. This study investigates how the duration and quality of retirement time varies by socioeconomic status (SES) measured by educational attainment. We apply hot-deck imputation to the Health and Retirement Study (HRS) to construct a synthetic sample of people who lived natural human life spans. We investigate, for women and men, the associations between three dependent variables, the duration of retirement, the share of retirement time spent with limitations of activities of daily living (ADLs—walking, dressing, bathing, eating, getting out of bed, using the toilet) and the probability of dying without ever retiring, and four groups of independent variables: retirement plan coverage and type, race, educational attainment, (an indicator of socioeconomic status), and marital status. Retirees who are free of ADL limitations have more autonomy than people with ADL limitations. Therefore, we use the number of ADLs to describe how some people, though they are retired, have much less control over the pace and content of their time than do retirees with no disability or impairment.

Though it is well-known (see below for references and discussion) that SES is linked to morbidity and to retirement decisions, this study is the first to explore how differences in retirement age and longevity interact to determine the distribution of retirement duration. As inequalities in retirement security (Morrissey, 2016; Wolff, 2007) longevity and morbidity (Auerbach et al., 2017, wages and wealth increase (Morrissey, 2016) so may inequality in retirement time grow.

In advanced market economies government policy, trade union demands, and employer human resource management practices all play a role in permitting most workers to retire. There is considerable research on working time (Dudel, Gomez, Benavides, & Myrskyla, 2016; Dudel & Myrskyla, 2017) but none that we know of on the duration of retirement. This study contributes to the literature on inequality of outcomes in retirement. We answer a basic question important to the scholarship on work and aging that has never been explored, but the answer is fundamental to our understanding of the equity outcomes of the U.S. retirement system. We measure: who gets to be retired?

THE DURATION OF HEALTHY RETIREMENT TIME

People with lower SES have higher mortality and morbidity (Auerbach et al., 2017; Buckles, Hagemann, Malamud, Morrill, & Wozniak, 2016) and Blacks, independent of SES, become sick and die sooner than Whites (Geruso, 2012). In addition, minorities and lower income individuals are less likely to have adequate retirement resources (Even and Macpherson, 2007).

This study combines the two growing inequalities—longevity and secure retirement income—to add to the scholarship assessing the class, race, and gender correlates of life course and labor market outcomes (Fisher, Chaffe, & Sonnega, 2016; Radl, 2012). If people dying...
sooner could retire earlier than those with longer and healthier lives, retirement time could be distributed more equally.

We develop four hypotheses based on economic theory and previous research. Each hypothesis indicates how we anticipate one of the four independent variables (SES, gender, retirement plan type, and race) may be correlated with one or more of the dependent variables (the duration of retirement, the share of retirement time spent with limitations of ADLs, and the probability of dying without ever retiring). We then test these hypotheses by estimating econometric models.

This study does not project trends, but increases in inequalities in longevity and retirement income security could exacerbate inequalities in retirement time. Those with higher educational attainment and incomes have higher retirement account balances and coverage rates so they may be able to retire with adequate income (Munnell, Hou, Webb, & Li, 2017). Retirement time free of ADL limitations might become a privilege disproportionately enjoyed by those in the highest socioeconomic classes. This study assesses the correlates of three dependent variables: the distribution of retirement time and healthy—precisely the share free of ADL limitations—retirement time, and the probability of dying without retiring.

We refine the definition of retirement—which we conceptualize as a time when individuals have greater control over the pace and content of their time compared to a typical employee (Biggs, McGann, Bowman, and Kimberley, 2016). The self-employed and self-identified homemakers (up to age 65) are not considered retired because, though they may not have a direct supervisor, they sell or exchange their labor directly or indirectly to a market: the self-employed sell labor to clients, homemakers reproduce the labor capacity of the main earner (Folbre, 2008). And, since people in lower socioeconomic classes are more likely to have had jobs that impose more mental and physical stress and are more likely to have been in a subordinate position at work we expect those with low SES to experience forms of cumulative disadvantage that shape their health in old age. Thus, we propose a first hypothesis:

Hypothesis 1—Higher socioeconomic status is positively correlated with the length of retirement time, the share of retirement time spent free of ADL limitations, and lower chance of dying without retiring.

Gender, independent from SES, affects the distribution of work and home responsibilities. Paid work, compared to home responsibilities, is a male-delegated task, so men may be relatively discouraged from retiring, more likely to take on paid work as their responsibility, and thus are more likely to die on the job. Also men die, on average, sooner than women. Thus, we propose a second hypothesis.

Hypothesis 2—Men are at greater risk than women of dying without retiring.

Employers can sponsor defined benefit (DB) or 401(k) or other defined contribution (DC) retirement plans. DB entitlements are computed using a formula that considers salary and length of employment. In contrast, DC plans pay a lump sum equal to employee and employer contributions plus investment returns net of fees. DB plans are associated with greater retirement security than 401(k) or other DC plans because DB plans pay a lifetime annuity, do not allow people to withdraw money before retirement, earn higher returns, pay lower fees, and do not allow non-participation by eligible employees. DB plan participants retire about 2 years earlier than otherwise similar workers covered by DC plans or uncovered workers, reflecting wealth accrual patterns that incent early retirement (Frieberg and Webb, 2005). Since the retirement income of DC participants depends partially on returns from financial markets, they may respond to the considerable financial market risk they face by working longer. We refer to workers’ response to financial risk in their DC plans as "precautionary working." Therefore, we have formed a third hypothesis.

