Making it Work: Transitions From Physically Demanding Employment in Advanced Age

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Abstract

As workers age, they may find it increasingly difficult to sustain employment, particularly if their work is physically demanding. While some workers transition to less onerous roles in the later stage of their careers, others have few employment alternatives. This analysis explores the interaction between older adults' education and transitions from physically demanding jobs. Using longitudinal data from the Health and Retirement Study, I track changes in employment status and work conditions for the original cohort of interviewees until retirement. Descriptive social sequence analysis reveals that physical demands are most prevalent in the careers of older men and women without a college education. Transitions to less demanding roles feature most clearly in the career sequences of the most educated workers. Using regression analysis, however, I find that workers in physically demanding jobs are no less likely to be employed than their similarly educated peers in less demanding roles. Further, for workers with similar job demands, employment probabilities are comparable across education levels. Overall, my findings suggest that educational attainment can explain differences in the demands older workers face, but does not affect the probability of continued employment in the pre-retirement years.

Making it Work: Transitions from Physically Demanding Employment in Advanced Age

For over three decades the U.S. labor force has been aging, fueled by decreases in fertility, increases in life expectancy, and the maturation of the baby boom generation. Recent projections affirm that this trend is likely to continue: In 2024 the median age of the labor force will climb to 42.4, compared with 40.3 just twenty years prior, and the number of workers over the age of 55 will reach 40.6 million, representing 25 percent of the labor force (Toossi, 2015). Older workers bring a wealth of knowledge and experience to the workplace, but an aging workforce also presents a unique set of challenges.

One such challenge comes from the process of aging itself. Though all workers face deteriorations in health as they age, not all are able to shift into less physically demanding roles. In this analysis, I describe the employment transitions of older workers in physically demanding jobs using data from the Health and Retirement Study (HRS)[1]. In the first part of my analysis, I employ sequence analysis techniques to describe employment transitions in the years leading up to retirement, separately by gender and educational attainment. This analysis contributes to the prior literature by informing whether the transition from physically demanding employment occurs gradually in the early onset of difficulty, or rather abruptly, after prolonged exposure leaves a worker unable to perform her duties. Descriptive sequence index plots suggest that it is not uncommon for the physicality of work to persist in the later stages of a career. Further, there is significant heterogeneity among education groups; for both men and women, the physical demands of employment decrease with a worker's level of education. Transitions to less onerous roles are also far less common for workers facing physical demands relative to their higher-educated peers.

In the second part of the paper, I estimate the likelihood that older adult workers sustain employment, given the physicality of their job and their level of education. Prior work shows that physical demands on the job pose a significant challenge to late life careers (McLaughlin & Neumark, 2017). I probe these findings by comparing the likelihood of employment for workers who have the same level of education but face different demands on the job, and for workers of different education levels who all report physical challenges. Though the odds of remaining employed are generally lowest for those in physically demanding jobs, employment probabilities are not statistically distinguishable across levels of education. Taken together, my results suggest that though education is correlated with physical demands at work, it is not predictive of continued employment in the later stages of a worker's career.

Prior literature

The physical demands of employment impact a worker's health and happiness. As explained by Muurinen and LeGrand (1985), people are endowed with three forms of capital: health, human,

[1] Health and Retirement Study, RAND HRS Longitudinal File 2016 (V1) public use dataset. Produced and distributed by the University of Michigan with funding from the National Institute on Aging (grant number NIA U01AG009740). Ann Arbor, MI, (2019).

and physical or financial (i.e. assets). At birth, levels of health capital are relatively comparable across individuals, but biological processes, work, and consumption affect the rate of health decline. Muurinen and LeGrand (1985) theorize that workers who are poor in human and financial capital rely more heavily on their health capital. Consistent with this theory, Case and Deaton (2005) find that manual workers report lower levels of health and experience more rapid deterioration than non-manual workers; these findings persist throughout workers' careers, despite the fact self-selection may inflate the health status of those who remain employed in physically demanding jobs. Hayward et al. (1989) also notes that though white collar clerical workers and blue collar workers both retire late in life and exhibit high levels of morbidity, the latter generally lack health and disability insurance. As a result, blue collar workers are more likely to remain in the industry until poor health demands a departure, resulting in higher rates of mortality and disability. These effects also compound over the life course. Nicholas, Done, and Baum (2018) find that workers with greater exposure to physically demanding work over their careers have a higher probability of claiming Social Security Disability Insurance (SSDI).

Given that health deteriorates with age, federal legislation encourages employers to grant workers with disabilities greater flexibility and accommodation in the workplace. Research indicates that advances in physical limitations have markedly slowed in recent years (Freedman, Spillman & Andreski, 2013), and the prevalence of chronic disease like obesity and arthritis have continued to rise (Hung, Ross, Boockvar & Siu, 2012). In 2008, the Americans with Disabilities Act Amendments Act (ADAAA) reaffirmed commitments to disabled Americans in the workplace, calling upon employers to make reasonable accommodations. These flexibilities also extend to workers who do not meet the Social Security Administration (SSA) criteria for disability; in fact, an analysis of the Current Population Survey Disability Supplement shows that nearly 95 percent of workers who requested an accommodation in 2012 did not have a qualified disability (Von Schrader, Xu & Bruyère, 2014). Firms that successfully adapt to the needs of their aging workforce exhibit increased productivity, retention, and company morale (Solovieva, Dowler & Walls, 2011; Silverstein, 2008).

Unfortunately, physically demanding industries are often limited in their ability to accommodate workers. Johnson, Mermin, and Resseger (2007) find evidence that older workers looking to scale back hours or responsibilities transition to a different industry. For example, less than 40 percent of older adults find a subsequent job in manufacturing. The mining and construction sectors remain notable exceptions, where 63 percent of workers remain in the industry following a job change (Johnson et al., 2007). These trends indicate that aging workers in low wage, low skill positions may face a choice: work and risk injury or leave the industry and risk unemployment. In relation to retirement, Glickman and Hermes (2015) find that older workers in blue collar jobs such as construction, farming, and operations are 55 percent more likely to claim retirement benefits before the full retirement age. Notably, the risk of separating from a physically demanding job is especially pronounced among workers affected by the recent increase in the full retirement age (McLaughlin and Neumark, 2017). Despite the shift toward computing and technology sectors, work-related physical demands are projected to increase

modestly through 2026, led by growth in the personal care, home health, and construction workforce (Cutler et al., 2019). Today, among Americans 65 and older, 17 percent are employed in blue collar industries (Mermin et al., 2008).

At the same time, recent scholarship has detected a shift toward less formal employment arrangements that stands to exacerbate the employment conditions facing older, low-skilled workers. Thelen (2019) cautions that if employers continue to skirt the standard employment contract, we will see the rise of an American precariat: a class of workers who contend with chronic unemployment and lack job benefits and security. McNair, Flynn, and Dutton (2007) note that older workers in particular face an increased risk of serving as a contingent workforce. In addition, Munnell et al. (2019) find that the majority of non-traditional jobs held by older workers are done so consistently, rather than as a bridge to retirement. Generally, employment is more precarious among blue collar workers because they receive relatively little training, making novice and senior workers more interchangeable (Hayward et al., 1989).

A worker's educational attainment also affects job transitions and career trajectories. Johnson et al. (2007) find that among older adults employed in 1992, more than one-third left their place of employment involuntarily by 2006 as the result of business closures, health complications, and layoffs. The authors note, however, that workers without a high school diploma were at increased risk, with 48 percent reporting involuntary separations from work, relative to 31 percent of college graduates. In the U.S., there is also a strong socioeconomic gradient in health and disability. Looking specifically at knee pain, Cutler et al. (2019) find that the physical demands of work and the prevalence of obesity largely explain why less educated people report more knee pain, despite few differences in clinical evaluations. Though education levels are rising among today's older adult population, nearly 1 in 6 full time workers in their mid-fifties did not graduate from high school (Johnson et al., 2007).