Hypothesis 3—Workers with DB plans have more retirement time, relatively more retirement time free of ADL limitations, and are more likely than those without a plan or those with a DC plan to retire.

Being Black may indicate cumulative disadvantages, beyond lower pay—poor childhoods, poor neighborhoods, and a lifetime of experiencing macro and micro aggression (Crystal and Shea, 1990)—that may independently affect retirement duration, healthy retirement time, and probability of not retiring. For example, race, independent of SES, is associated with access to health care, residence in healthy communities, and workplace protection from injury and illness, all factors that affect retirement timing, morbidity, and mortality. However, if Blacks retire sooner than Whites because of unobserved factors such as social norms—Radl (2012) discusses the flexibility of retirement norms—discrimination, or other industry and occupational factors, Blacks may be able to compensate for shorter age-50 life expectancies by retiring earlier. Thus, we propose a fourth hypothesis.

Hypothesis 4—Black men and women have relatively less healthy retirement time than Whites.

**METHODS**

The ideal population to examine the distributions of retirement durations and outcomes would be HRS participants from the time of their retirement until their eventual death. In perhaps 15 or 20 years researchers will be able to do so when more people in the HRS live normal human life spans and die. However, only about a third of those HRS participants who have retired have died and an HRS sample would be heavily censored, yielding misleading results about retirement durations, since the remaining two thirds of the sample are still retired and are living normal life spans.

**Creation of Synthetic Cohort**

As a sample containing individuals with normal life spans does not yet exist, we proceed with the next best solution by creating a synthetic cohort to represent the life course of people from age 53 until death using data from both the HRS and the Asset and Health Dynamics Among the Oldest Old Study (AHEAD) cohorts. The HRS is a nationally representative panel of older American households containing information on demographics, work history, retirement transitions, disability, and date of death. The first cohort, comprising individuals...
born 1931–1941 and their spouses of any age has been interviewed every 2 years since 1992, most recently in 2014. Individuals born in 1923 or earlier were added in 1993 (referred to as the AHEAD cohort) (More recent birth cohorts were added in 1998, 2004, and 2010, but do not form part of our sample).

Only people attached to the labor force can retire from work so we include respondents who ever worked at least 8 years. Only four percent of the sample, mainly women, reports they are homemakers and we classify them as “workers” before the age 65 because homemakers engage in reproducing some labor market capacity of their spouse (other assumptions did not change the results).

Following Andridge and Little (2010), Friedberg, Hou, Sun, Webb, Li (2014), Hund, Michaud, and Rohwedder (2014), and Levell, Roantree, and Shaw (2015) we link people in three HRS cohorts to impute full employment and disability histories from ages 53–57 until eventual death, up to 47 years later (the oldest person in our imputed sample died age 100 and was linked to other participants to create a history from age 53).

Hot-deck imputation fills in a “recipient” individual’s unobserved values with observed values from another “donor” individual with similar characteristics. We take recipient individuals from one cohort who are not observed across their entire life span from pre-retirement until death, and splice them together with donor individuals from other observed cohorts with similar characteristics. This creates a set of synthetic individuals for whom we have complete life histories from ages 53 to 57 until death.

We considered, but rejected a parametric approach using Markov chains. In a Markov process, transition probabilities depend on characteristics, such as age, education, and race, but not on past transitions. This assumption may be too restrictive when modeling retirement transitions—for example, some workers may retire early due to ill health and may be at elevated risk of disability or death, while for other workers, early retirement may have health protective effects. Our non-parametric approach allows us to capture these relationships.

The covariates, characteristics used to match recipient and donor individuals for hot-deck imputation (Rubin, 1987) are the following: race, age, gender, education rank, job years, ADL limitations, type of pension plan (DC only, DB, or none), and a binary variable of married/partnered or not. We identify DB coverage among AHEAD participants from pension income receipt and assume this birth cohort did not have DC coverage.

We first match each recipient to a donor who shares all seven characteristics. If a complete match is not found across all characteristics, we sequentially remove characteristics until each recipient individual has a matching donor (As the AHEAD mostly cohort retired prior to DC plans becoming widespread, our algorithm results in AHEAD participants being matched with HRS participants who had either a DB plan or no retirement plan coverage, conditional on such a match being available. The effects of DC plan coverage are identified from HRS participants who died prior to ages 75–79. We regard this approach as preferable to the alternative of reversing the order of splicing.).

The core sample to which additional information is appended are AHEAD respondents born 1919–1923 and, thus, aged 75–79 in 1998 and if they survived, aged 91–95 by 2014. We do not use the 1993 or 1995 data because, although, the HRS continues to re-interview participants who become institutionalized, it excluded those institutionalized at baseline so the population is not representative initially, although by 1998, most of those initially institutionalized have likely died.