Research Design

Data

This analysis leverages publicly available data from the Health and Retirement Study (HRS). Congress called for a nationally representative survey to better understand issues of health and retirement among the aged in 1990, and the HRS remains the most comprehensive assessment of Americans over the age of 50. The HRS is sponsored by the National Institute on Aging (grant number NIA U01AG009740) and is conducted by the University of Michigan. This biennial panel survey captures a wealth of information related to health status, health care services, employment, income, and family dynamics. The core sample of nearly 10,000 adults born between 1931 and 1941 was first interviewed in 1992, and the survey has continued to evolve over time. In 2016 the 'late baby-boomers' (born 1960 through 1965) were added to the fold. Approximately 20,000 telephonic interviews are conducted in each wave. Questions are asked of individuals and households, and exit interviews record circumstances at the end of life.

The longitudinal nature of the HRS allows me to track individuals' work experiences over time. A comprehensive set of employment data, including an abbreviated job history, is

taken during the first wave. With each new interview, participants report changes in their employment status during the intervening years. This paper leverages the RAND HRS Longitudinal File[2], a user-friendly dataset constructed from the HRS core surveys. The most recent release at the time of writing (V1 2016) compiles information from 13 waves of the HRS, spanning calendar year 1992 to 2016. The following key variables were extracted from the RAND HRS Longitudinal File:

- *Cohort*: An individual's cohort can be defined on the basis of their birth year or the sample for which they were recruited. For this analysis, eligible members of the first HRS cohort who responded in 1992 are identified using a comprehensive eligibility variable.
- *Retirement*: Using labor force status, I identify the wave in which the respondent first mentions full retirement. Because positions held in retirement are likely to differ from those in the worker's primary career, retirement is treated as an absorbing state.
- *Death*: Using interview status, I create an indicator for the wave in which the respondent dies (if applicable). This information is derived from interviewers' contact with the respondent (University of Michigan Institute for Social Research, 2019).
- *Physical demands of employment*: For each job recorded in the HRS, respondents indicate whether the following statements are true all/almost all of the time, most of the time, some of the time, or none/almost none of the time: My job requires lots of physical effort; my job requires lifting heavy loads; and my job requires stooping, kneeling, or crouching. These data are not collected for proxy interviews or during periods of unemployment, disability, or labor force withdrawal.
- *Education*: Five categories are generated using a respondent's completed years of education and whether they report having a high school or college degree: less than high school, passed the General Educational Development (GED) test, high school graduate, some college[3], and college and above. I treat GED and high school as equivalent.

I make several modifications to the data. First, I retain the initial cohort of the HRS sample interviewed in 1992. Respondents are aged 50 to 62 at the first interview and 74 to 86 in 2016, which allows me to capture the majority of their late careers. Further, by limiting the number of birth cohorts, I ensure that the descriptive social sequence analysis reflects changes in the physicality of work across waves, rather than changes in the age composition of workers. Because physical demands of employment are only relevant to (and thus asked of) the employed, the analysis sample contains respondents working for pay in the initial interview, who constitute two-thirds of the core HRS sample. Non-response presents a challenge for all longitudinal surveys. The employment likelihood analysis includes all workers from the 1992 cohort, but the descriptive sequence analysis is limited to those with a complete interview history leading up to

[2] The RAND HRS Longitudinal File is an easy-to-use dataset based on the HRS core data. This file was developed at RAND with funding from the National Institute on Aging and the Social Security Administration.

[3] Some college refers to a high school diploma or GED and (1) over 12 years of education or (2) a degree that is less than a Bachelors of Arts (RAND Center for the Study of Aging, 2019).

retirement. Additional details are provided in the sections below. The HRS is a nationally representative sample; these analyses use sampling weights provided by RAND.

Sequence Analysis

I start by describing how the physicality of employment changes in the later stage of older workers' careers. Social sequence analysis theory upholds that because social actors are interconnected, their actions and experiences unfold in regular sequence patterns (Cornwell, 2015). In this way, sequence description techniques and visualization aides are capable of distilling thousands of individual employment narratives into a unified story.

The primary data visualization technique used in this analysis is a sequence index plot, which illustrates the timing and overall pattern of career events. I first show the career trajectory of older adults, which is comprised of several elements: Working for pay, including part-time, full-time, and partial retirement; unemployed; not in the labor force, which includes disability; retired; and deceased. I then display the physical demands of workers, noting changes in the four degrees of physicality: all/almost all, most, some, none/almost none of the time. Because these data are only available when the respondent is working, periods of unemployment or labor force exit are coded as 'NA'. In all sequence index plots, the number of individuals is listed on the *y*-axis; each individual's sequence stacks on top of the other. In this analysis, there are 13 positions within an individual sequence, reflecting the 13 survey waves that span 26 years (on the *x*-axis). Sequence elements are distinguished using the color scheme outlined in the legends. Because respondents cycle through stages of employment and job demands, sequences may contain repeat elements. The relative frequency of each sequence is conveyed by the width of the horizontal bands. The main limitation of this approach is that a given plot can fully display approximately 400 observations (Brzinsky-Fay, 2014). To minimize the distortion due to over plotting, I stratify the sample by sex and educational attainment and group similar individual sequences together.

The second visual aid, transition plots, display probabilities for each pair of adjacent elements. Though dimensions of time or observation are no longer distinguished, transition plots can identify the most common category changes within a sequence. In this analysis, each cell of the five-by-five transition graph reports the probability that a given element in wave (t) preceded an element in wave ($t+2$); these elements are plotted on the y-axis and x-axis, respectively. A larger circle indicates a higher probability (i.e. a more typical transition). In this analysis, the diagonal element has been removed from the graph to underscore the most likely transitions in physical demands.

Missing sequence elements can be attributed to survey non-response. Though there is no universal remedy for gaps in the data, there are several proposed solutions for social sequence analysis, including imputation, deletion, and designation (Cornwell, 2015). In this analysis, I include only those respondents who replied to all waves of the survey prior to their first mention of full retirement or their death. Owing to the relatively high response rate of the HRS survey, I retain three-quarters of all respondents working in the first wave of the survey (4,967 individuals). Descriptive statistics of the sequence analysis sample are presented in the first two columns of **Table 1**. At the time of their first interview, the average respondent is 55 years of age

and reports being in good health. Every 2 in 5 respondents report that their job requires a lot of physical effort.

Table 1: Descriptive statistics of analytic samples at first interview (1992)

	Sequence Analysis		Regression Analysis	
	Men	Women	Men	Women
Age	55.51	55.43	57.67	57.59
High school	0.36	0.42	0.36	0.43
Some college	0.20	0.23	0.21	0.22
College and above	0.25	0.19	0.24	0.18
Very good heath	0.33	0.35	0.35	0.37
Good heath	0.29	0.27	0.31	0.30
Fair health	0.09	0.10	0.11	0.10
Poor heath	0.03	0.02	0.02	0.02
Partnered	0.03	0.01	0.03	0.02
Divorced	0.09	0.28	0.10	0.32
Single	0.02	0.04	0.02	0.04
Black	0.08	0.12	0.09	0.13
Other race	0.02	0.02	0.03	0.03
Hispanic ethnicity	0.05	0.04	0.06	0.05
Working part time	0.06	0.26	0.04	0.21
Partially retired	0.05	0.05	0.03	0.03
Lots of physical work	0.40	0.39	0.38	0.37
Lifting heavy loads	0.19	0.13	0.17	0.13
Stooping, kneeling, or crouching	0.29	0.24	0.27	0.22
N	2,624	2,343	2,999	3,013

Source: HRS cohort that reported working for pay during the first interview. The second and third columns reflect the observations used in the social sequence analysis, separately by sex. The social sequence sample is restricted to interviewees that responded to all survey waves prior to retirement or death. The fourth and fifth columns reflect the observations used in the regression analysis, where this restriction is no longer imposed. Physical demands of employment are recoded as a binary measure; the table shows the share of respondents that report the physical demand all/almost all or most of the time in their first interview. Reference categories are omitted.

Regression Analysis

I then estimate a series of logit regressions to explore the interaction between physical demands at work and the likelihood of continued employment, separately for men and women at each of the four education levels. This allows me to compare the labor market transitions experienced by

workers who have the same level of education but face different demands on the job, as well as workers across education levels who all report physical challenges.

For this analysis, I relax the restriction imposed on the descriptive sample and include all respondents who report working in the initial interview, even those with an incomplete survey history. As shown in **Table 1**, this sample is larger and relatively older but otherwise comparable on observable domains, including the prevalence of physical demands at work. From this sample, I create two subsamples based on employment status in the previous wave: employed (including wage or salary and self-employment) and not working. For each subsample, I estimate logit models for employment status in the current wave. More specifically, the probability that individual *i* in cohort *c* is working at time *t* will be modelled as a function of the physical demands of the job (PD), a worker's level of education (EDU), and individual characteristics (Z), which include the respondent's age and its square, race, marital status, and self-reported health.

$$Y = \alpha + \beta EDU_{ict} \cdot PD_{ict} + \gamma EDU_{ict} + \mu PD_{ict} + \delta Z_{ict}$$

The above logit model allows for differential effects of physical demands on those with less than a high school education, high school degree (including GED), and some college, all relative to those with a college degree and above. I then calculate predicted probabilities from the model and conduct a pairwise comparison test to determine which combinations of physical demands and educational attainment are statistically significantly different from one another.

This approach hinges on a series of assumptions. Employment decisions are complex. To the extent that this model specification does not capture the necessary underlying factors, omitted variables may bias the results. Physical demands in the workplace may also take many forms. To that end, I test whether the results are robust across the three HRS measures of physicality. This analysis also does not distinguish between types of employment (e.g. part-, full-time, and self-employment); rather, my focus is on whether the physicality of a job makes it difficult for workers to remain employed in any capacity. To ensure these results reflect the economy in a steady state, I conduct a sensitivity check using only the waves before the Great Recession (1992-2006) and compare this to the post-recession period (2010-2016) and the full sample.

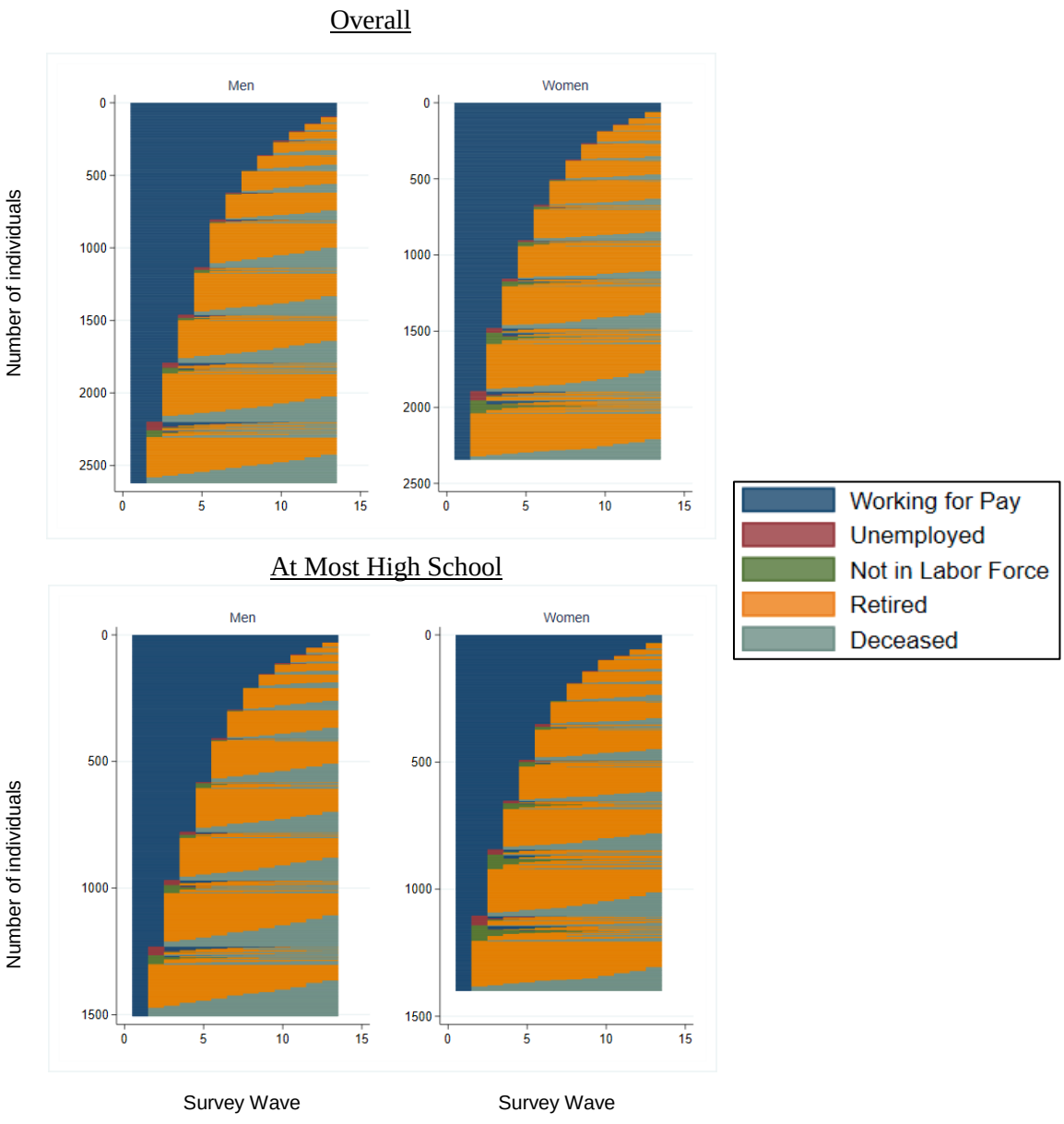
Results

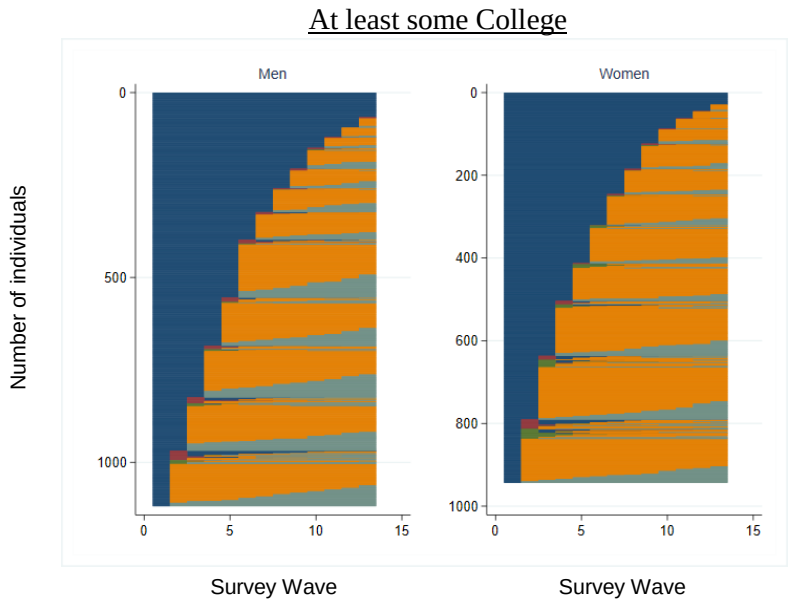
Descriptive Analysis of Transitions from Physically Demanding Employment

I use sequence index plots to display changes in the physical demands of employment as workers in the U.S. approach retirement. If workers hold a series of jobs, each with progressively lower physical scores, it suggests older adults may be adapting their employment conditions to the health deteriorations associated with aging. We may expect this pattern to be particularly marked among workers who report high levels of physicality in the initial waves. Though differences in age may obscure these effects, using a single interview cohort holds the sample constant, ensuring that workers are never more than 12 years apart in a given wave and that the age distribution does not change over time.