We splice older AHEAD cohort members born 1903–1907 and thus aged 91–95 in 1998 (and who had all died by 2014) with matching characteristics creating a sample of individuals aged 75–79 to date of death. Then, we splice the younger HRS cohort respondents, born 1935–1939 and thus aged 53–57 in 1992 and who survived to be ages 75–79 in 2014 creating a sample of individuals aged 53–57 to date of death.

Finally, we add individuals ages 53–57 in 1992 but who died prior to attaining ages 75–79 to create a synthetic panel whose mortality from ages 53–57 to 75–79 is representative of the 1935–1939 birth cohort after applying HRS sample weights. This process ensures that we select participants who die prior to ages 75–79 whose education level is representative of early decades. The method we use to add this cohort is to randomly draw members of the HRS 1935–1939 birth cohort who died prior to ages 75–79 until the mortality rates for ages 53 to 79 and probability of survival to age 79 both match the predictions of life tables for the 1935–1939 birth cohort (Since the HRS oversamples minorities, we ensure the mortality rates match cohort life tables after the application of HRS sampling weights.). By construction, the mortality rates for ages 75–79 to 91–95 reflect the mortality rates of AHEAD participants born 1919–1923, and the mortality rates above ages 91–95 reflect those of AHEAD participants born 1903–1907. We use a bootstrapping technique to ensure robustness for our results, given that each round of hot-deck imputation can connect recipient individuals with a different set of donors, and we run the hot-deck imputation one hundred times and present those mean statistics and coefficients.

**DEPENDENT VARIABLES**

Retirement duration is computed using retirement and death ages. Death age is straightforward, computing retirement age is more complicated. Self-reports about retirement age are insufficient: many who self-report being retired work. To solve this problem that bedevils all researchers attempting to identify the age of retirement we use the composite variable “labor force status” created by RAND: a person is in the labor force if working full or part time, unemployed, or on temporary layoff (The RAND Corporation [the contractor that organizes the HRS data] created the single labor force variable because individuals report contradictory answers. In one section of the survey participants are asked whether they are fully, partly, or not retired and in another section they are asked whether they are currently working for pay. Some “retirees” report they are partly retired and report working for pay—so their status is ambiguous. In another section, participants can choose multiple responses when asked whether they are working, unemployed, temporarily laid off, disabled, retired, a homemaker, or other.). RAND codes people as “retired” if they are not working, not looking for a job, and mention retirement. We reclassify SSDI recipients as retired at age 66; SSDI recipients younger than their Social Security Full Retirement Age are subject to return-to-work programs and an expectation they attempt to work. The precise date of retirement is the date a participant withdraws from their last job and is not unemployed or on temporary layoff between the date they separated from the job and the date they self-declared they are retired (in these cases we impute a date of transition from unemployment or temporary layoff to retirement). Although retirement is not uncommon (Maestas, 2007), we classify workers as retired when they quit their last job. Participants are classified as disabled if they report...
experiencing difficulty performing one or more ADLs, and since participants are only asked about ADL limitations at the time of their interview and not the date of onset we assume the ADL started on the day of the interview.

INDEPENDENT VARIABLES
We analyze women and men separately using a binary variable—female or male (the HRS requires people to identify as male or female—or the surveyor does). The type of retirement plan affects the retirement decision so we use the plan type reported in the participant’s last job held before the time we classify a participant as retired. We classify workers as covered by a DB plan (regardless of whether they are also covered by a DC plan), covered only by a DC plan, or lacking retirement plan coverage. Although it might be preferable to focus on retirement plan coverage in the participant’s career job, this would often necessitate using responses to retrospective questions on plan type that are likely even more unreliable than responses to questions about plan type in the current job.

Race is identified as Black or non-Black.

Our sample contains 1,282 men and 1,528 women. We discard 21 men and 285 women who had not worked for pay for at least 8 years, leaving a final sample of 1,261 men and 1,243 women, of whom 14.2 and 18.4% were Black, reflecting the oversampling of Blacks in the HRS.

Because our sample is a synthetic cohort we carefully constructed our measure of SES by using a ranking of educational attainment that takes into account changes over time in markers of SES. We justify using educational attainment rather than income as a measure of SES because it is determined early in life before the onset of chronic disease that may affect labor market outcomes.

Since average educational attainment has increased dramatically across the three birth cohorts: those with less than a high school education have become a much smaller and select group—we control for improvements in educational attainment over time by sorting participants into three education terciles rather than using the convention of categorizing educational attainment by whether participants have completed high school, have some college-level education, or have a 4-year degree or more. Pre-retirement, the sizes of the terciles are equal. At older ages, we adjust their relative sizes to reflect the socioeconomic mortality gradient.

The methodology for reassigning respondents from different cohorts to one cohort-independent educational ranking is adapted from (Friedberg, Sun, Webb, & Li, 2014; Munnell, Hou, Webb, & Li, 2017).

We estimate the following ordered probit model:
\[
y = x\beta + e
\]
where \( y = 0 \) if \( y^* \) is \( \leq a_1 \), the dividing line between less than high school and high school education, \( y = 1 \) if \( a_1 < y^* \leq a_2 \), the dividing line between high school education and some college-level education, and \( x \) is a vector of correlates of educational attainment including gender, ethnicity, industry, occupation, family income decile, family size, residence in a Metropolitan Statistical Area. The correlates are used to determine the probability with which individuals at the margin are reassigned.