Figure 1 shows the unique employment sequences of male and female workers, among those employed in their first HRS interview. Overall, the likelihood of working decreases over time, and few respondents work for all 13 waves (26 years) covered by the survey. For many, retirement constitutes the largest share of the transition sequence, with relatively short and infrequent spells of unemployment or labor force withdrawal. As interviewees age into later survey waves, death becomes increasingly likely. When these data are stratified by educational attainment, it becomes clear that men with at least some college experience sustain longer work-lives than those with no more than a high school degree. Among the years when these men are not working for pay, the sequence index plots show relatively fewer retirement years and higher incidence of mortality for workers in the lower education groups. Though differences in the time spent working for pay are less stark for HRS women of different education levels, retirement still features more prominently in the sequences of college-educated workers.

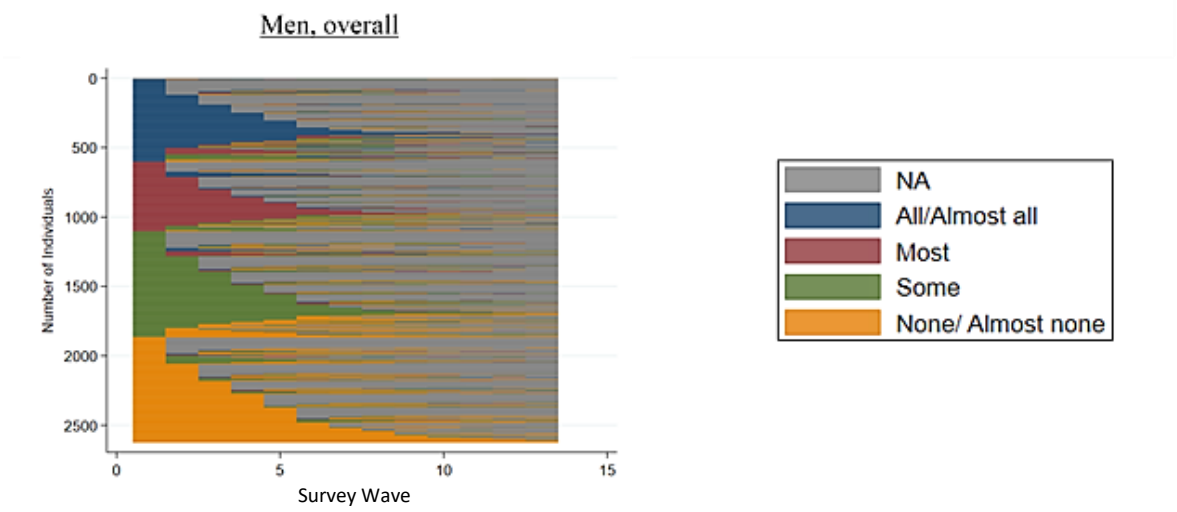
Figure 1: Late-life Career Sequence Index Plot, HRS Respondents, by sex and level of education

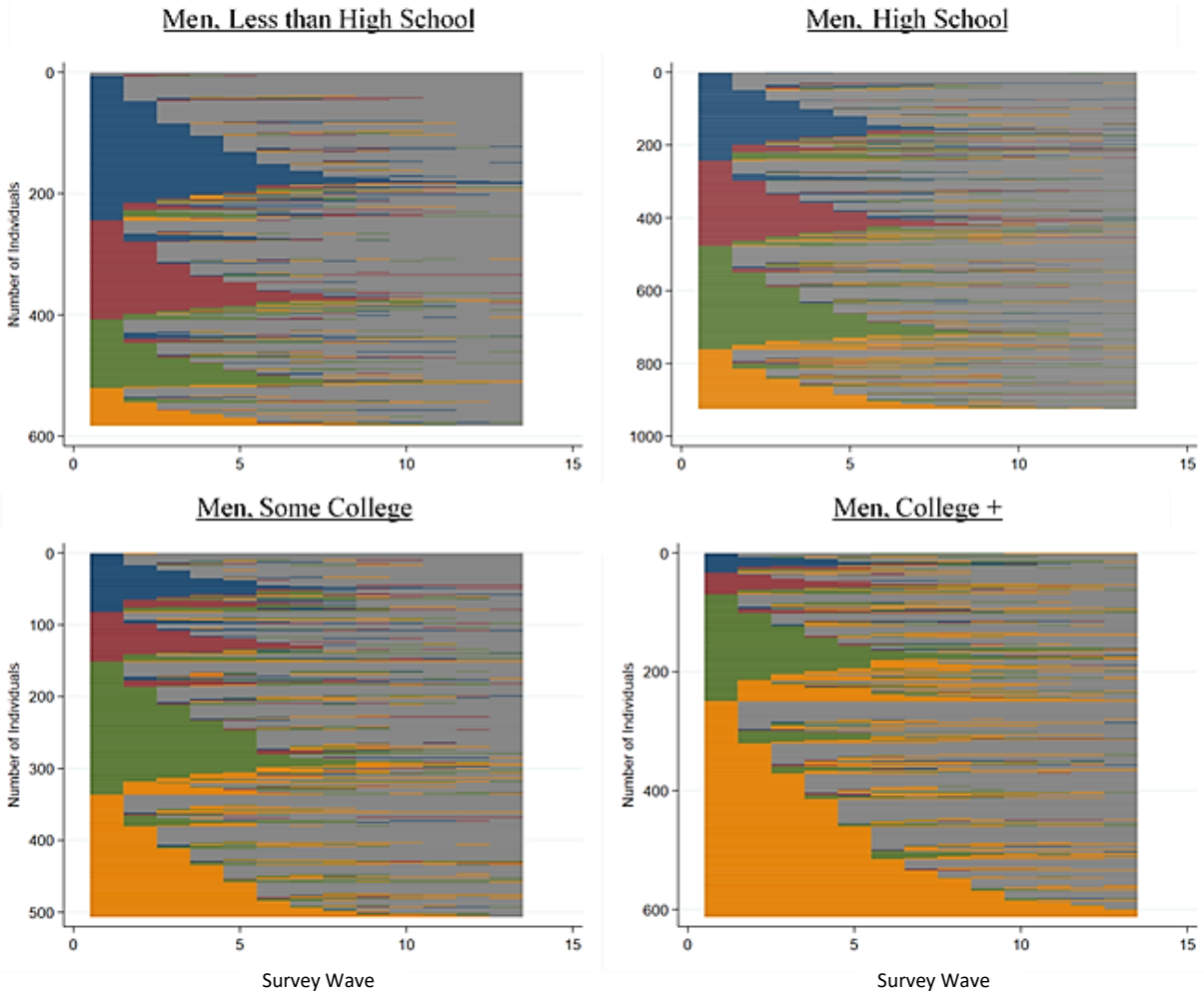




The later years spent working for pay vary in their physical intensity. Though it becomes less likely with age, it is not uncommon for HRS men to report that their job requires physical effort all, almost all, or most of the time (**Figure 2**). Beginning in the first survey wave, physically demanding work features most prominently in the careers of workers who do not attend college. The differences between the lowest and highest levels of education are particularly striking; while the modal response for workers with less than a high school degree is all or almost all physically demanding tasks, the majority of workers with a college degree report none. Transitions among these physical demands are also more common for workers in the higher education categories. For example, spells of employment where physical demands are required some of the time are more often followed by jobs with (almost) none among the college-educated. This suggests that not all workers are able to find employment that matches their physical capacity.

Figure 2: Sequence Index Plot, Lots of Physical effort, Male HRS Respondents by level of education



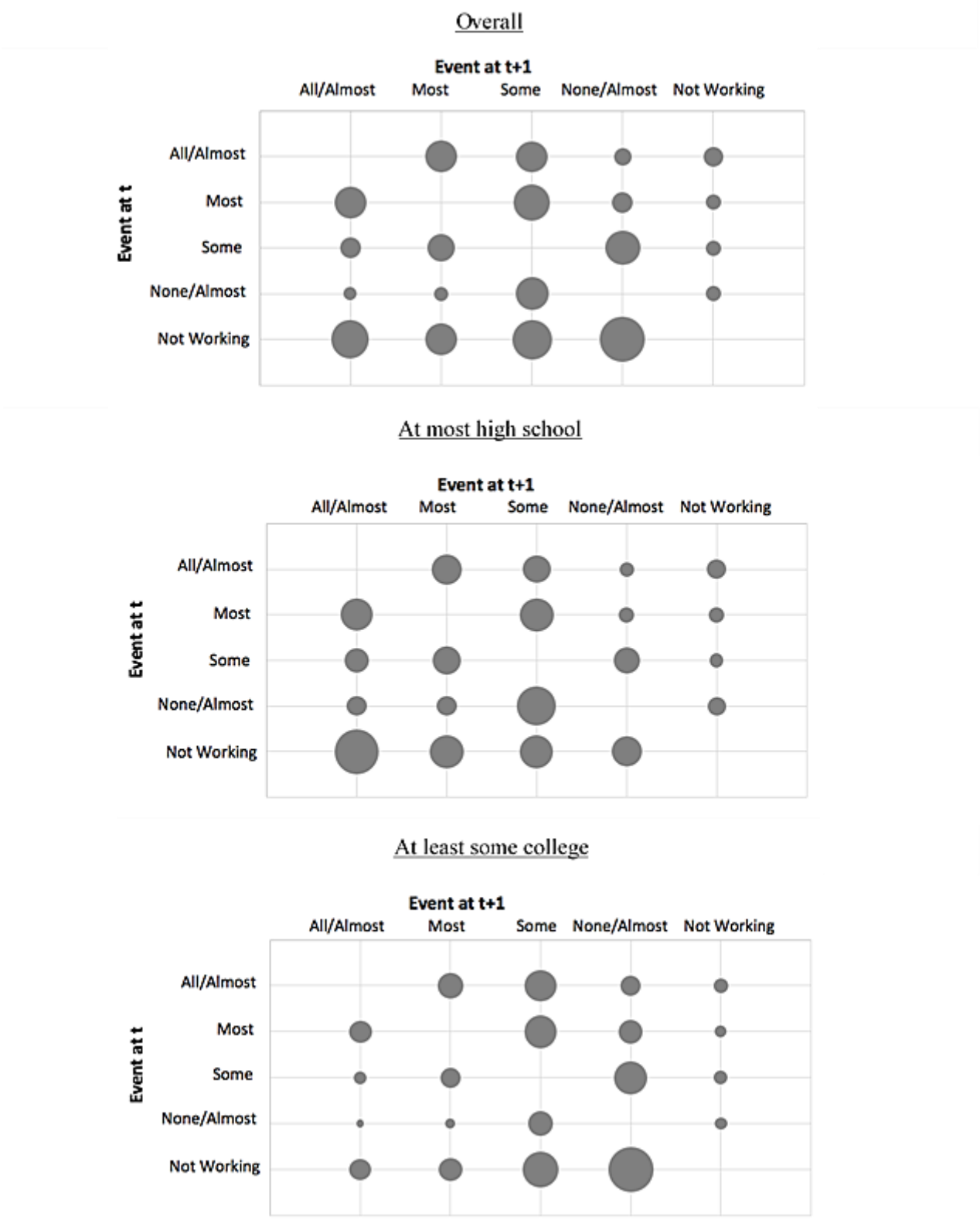


The transition plots in **Figure 3** underscore this educational gradient. Among male workers with some college education, the most likely employment transition is one that lowers their physical burden. Those who perform physical tasks most of time in period *t*, for example, have the greatest probability of transitioning to a job with only some demands in *t+2*. However, among men with at most a high school degree, an increase in physicality is just as likely. For workers in the lower education categories who face physical tasks on most days, subsequent jobs are equally likely to be more challenging (all/almost all) than less so (some). This trend is most pronounced among jobs that break an unemployment spell; in fact, workers who do not attend college are likely to accept a position in the highest physical demands category.

Though women are less likely than men to be in occupations that require physical tasks overall, the physical demands they face at work are also patterned by education (**Figure A1**). Physical tasks feature most prominently in the careers of women with less than a high school education, a near mirror image of their male peers. Women with a high school degree, in contrast, resemble the college-educated. Transitions among the physicality categories are fairly common for all education levels, and relatively more so than for men. Among the types of

employment transitions, an increase in physical demands is most likely among women who do not attend college, though declines are more visible overall than among HRS men (**Figure A2**).

Figure 3: Probability of Transition between Jobs with Lots of Physical Effort for HRS Men, by Level of Education



The HRS also asks respondents whether their job requires lifting heavy loads or stooping, kneeling, and crouching. Social sequence plots for physicality as defined by these alternate measures, separately by sex, are presented in Appendix **Figures A3** and **A4**. These findings are qualitatively similar to the above, which captures HRS responses to 'lots of physical effort,' with two exceptions. First, jobs that involve lifting heavy loads are less common, particularly among women, though these tasks are still more prevalent in the careers of workers who do not attend college. Second, the sequence index plots for lifting heavy loads and stooping show more frequent transitions from the 'some' to the 'none/almost none' category, which transcend the skill divide to a greater extent than that shown in the comprehensive physical effort measure.

Labor Market Transitions and Physical Demands of Employment

Having concluded that employment transitions vary with the physical nature of the job, and that workers with less education generally face more physical demands, I use regression models to quantify this interaction. Results from the logit model are shown in Appendix **Table A1**.

For ease of interpretation, **Table 2** reports the predicted probability that a respondent is employed in the current wave, given their level of education and the physical demands of their job in the prior wave. Among male workers with less than a high school degree, for example, the predicted probability of continued employment is lower for those in physically demanding jobs (79.2 percent versus 78.2 percent). A pairwise comparison test reveals that this difference, and all those displayed, are not statistically significant. I conclude that for a given level of education, workers with a history of physical demands are no less likely to find employment than those in less demanding roles.

Table 2: Predicted probability of work and physical effort, by sex and education

	No Physical Demands	Physical Demands	Pairwise comparison
Men			
Less than high school	0.792 (0.77, 0.82)	0.782 (0.76, 0.80)	-0.009 [0.524]
High school	0.775 (0.76, 0.79)	0.770 (0.75, 0.79)	-0.005 [0.713]
Some college	0.786 (0.77, 0.81)	0.788 (0.76, 0.82)	0.002 [0.912]
College +	0.821 (0.80, 0.84)	0.797 (0.75, 0.84)	-0.024 [0.324]
Women			
Less than high school	0.778 (0.75, 0.81)	0.790 (0.77, 0.81)	0.013 [0.478]
High school	0.784 (0.77, 0.80)	0.756 (0.74, 0.78)	-0.028 [0.027]
Some college	0.781 (0.76, 0.75)	0.783 (0.75, 0.81)	0.002 [0.903]
College +	0.766 (0.75, 0.72)	0.756 (0.72, 0.79)	-0.010 [0.650]

Source: HRS cohort that reported working for pay. Estimates are predicted probabilities from interaction terms in a logit regression, where the outcome is working for pay. Confidence intervals are reported in parenthesis. Contrast estimates from a pairwise comparison of the predicted probabilities are shown with unadjusted p-values in brackets. N=12050 for men; N=12391 for women.