We first sort those with less than a high school education (including GED) in the lowest tercile, those with at most a high school education in the middle tercile, and those with some college or more in the top tercile. If more than 1/3 of individuals in each cohort have at least some college education, we reassign individuals from the top tercile to the middle to reduce the size of the top tercile to 1/3 of total. The probability of being selected and moved is proportional to the probability that someone with that individual’s characteristics would not have graduated from college (those least likely to have gone to college based on their characteristics are more likely to be reassigned). We then reassign individuals into each tercile, until each has an equal number of individuals. Among the AHEAD cohort, a larger share of individuals did not graduate high school, so more individuals are reassigned from the lowest to the middle tercile.

We use a person’s marital status at the date of retirement as their marital status.

Regression Analysis
To identify the relationships between retirement time and SES, we use multivariate analysis. We estimate a Tobit model of the determinants of the duration of retirement time, because retirement time is left-censored, that is, some people die without ever retiring. The dependent variable in the first regression is the number of years in retirement. The second regression estimates a Tobit model to explain variations in the second dependent variable—retirement spent with one or more ADLs, because the sample is both left- and right-censored—people cannot report less than zero or more than 100% of their time with ADLs (those who die without retiring are excluded from this model). Because of the censoring an ordinary least squares model would yield biased coefficient estimates.

We use a probit model (named for estimating probabilities) for whether a person died without retiring, in which the dependent variable equals 1 if the individual dies without retiring, and 0 otherwise.

The Tobit model used in the first regression with the dependent variable duration of retirement time is as follows:
\[
\begin{align*}
& \text{if } y^*_i \leq 0, y_i = 0 \\
& \text{if } y^*_i > 0, y_i = y^*_i \\
& y^*_i = x\beta + u_i, \quad u_i \sim (0, \sigma^2)
\end{align*}
\]
where \( y^*_i \) is a latent variable measuring the duration of retirement time and \( x \) is a vector of socioeconomic characteristics including education tercile, race, marital status, and retirement plan type.

The \( \beta \) coefficients in the Tobit model measure how the unobserved variable \( y \) changes with respect to the explanatory variable. We report two marginal effects—the change in the expected value among the sub-population for which \( y \) is not at a boundary and the change in the probability of not being left-censored (any value above 0).

Our Tobit model for the second regression with the dependent variable the share of retirement time is identical, except that if \( y^*_i \geq 1, y_i = 1 \).

For our third regression, the probit model, we report marginal effects—the change in the probability of dying without ever retiring. In all three models, we hold all other explanatory variables constant at their means when reporting marginal effects. When evaluating the impact of being in the top education tercile, we set the bottom tercile education dummy to zero, not to its mean, likewise for the bottom tercile.

We first estimated models for a pooled sample of men and women with gender interacted with the explanatory variables. We performed
a likelihood ratio test and rejected the null hypothesis that the coefficients on the other explanatory variables do not vary between men and women. Therefore, given the significant differences between men and women with regard to work and retirement, an expected result among these older cohorts, we report results for men and women separately.

**RESULTS**

First, we report the descriptive statistics and are confident our sample is sound because the means in the spliced sample conform to expectations about longevity and retirement timing (see Table 1 [results for women] and Table 2 [results for men] displaying means of the dependent and independent variables) as follows.

**Retirement duration**

As expected, the unconditional means of retirement and death ages differ by educational tercile, race, and retirement plan type and coverage in expected and statistically significant ways. The unconditional means for the first dependent variable, retirement duration, reveal large differences between men and women—women have 17.8 years of retirement and men have 13.8 years because women live 3.8 years longer and retire 0.2 years sooner than men.

Black women have 15.9 years of retirement time, and non-Black women, 18.2 years. Black women retire 0.8 years sooner than non-Black women, but not enough to compensate for dying 3.1 years earlier. Women in the top educational tercile have 19.7 years of retirement time, which is 2.2 more years than mid tercile women and 3.8 more years than women in the bottom education tercile, mostly because high-education women live 2.3 and 5.4 years longer than women in the mid and bottom terciles. Like men (see below), female DB plan participants have relatively longer lives; DB participants live until 83 and they retire at the relatively young age of 63.6. Again, in patterns similar to men’s, female DB participants have 19.4 retirement years while women without retirement plans have only 16.9 retirement years. Married or partnered women have 19.6 years of retirement time compared to divorced or separated women who have only 15.4 years. Married women live much longer than divorced or separated women—death ages are 82.3 and 78.6 respectively. Widowed women, like widowed men work longer; widowed women’s retirement age is 68.3.

Non-Black men have 13.9 years and Black men 12.8 years of retirement time—non-Black men retire more than 2 years later than Black men but live 3.3 more years. Men in the top and middle educational terciles have 14.3 years in retirement, while those at the bottom have 1.7 fewer years to 12.6 years in retirement. Men in the bottom education tercile retire 2.3 years sooner than men at the top but die 4 years younger. Male DB plan participants live long lives—average age of death is 80.1 and retire at the relatively young age of 63.2. DB men have the most retirement time of any group of men—16.9 years compared to men without retirement plans who have 10.4 retirement years. Married or partnered men have 15.6 years of retirement time compared to divorced or separated men who have 16.3 years, but married men retire much later than divorced or separated men. Widowed men work until they are 70.6 and die at the old age of 81.2 years, so that they have only 10.6 years of retirement.