For women, employment probabilities are not as clearly patterned by education or physical demands. As shown in the latter half of **Table 2**, physically demanding jobs are associated with a higher likelihood of continued employment for women with less than a high school degree and some college experience, though the difference is small in magnitude (1.3 percentage points and 0.2 percentage points, respectively). Also in contrast to men, the probability of employment tends to decrease with education for women in both physical and non-physical jobs. Nevertheless, the pairwise coefficient tests comparing probabilities across job demands and education categories show that these differences are not statistically meaningful.

I conduct two robustness tests. First, I generate employment probabilities using the two other HRS measures of physical demands: lifting heavy loads and stooping. As shown in Appendix **Tables A2** and **A3,** the differences between workers with a history of physical and non-physical jobs are small and statistically indistinguishable for both measures. Second, I test whether the estimates are robust to the employment effects of the Great Recession. Under ideal circumstances, my analysis would capture the economy in a steady state. Thus, I estimate logit regressions separately for the pre-recession (1992-2006) and post-recession (2012-2016) periods, and also include a dummy variable for the survey waves conducted in 2008 and 2010. As shown in Appendix **Table A4**, the estimated employment probabilities do not differ statistically when comparing workers with the same education but different on-the-job demands. I conclude that the unique labor market conditions during the Great Recession cannot explain these null results.

Discussion and Conclusion

In recent decades, older adults have extended their work lives. This is made possible by both advances in medicine, which make for healthier years lived, and policy protections, which ensure greater equality of employment opportunities with the onset of age-related disability. The evidence presented here underscores the extent to which the later stages of a worker's career are shaped by the demands they face on the job. Notably, I find that the degree of workplace physicality is closely linked to the educational attainment of the worker.

As revealed in the 1992 to 2016 waves of the Health and Retirement Study (HRS), jobs that require physical effort feature most prominently in the careers of workers with less formal education. Though transitions to less demanding jobs are observed, social sequence analysis reveals such improvements most clearly for the college-educated, especially those who report some degree of physicality in the first job for which data is collected. Despite these descriptive differences among education levels, however, schooling is not associated with the probability of continued employment for those in physically demanding jobs. I conclude that older adult workers, particularly those without college experience, contend with physical demands in their pre-retirement years, but that less formal education does not preclude employment, even for workers in physically demanding positions.

Although the evidence presented here is descriptive, there are several policy implications. As revealed in the social sequence analysis, older Americans continue to find work in physically demanding jobs, even in the later stages of their careers. To perform in these roles, workers must

maintain their physical and mental health. The SSA has long recognized the importance of guaranteeing health insurance to workers, particularly for Supplemental Security Income (SSI) and Social Security Disability Insurance (SSDI) beneficiaries who risk eligibility for Medicare or Medicaid as they re-enter the labor force. The SSA currently offers a series of supports to ease this transition, including coverage buy-in options and reduced insurance premiums. However, for older workers more generally, health insurance may be harder to procure. The Patient Protection and Affordable Care Act made key improvements: establishing exchanges for private insurance to be bought and sold, outlining essential coverage minimums, and mandating that employers offer affordable, valuable insurance options to their workers. Private insurance coverage plays a critical role even for older workers, who often use employer-sponsored coverage to defray out-of-pocket and other costs not covered by traditional Medicare. As such, policy makers should continue to support workers' access to comprehensive health insurance.

This analysis also finds that job transitions are less common for workers whose careers comprise highly physical roles. The SSA may be uniquely positioned to support these efforts, for example, by extending their suite of training, career counseling, and other employment supports to older workers looking to transition to less physically demanding jobs and industries. These services are currently provided to SSA beneficiaries, but they may also prevent periods of unemployment or work-related disability for aging workers in physically demanding jobs. Further, this analysis motivates additional workplace safety protections and disability-related accommodations. To this end, the SSA could consider expanding the Job Accommodation Network (JAN) to help older workers in physically demanding jobs understand their rights under the ADAAA, procure workplace accommodations, and pursue self-employment opportunities.

Finally, though this analysis does not directly engage with the worker's retirement decision, my results identify this as a promising area of future research. As revealed in the HRS data, for example, some workers re-enter the labor force after presenting as retired. An extension of this analysis could compare the physical demands of employment in the pre- and post-retirement periods for this subset of workers. In addition, workers that face different levels of physicality on the job may have different retirement expectations and realizations. Premature retirement has implications not only for SSA program outlays and solvency, but also for the financial health of older adults. Thus, future work could also explore the interaction between physically demanding occupations and the decision to retire, or compare Social Security retirement benefits by the physicality of the worker's career. In light of recent policy initiatives and economic circumstances, it is increasingly important to understand how work conditions and educational attainment influence a worker's ability to extend their career.

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Table A1: Logit regression results, probability of employment given physical effort of job

	Men	Women
Education		
High school	-0.109 (0.103)	0.041 (0.101)
Some college	-0.036 (0.111)	0.022 (0.108)
College and above	0.199 (0.108)	-0.069 (0.110)
Physical demands	-0.064 (0.102)	0.079 (0.111)
Education X Physical demands		
High school	0.036 (0.128)	-0.248 (0.134)
Some college	0.077 (0.153)	-0.066 (0.159)
College and above	-0.101 (0.191)	-0.139 (0.171)
Age	-0.734 (0.073)	-0.641 (0.068)
Age squared	0.005 (0.001)	0.004 (0.001)
Race		
Black	0.037 (0.077)	-0.004 (0.064)
Other	0.170 (0.127)	0.301 (0.155)
Health		
Very good	-0.053 (0.079)	-0.089 (0.074)
Good	-0.235 (0.079)	-0.276 (0.076)
Fair	-0.580 (0.093)	-0.852 (0.089)
Poor	-1.799 (0.135)	-2.124 (0.141)
Marital Status		
Partnered	-0.185 (0.164)	0.052 (0.187)
Separated, divorced, widowed	-0.108 (0.073)	0.184 (0.051)
Never married	-0.031 (0.166)	0.133 (0.133)

Constant	28.022 (2.386)	24.436 (2.231)
N	12,050	12,391

Source: HRS cohort that reported working for pay during the first interview. The table shows the results of a logit regression of employment on individual characteristics and the physical demands of employment in the prior interview wave. Employment is defined as working for pay, including full- and part-time, and self-employed. Physical demand of employment is coded as a binary measure. Workers that report that their job ‘requires lots of physical effort’ all/almost all or most of the time are counted as ‘Physical Demands’. Reporting some or none/almost none qualifies as ‘No Physical Demands’.

Table A2: Predicted probability of employment and lifting heavy loads, by sex and level of education

	No Physical Demands	Physical Demands	Pairwise comparison
Men			
Less than high school	0.789 (0.77, 0.81)	0.777 (0.75, 0.80)	-0.012 [0.471]
High school	0.779 (0.76, 0.79)	0.754 (0.72, 0.78)	-0.025 [0.127]
Some college	0.789 (0.77, 0.81)	0.775 (0.73, 0.82)	-0.014 [0.543]
College +	0.820 (0.80, 0.84)	0.750 (0.66, 0.84)	-0.071 [0.111]
Women			
Less than high school	0.789 (0.77, 0.81)	0.771 (0.73, 0.81)	-0.018 [0.435]
High school	0.779 (0.77, 0.79)	0.745 (0.71, 0.78)	-0.034 [0.074]
Some college	0.780 (0.76, 0.80)	0.808 (0.76 0.86)	0.029 [0.282]
College +	0.762 (0.74, 0.78)	0.814 (0.74, 0.89)	0.051 [0.170]

Source: HRS cohort that reported working for pay during the first interview. Estimates are predicted probabilities from interaction terms in a logistic regression, where the outcome is working for pay. Confidence intervals are reported in parenthesis. Contrast estimates from a pairwise comparison of the predicted probabilities are reported in the fourth column, with unadjusted p-values in brackets. Physical demands of employment are recoded as a binary measure. Workers that report that their job 'requires lifting heavy loads' all/almost all or most of the time are counted as 'Physical Demands'. Reporting some or none/almost none qualifies as 'No Physical Demands'. N=12017 for men; N=12345 for women.