**Shares of retirement time spent with one or more ADL limitations**

The second dependent variable—shares of retirement time spent with one or more ADL limitation also varies by gender,

### Table 1. Women's Average Retirement Age, Death Age, Retirement Duration, Share Spent With ADL Limitation, and Share not Having Any Retirement Time by Race, Education Tercile, Retirement Plan Type, and Marital Status

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>Retirement Age (Years)</th>
<th>Death Age (Years)</th>
<th>Dependent Variables</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Retirement Duration (Years)</td>
</tr>
<tr>
<td>All women</td>
<td>64.2</td>
<td>81.9</td>
<td>17.7</td>
</tr>
<tr>
<td>Education tercile</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>One (lowest)</td>
<td>63.1</td>
<td>79.0</td>
<td>15.9</td>
</tr>
<tr>
<td>Two</td>
<td>64.6</td>
<td>82.1</td>
<td>17.5</td>
</tr>
<tr>
<td>Three (highest)</td>
<td>64.7</td>
<td>84.4</td>
<td>19.7</td>
</tr>
<tr>
<td>Retirement plan type</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No plan</td>
<td>64.0</td>
<td>80.9</td>
<td>16.9</td>
</tr>
<tr>
<td>DB plan</td>
<td>63.6</td>
<td>83.0</td>
<td>19.4</td>
</tr>
<tr>
<td>DC plan only</td>
<td>65.1</td>
<td>82.9</td>
<td>17.8</td>
</tr>
<tr>
<td>Race</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Black</td>
<td>63.5</td>
<td>79.4</td>
<td>15.9</td>
</tr>
<tr>
<td>Non-Black</td>
<td>64.3</td>
<td>82.5</td>
<td>18.2</td>
</tr>
<tr>
<td>Marital status</td>
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<td></td>
</tr>
<tr>
<td>Married/partnered</td>
<td>62.7</td>
<td>82.3</td>
<td>19.6</td>
</tr>
<tr>
<td>Divorced/separated</td>
<td>63.2</td>
<td>78.6</td>
<td>15.4</td>
</tr>
<tr>
<td>Widowed</td>
<td>68.3</td>
<td>83.1</td>
<td>14.8</td>
</tr>
<tr>
<td>Never married</td>
<td>62.4</td>
<td>79.7</td>
<td>17.3</td>
</tr>
</tbody>
</table>

Note: ADL = activities of daily living; DB = defined benefit; HRS = Health and Retirement Study.

Source: Authors’ calculations using spliced sample. We use sample weights at the age of entry into the spliced sample, scaled such that the sum of weights is equal to that of the HRS wave 4.
educational attainment, race, and retirement plan type and coverage. Though women have more retirement time than men, they spend a larger proportion of their retirement time impaired; 26% compared to 23%. Notably, Black women spend 38% of their retirement time disabled, compared with 20% for men and women in the top tercile of educational attainment and 27% for men in the bottom tercile.

Again, DB participants compare favorably to those with DC coverage or no coverage. DB women spend 23% of their retirement time disabled compared with 29% for women with no coverage and 25% for DC-covered women. Men with DBs and DCs each spend an average 20% of their retirement time disabled compared with the 28% share for men without retirement plan coverage.

Dying without retiring

Differences for the third retirement outcome and third dependent variable—dying without retirement—also vary by gender, retirement plan type and coverage, race, and educational level. Nine percent of women and 14% of men die without ever retiring. Men face larger risks of dying without retiring not only because men retire 0.2 years later than women, but mainly because women live longer, on average, 3.8 more years.

There are fewer differentials in the risk of not retiring between categories of women than there are for men. Widowed women and women without a retirement plan face the highest risk of dying without retiring: 15% and 13%. And as is the case with men, women with DB plans face the lowest risk—4%. There are slight differences between Black and non-Black women—the risks are 10% and 9%. High education tercile women face a 7% risk while women in the mid and low terciles each face a 10% risk of dying without retiring.

Among men, as in the case with women, DB plan participants have the least risk, 6% die without retiring and men with no plan and widowed men have the highest risk of dying without retiring, 24% for each category. The probability of dying without retiring is about the same for Black and non-Black men, 14% and 15%. Seventeen percent of men in the bottom education tercile die without retiring compared to 14% in the top and 12% of men in the middle tercile, a reversal of the expected ordering reflecting differences in retirement ages.

In sum, Blacks retire earlier than non-Blacks but not so much earlier to make up for their earlier deaths. Higher educational attainment is associated with longer lives, which means more retirement time, healthy retirement time, and a higher probability of retiring before dying. The education gradient in longevity is consistent with published data and prior research (Arias, Heron, & Xu, 2016; Munnell, Hou, Webb, & Li, 2017).