Table A3: Predicted probability of employment and stooping, kneeling or crouching, by sex and level of education

	No Physical Demands	Physical Demands	Pairwise comparison
Men			
Less than high school	0.794 (0.77, 0.82)	0.775 (0.75, 0.80)	-0.018 [0.234]
High school	0.775 (0.76, 0.79)	0.770 (0.75, 0.79)	-0.006 [0.684]
Some college	0.794 (0.77, 0.81)	0.762 (0.73, 0.80)	-0.031 [0.115]
College +	0.819 (0.80, 0.83)	0.798 (0.75, 0.85)	-0.021 [0.438]
Women			
Less than high school	0.780 (0.77, 0.81)	0.795 (0.73, 0.81)	0.015 [0.421]
High school	0.777 (0.77, 0.79)	0.765 (0.71, 0.78)	-0.012 [0.413]
Some college	0.775 (0.76, 0.80)	0.813 (0.76 0.86)	0.038 [0.035]
College +	0.767 (0.74, 0.78)	0.748 (0.74, 0.89)	-0.019 [0.435]

Source: HRS cohort that reported working for pay during the first interview. Estimates are predicted probabilities from interaction terms in a logit regression, where the outcome is working for pay. Confidence intervals are reported in parenthesis. Contrast estimates from a pairwise comparison of the predicted probabilities are reported in the fourth column, with unadjusted p-values in brackets. Physical demands of employment are recoded as a binary measure. Workers that report that their job 'requires stooping, kneeling, or crouching' all/almost all or most of the time are counted as 'Physical Demands'. Reporting some or none/almost none qualifies as 'No Physical Demands'. N=12022 for men; N=12372 for women.

Table A4: Robustness test – Pairwise comparison of predicted employment probabilities for jobs with and without physical effort, by sex and level of education

	Pre-recession period	Post-recession period	Control for recession wave
Men	N=10,395	N=684	N=12,050
Less than high school	-0.008 [0.642]	0.009 [0.915]	-0.009 [0.530]
High school	-0.005 [0.725]	0.037 [0.645]	-0.004 [0.726]
Some college	0.008 [0.653]	0.054 [0.506]	0.002 [0.923]
College +	-0.030 [0.259]	0.051 [0.656]	-0.024 [0.328]
Women	N=10,605	N=755	N=12,391
Less than high school	0.017 [0.352]	-0.040 [0.541]	0.012 [0.484]
High school	-0.034 [0.009]	0.053 [0.334]	-0.028 [0.027]
Some college	0.007 [0.683]	-0.001 [0.986]	0.002 [0.901]
College +	-0.027 [0.240]	0.107 [0.224]	-0.010 [0.644]

Source: HRS cohort that reported working for pay during the first interview. Columns show the results of a pairwise comparison test, comparing the predicted probabilities of employment for workers in jobs with and without physical demands. Unadjusted p-values are reported in brackets. Physical demands of employment are recoded as a binary measure. Workers that report that their job 'requires lots of physical effort' all/almost all or most of the time are counted as 'Physical Demands'. Reporting some or none/almost none qualifies as 'No Physical Demands'.

Figure A1: Sequence Index Plot, Lots of Physical effort, Female HRS Respondents by level of education

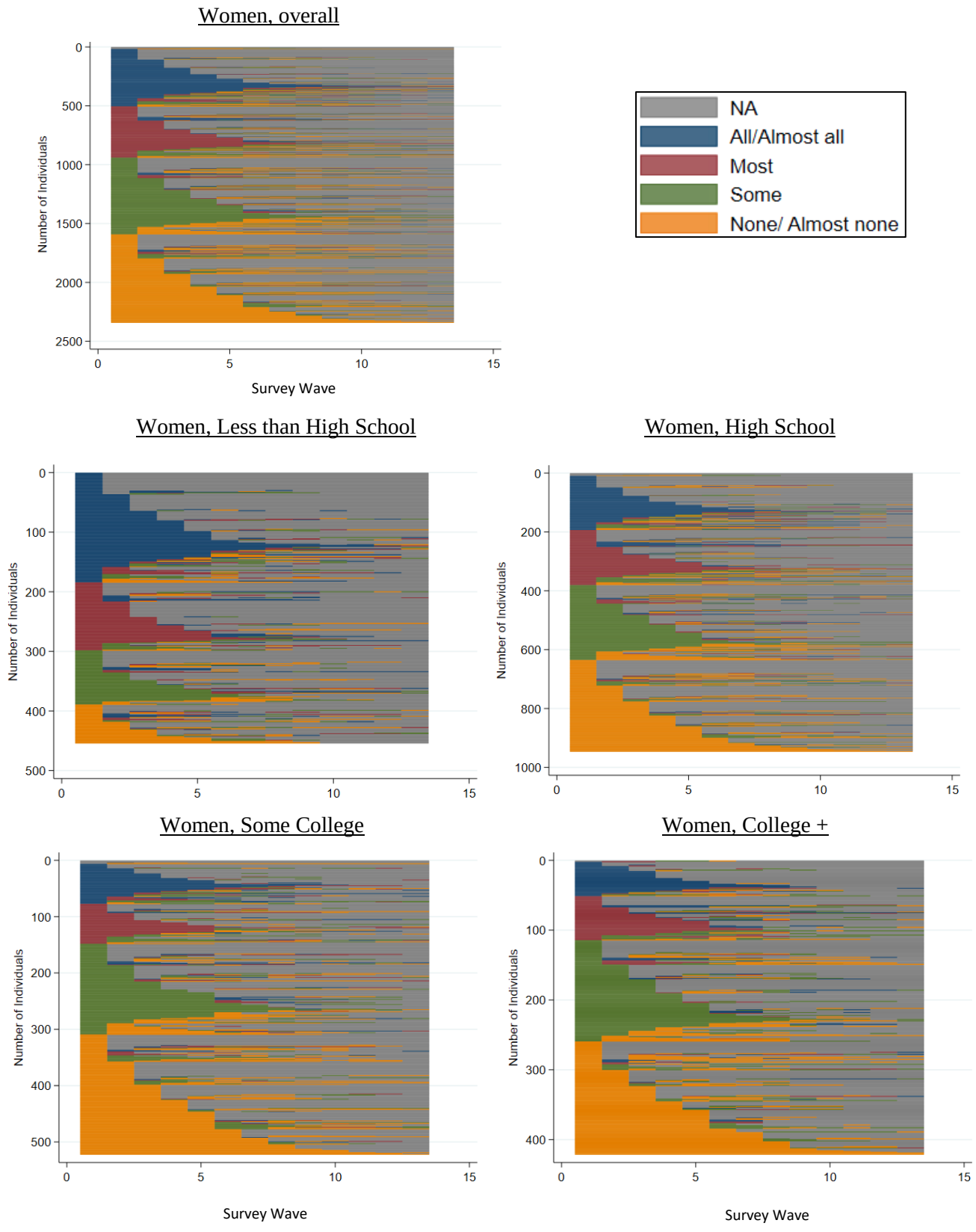
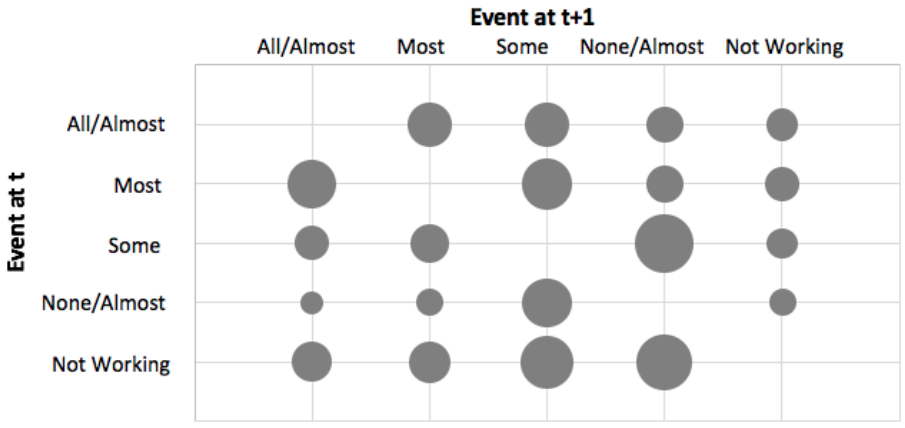
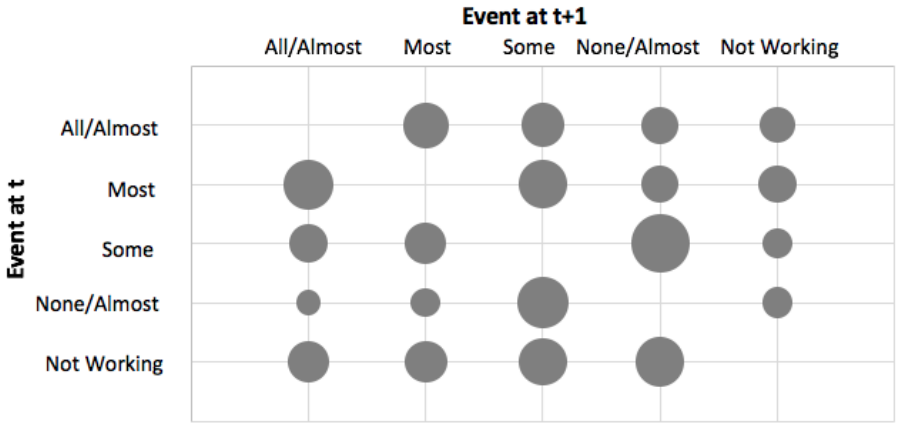