Retirement plan design and coverage help explain retirement outcomes for men especially, though men and women without retirement plans have relatively worse outcomes. Divorced men die sooner than married men and retire later, perhaps because married men having higher educational attainment and SES status than divorced men—further research could explore the interaction of death age and retirement age by marital status. Married women also have longer retirement times due to living longer and retiring sooner than non-married women.

We now present multivariate analyses that estimate the relationships between the five independent variables and the three dependent variables.
Women's Retirement Time

Using a Tobit regression we find women's retirement experience varies greatly with educational attainment (our proxy for SES) and race. Focusing on non-censored observations, the two Tobit estimations of factors correlated with retirement time and retirement time with one or more ADL limitations suggest that Black women spend a greater share—6.1 percentage points more—of their retirement time with one or more ADL limitations than non-Black women. Women in the top education tercile had 1.7 more retirement years than those in the middle tercile, and spent a smaller share of their retirement with ADL limitations. Women in the bottom tercile of educational attainment spent a larger share of their retirement with ADL limitations, 2.9 percentage points, compared to women in the middle education tercile.

The Tobit results also suggest that for women, having a DB plan does not significantly affect the share of retirement time spent with ADL limitations or the probability of dying without retiring. However, the probit estimate of the probability of dying without retiring suggests that having no retirement plan raises the chance of dying without retiring by 6 percentage points. Being married or partnered is associated with 1.8 more years retirement time and a reduction in the share of retirement time with ADLs of 4.5 percentage points. Having a husband or partner may indicate a woman has more money and receives more care than if she were single (Table 3).

Men's Retirement Time

In contrast to women, men's retirement experience varies little with race and educational attainment. Only DB plan coverage, not having any retirement account and being married were correlated with the three retirement outcomes for men: retirement time, time spent with ADL limitations, and the chance of “dying in their boots.” Race had no statistically significant relationship with retirement outcomes—which was unexpected, perhaps because being Black is highly correlated with retirement plan coverage and having a DB plan. More exploration of the experience of Black and non-Black men in retirement is needed—the correlations between race, educational attainment, and retirement plan coverage may account for the racial disparities observed in the cross tabulations reported earlier.

Among non-censored observations, we find relative to a base case of having a DC plan, having a DB plan is associated with a 2.7-year increase in retirement time, and not having any retirement plan a 2.4-year decrease. Using a probit we find relative to the same base case, having a DB plan is associated with a 7.6 percentage point decrease in the probability that a man “dies in his boots,” and having no retirement plan is associated with an increase in that probability of 10.2 percentage points. Having no retirement plan is associated with a 27.7 percentage point increase in the share of retirement time spent with ADL limitations. Finally, being married is associated with 1.5 more years in retirement. A larger sample size is needed to model possible interactions between plan type and education level (Table 4).

In summary, we find support for hypothesis one for women only. Educational attainment is correlated with retirement duration. For men, having a secure retirement and being induced to retire, proxied by having a DB plan, is more highly correlated with retirement duration than race or educational attainment. The reason educational attainment is largely uncorrelated with men's retirement time is that men with higher levels of educational attainment both retire and die at older ages. We also find strong support for hypothesis one for women.

We find support for the second hypothesis that, relative to women and independent of educational attainment, men are discouraged from retiring because of gender role rigidities that assign earning wages and salaries to men, who are therefore more likely to delay retirement and die on the job.

Further, we find strong support for our third hypothesis only for men. The type of retirement plan men have affects their

### Table 3. Women's Retirement (Regression Results for Retirement Time, Share of Retirement Spent With ADLs, Share With Zero Retirement Time (Tobit and Probit Results)

<table>
<thead>
<tr>
<th></th>
<th>Retirement Time (Years)</th>
<th>Sick Share (Share of Retirement Time Spent With One or More ADLs) Marginal Effects (Tobit)</th>
<th>Share of Workers Who Died Without Retiring (Probit)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Marginal Effects (Tobit)</td>
<td>Non-censored Observations</td>
<td>Non-censored Observations</td>
</tr>
<tr>
<td>Education rank 1 (low)</td>
<td>−0.846 (−1.36)</td>
<td>−0.012 (−1.10)</td>
<td>0.029* (2.40)</td>
</tr>
<tr>
<td>Education rank 3 (high)</td>
<td>1.667* (2.70)</td>
<td>0.021* (2.82)</td>
<td>−0.030* (−2.70)</td>
</tr>
<tr>
<td>Married/partnered at</td>
<td>1.800* (2.79)</td>
<td>0.028* (2.40)</td>
<td>−0.045* (−3.32)</td>
</tr>
<tr>
<td>retirement</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Had defined benefit plan</td>
<td>1.272 (1.73)</td>
<td>0.016 (1.84)</td>
<td>−0.007 (−0.50)</td>
</tr>
<tr>
<td>at work</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Had no retirement plan</td>
<td>−0.078 (−1.22)</td>
<td>−0.018 (−1.12)</td>
<td>0.019 (1.57)</td>
</tr>
<tr>
<td>at work</td>
<td>−1.009 (−1.55)</td>
<td>−0.015 (−1.41)</td>
<td>0.061* (4.55)</td>
</tr>
</tbody>
</table>

Note. ADL = activities of daily living; HRS = Health and Retirement Study. We use sample weights at the age of entry into the spliced sample, scaled such that the sum of weights is equal to that of the HRS wave 4. The marginal effects are reported, Z-statistics are in parenthesis. Our base case is a non-Black single female with only DC retirement plan coverage and in the second tercile of educational attainment.