Figure A2: Probability of Transition between Jobs with Lots of Physical Effort for HRS Women, by Level of Education

Overall



At most high school



At least some college

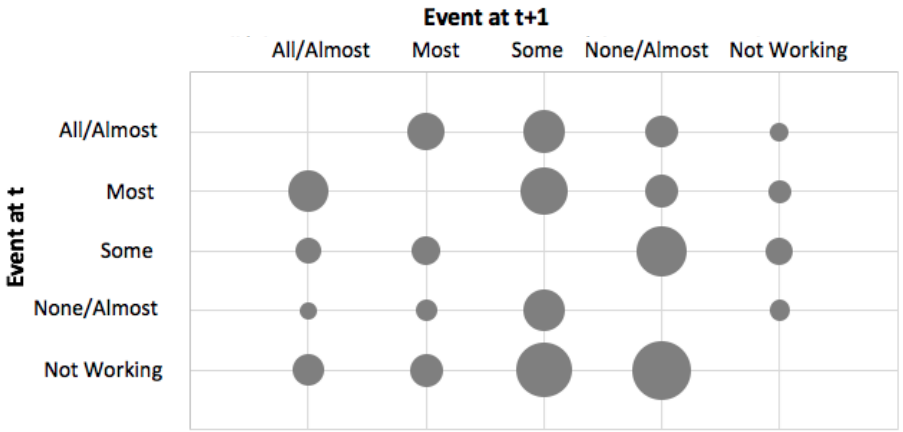


Figure A3: Sequence Index Plot, Lifting Heavy Loads, HRS Respondents, by sex and level of education

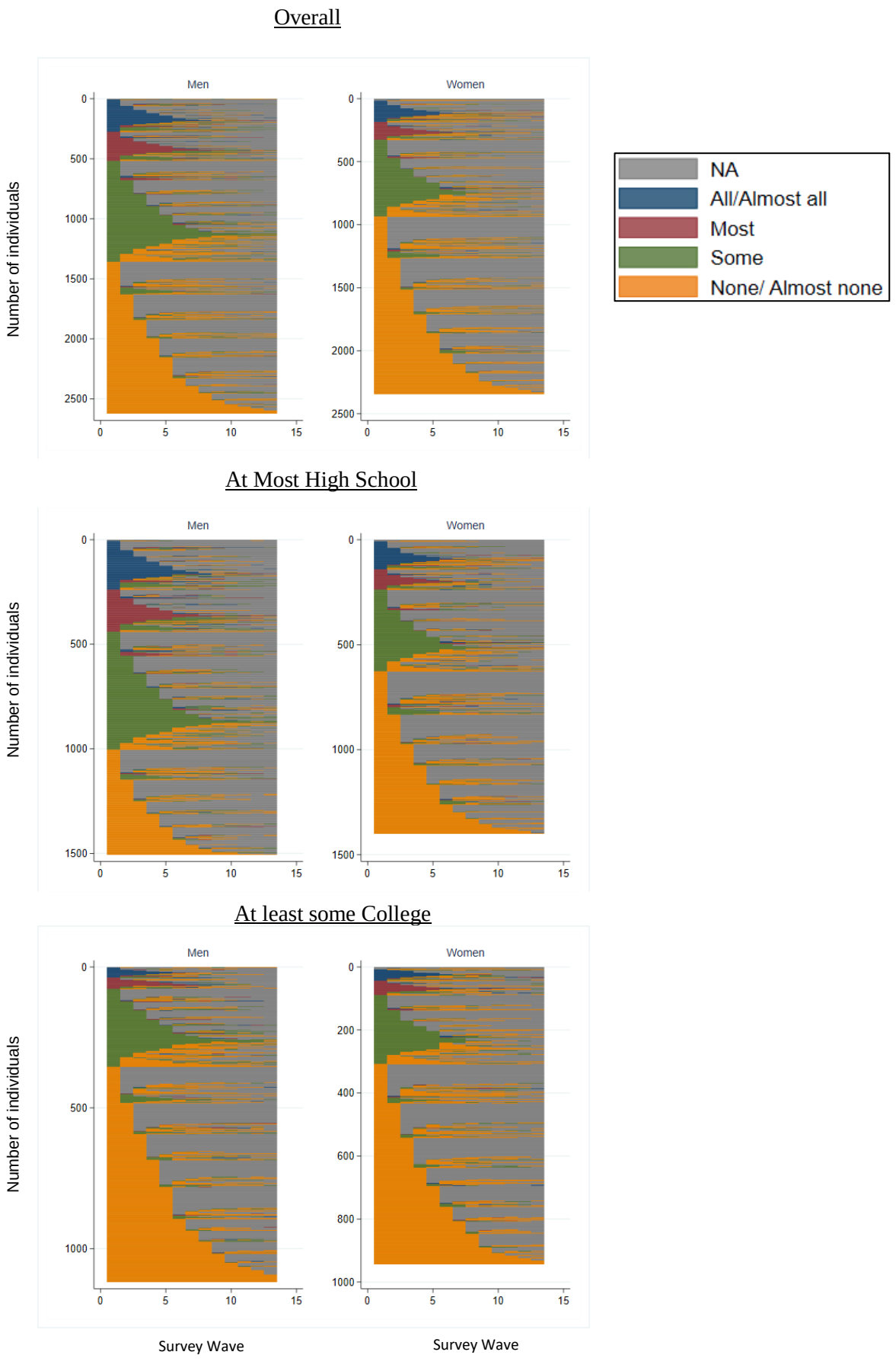


Figure A4: Sequence Index Plot Stooping, Kneeling, or Crouching, HRS Respondents, by sex and level of education