*Significance at the .05 level.

Source: Authors' calculations using spliced sample.
Table 4. Men’s Retirement (Regression Results for Retirement Time, Share of Retirement Spent With ADLs, Share With Zero Retirement Time (Tobit and Probit Results)

<table>
<thead>
<tr>
<th></th>
<th>Retirement Time (Years)</th>
<th>Sick Share (Share of Retirement Time Spent With One or More ADLs)</th>
<th>Share of Workers Who Died Without Retiring (Probit)</th>
</tr>
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<tr>
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<td>Marginal Effects (Tobit)</td>
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<tr>
<td></td>
<td>Non-censored</td>
<td>Non-censored</td>
<td>Non-censored</td>
</tr>
<tr>
<td></td>
<td>Observations</td>
<td>Observations</td>
<td>Observations</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Education rank 1 (low)</td>
<td>−0.801 (−1.52)</td>
<td>−0.022 (−1.46)</td>
<td>0.020 (1.76)</td>
</tr>
<tr>
<td>Education rank 3 (high)</td>
<td>−0.508 (−0.97)</td>
<td>−0.013 (−0.95)</td>
<td>−0.002 (−0.24)</td>
</tr>
<tr>
<td>Married/partnered at</td>
<td>1.413* (2.26)</td>
<td>0.042* (1.96)</td>
<td>−0.294 (−1.94)</td>
</tr>
<tr>
<td>retirement</td>
<td></td>
<td></td>
<td>−0.063* (−2.17)</td>
</tr>
<tr>
<td>Had defined benefit plan</td>
<td>2.688* (4.82)</td>
<td>0.066* (5.02)</td>
<td>−0.002 (0.06)</td>
</tr>
<tr>
<td>at work</td>
<td></td>
<td></td>
<td>0.002 (0.06)</td>
</tr>
<tr>
<td>Had no retirement plan</td>
<td>−2.415* (−4.46)</td>
<td>−0.068* (−4.06)</td>
<td>0.275* (2.26)</td>
</tr>
<tr>
<td>at work</td>
<td></td>
<td></td>
<td>0.063* (2.35)</td>
</tr>
<tr>
<td>Black</td>
<td>0.144 (0.21)</td>
<td>0.004 (0.24)</td>
<td>0.021 (1.54)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0.046 (1.66)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>−0.160 (−0.07)</td>
</tr>
</tbody>
</table>

Note. ADL = activities of daily living; HRS = Health and Retirement Study. We use sample weights at the age of entry into the spliced sample, scaled such that the sum of weights is equal to that of the HRS wave 4. The marginal effects are reported, Z-statistics are in parenthesis. Our base case is a non-Black single male with only DC retirement plan coverage and in the second tercile of educational attainment.

*pSignificance at the .05 level.

Source: Authors’ calculations using spliced sample.

Though the male mortality gradient is large—ranked from low to high educational attainment male death ages are 75.9; 78.4; 79.9 years—it is not surprising we find educational attainment is not significantly correlated with male retirement duration after controlling for retirement coverage and race. Male retirement ages also rise with educational attainment, yielding little variation in retirement time—retirement duration is equal for men in the middle and top education levels, even though men in the top education tercile live 1.5 years longer than men in the middle tercile. Mid-tercile men effectively, on average, compensate for their earlier deaths by retiring 1.5 years earlier than men with higher attainment.

Having a secure pension for life—proxied here by a DB plan—is significantly associated with a smaller chance that a man will die before retiring and with more retirement time, reflecting earlier retirement and greater longevity of men with DB plans than those without (see above discussion). A likely part of the explanation is that DB plans are more prevalent among unionized workforces and are often designed to allow blue-collar men a way to retire before becoming eligible for Social Security (Friedberg and Webb, 2005).

Therefore, plan design means that some members of groups whose working environments are injurious to their health can retire earlier to compensate for their shorter life span, equalizing the distribution of retirement time. The policy implications are that pension formulas could allow disadvantaged groups to retire earlier than others to accommodate their shorter life expectancy and higher morbidity, which was often the effect of union contracts in manufacturing, metal, and extractive industries.

**LIMITATIONS AND DIRECTIONS FOR RESEARCH**

Retirement time is a valued life stage and an equitable distribution of retirement time is an important social policy goal especially if retirement—having control over the pace and content of time at the end of
a lifetime of work—improves health. The first limitation of the study is the sample size that is too small to investigate interactive effects, for example, how Black men in particular may benefit from having a defined benefit pension plan or be covered by any type of retirement plan. Further research is needed on the effect of retirement on health and the class, race, and gender effects of life course experiences on the distribution of healthy or ADL-free retirement time (Brewer, 2002).

The second limitation of the sample size is not being able to sort out the relationship between education level and having a DB plan. Education and DB is likely correlated with access to retirement time that is free of ADL limitations. And, the factors that determine the distribution of retirement income may also affect access to healthy retirement time, something we can not investigate with this sample Wolff (2007), Economic Policy Institute (Morrissey, 2016; Sanzenbacher, Webb, Cosgrove, & Orlova, 2015) have documented the growth in retirement income inequality.

Participants enter our sample at age 55, on average. The third limitation of the study is that we can not take into account the non-negligible mortality from age 22 to 55 which also varies with SES. Based on Arias, Heron, and Xu (2016), we calculated, using 2012 period mortality rates, 8.5% of White men and 12.2 of Black men aged 22 die by age 55.

Next, we discuss how debates on the effect of retirement on health and productivity are informed by this study’s findings.

**Retirement’s Effect on Health**

If retirement time can improve health or slow down health deterioration, the ability to retire earlier rather than later for people in lower socioeconomic groups—especially women—could result in curbing or reversing the growing gap in longevity and morbidity by education level.

A meta-analysis revealed most studies found a positive effect of retirement on mental health, especially if the retirement was voluntary (Heide, Rijn, Robroek, Burdorf & Proper, 2013). The pathway from retirement to health could be that people who do not work for pay have more control over the pace and content of their time which is sometimes healthier (Schmitz, 2016). If retirement improves health, then retirement itself may have contributed to longevity improvements, working longer could reverse longevity gains.

Other researchers argue policymakers should promote delayed retirement because the age of onset of work—limiting disability has grown: the majority of Americans could work into their late 70s or 80s (Alstott, 2016). Others argue working longer could improve health because paid work provides social engagement and provides the salubrious effects of productive engagement, social contact, and camaraderie (Waddell & Burton, 2006).

However, since social engagement can be achieved without work, and that the most direct benefit of paid work to health is pay, the pathway linking working at older ages to health may be money. Income is associated with better health (Marmot, 2002): our question is what pathway works for what kinds of people.

Furthermore, even if some people are energized by paid work in old age, retirement time could become less equal if high SES older workers have jobs with characteristics associated with longevity and low SES workers do not. Older Black workers are more likely to have undesirable job characteristics (Landsbergis, Grywacz, & LaMontagne, 2014; Johnson, Mermin, & Resseler, 2011).

Working longer could lead to higher health costs and worse health, especially for workers in stressful or physically demanding occupations (Coe & Zamarro, 2011; Neuman, 2007). Older workers, especially, value workplace flexibility, and if managers of older workers do not respond to those preferences (Earl & Taylor, 2015) work may be detrimental to their health. New forms of work organization that emphasize intensity and efficiency may be especially stressful for older workers (Fleischmann, 2014; Kulik, Ryan, Harper and George, 2014). Older workers may face health debilitating “micro aggressions” because of age discrimination (Angus and Reeve, 2006; Rupp, Vodanovich, & Credé, 2006) and have little control over how they do their jobs, which would increase morbidity and shorten lives. Older workers are given limited opportunities for training, and promotion, which leads to low job satisfaction and mental stress (Roscigno, Mong, Byron, & Tester, 2007).

In sum, heavy work may lead to physical stress, while constant change in the workplace and age discrimination in all its forms leads to psychological stress that can be intolerable at a time of life when age-related health problems may be beginning to show their effects.

**Retirement’s Effect on Productivity**

This study suggests that if the distribution of retirement time becomes more unequal and more older people facing financial insecurity seek work or work, shame and despair caused by economic insecurity could worsen (Woolf, 2017). Job insecurity reduces feelings of control over one’s environment and opportunities for positive self-evaluation, which are emotional states that have deleterious health consequences. If retirement is viewed as a just reward for a lifetime of paid work, and retirement time is becoming more unequal, then foreshortening retirement could lead to feelings of failure and depression. The morale and productivity of the workforce may drop if less educated older people work longer because of financial insecurity. Scott-Marshall (2010) found that work-related insecurity negatively affected the health of all groups, but that the effects were greater at older ages and for those with visible minority status (McDonough, 2000).

Policy options to promote an equitable distribution of secure healthy retirement time include expanding retirement plan coverage, which supplements Social Security, including a universal workplace pension system, and encouraging or mandating retirement plans to have some DB features: continual contributions and annuities.

**CONCLUSION**

This study is the first to address inequality in retirement time. We created a unique sample to identify correlates of retirement duration and the disability status of those in retirement. We created a spliced sample to observe sample participants over natural human life spans. Since this approach limits the set of explanatory variables to the set of covariates used in the hot-deck imputation, the data should be reanalyzed when more HRS participants have lived natural human spans. More longitudinal research on the relationships between gender, work characteristics, health, and longevity is also needed.

Men are more likely than women to die while working. Blacks and women with low educational attainment have shorter retirements and spend larger shares of their retirements with impaired health. Men with DB retirement plan coverage—a proxy for retirement income security—have longer retirement time durations because they live longer and retire earlier.

If the inequality of longevity and morbidity by race and socioeconomic status grows with the inequality of retirement security,
non-disabled retirement time will become more unequally distributed. Certain groups who experience shorter life spans cannot entirely compensate by retiring early.

**SUPPLEMENTARY MATERIAL**

Supplementary data are available at *Work, Aging and Retirement* online.

**REFERENCES**


