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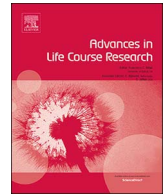
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Later-life employment trajectories and health



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ABSTRACT

Background: Despite the recent policy push to keep older adults in the labour force, we know almost nothing about the potential health consequences of working longer. Drawing on a life course approach that considers stability and change in employment patterns, this study examines the relationship between long-term labour market involvement in later life and self-rated health.

Methods: Our data are from the Health and Retirement Study (1992–2012) for the cohort born 1931–1941 (N = 6522). We used optimal matching analysis to map employment trajectories from ages 52–69, and then logistic regression to examine associations between these trajectories and self-rated health in the early 70s, net of socio-demographics, household resources and prior health.

Findings: Women prevail in groups characterized by a weak(er) attachment to the labour market and men, in groups signifying a strong(er) attachment. Men who downshifted from full-time to part-time work around age 65 were the least likely to report poor health in their early 70s. Women had the best health if they remained employed, either full-time or part-time. However, unlike men, they appeared to benefit most in health terms when part-time hours were part of a longer-term pattern.

Conclusion: While our study findings show that continuing to work in later life may be positively associated with health, they also suggest the need for flexible employment policies that foster opportunities to work part-time.

1. Introduction

Across the developed world, falling birth rates and the ‘baby boom’ cohort’s retirement have raised the spectre of unsustainable public pension costs. One of several widely agreed-upon solutions is to step up the labour force participation of older adults (Vickerstaff, 2010). This strategy is justified partly by improved later-life health at the population level. Yet, linking employment primarily to aggregate health indicators glosses over considerations that have the potential to undermine intended social and economic goals. Notably, it is not clear whether or not working longer will foster health—or harm it. Existing research on employment in later life is limited by its focus on retirement, most often as a discrete event (Insler, 2014; Neuman, 2008; Stenholm et al., 2014). Moreover, findings are equivocal (van der Heide, van Rijn, Aibroek, Burdorf, & Proper, 2013). Some studies report negative associations between leaving the labour force and health (Dave, Rashad, & Spasojevic, 2008; Moon, Glymour, Subramanian, Avendano, & Kawachi, 2012); while others show health improvement (Hessel, 2016; Westerlund et al., 2009).

Framing this period within a life course perspective (Kim & Moen, 2002) has the potential to address this limitation by compelling us to go beyond a categorical way of thinking about retirement. For one thing, the approach considers the “Third Age”—the phase lying between the family- and career-building years and the frailty years of old age—as a project that unfolds over time (Moen, 2011). Of key interest is understanding pattern and fluctuation in various life domains, such as employment, across the years that span this period (Abbott, 1990). This way of thinking shifts the focus of the study of retirement as a single event to retirement as a process. Indeed, there is evidence that, as they approach retirement, older adults experience a range of complex labour market passages that may span a number of years and involve multiple states, including downshifting from full-time to part-time work or what some refer to as, bridge employment (Beehr, 2014; Cahill et al., 2016; Skoog & Ciecka, 2010). Moreover, it is these labour market sequences within which retirement is embedded that shape the meaning and consequences of transitions such as retirement (Aisenbrey & Fasang, 2010; Wahrendorf, Zaninotto, Hoven, Head, & Ewan Carr, 2017). For example, whether becoming eligible for public pension is preceded by a lengthy period of stable full-time work or by years of employment instability

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may influence whether retirement marks the beginning of a period of “leisure” or the continuation of a series of low-paid, part-time jobs that may have very different health consequences. Mapping the biographical terrain of these employment patterns as a whole, rather than focusing solely on retirement, is an essential first step toward a better understanding of the relationship between health and extended working lives.

A life course perspective also incorporates the notion of “linked lives,” the idea that older adults’ employment trajectories are shaped by ties to family (Moen, 2003). Importantly, the division of labour by sex means that earlier—and, thus, likely later—roles will be gendered, with men assuming primary responsibility for breadwinning and women providing the bulk of family care (Meyer & Parker, 2011). Recent research on extended employment sequences in later life suggests that this is the case. Older women are more likely to prevail in pathways marked by weaker attachment to the labour market (e.g., part-time, early withdrawal, non-employment), while higher shares of men continue to work full-time (Worts, Corna, Sacker, McMunn, & McDonough, 2016; Tang & Burr, 2015; Wahrendorf et al., 2017; Warner & Hofmeister, 2006). However, the predominant focus on retirement in existing health research means that we leave out the many women who cannot ‘retire’ because they have not been stably employed. Thus, charting the full range of labour market involvement in later life, for instance, from the early 50s onward, addresses this gap, and allows for a more accurate understanding of the role of gender.

In this study, we draw on the life course perspective to explore associations between self-assessed health, a reliable and well-validated measure of physical health (Manderbacka, Lundberg, & Martikainen, 1999), and later-life labour market trajectories. We employ sequence analysis to model adults’ employment patterns as biographical sequences—a series of labour market states that span the 50s to post-state pension eligibility—taking the entire chain as the unit of analysis (Billari & Piccarreta, 2005). Among other things, this approach enables us to study associations between health and retirement as a process embedded in histories of employment. We investigate whether some employment biographies are more (or less) health-enhancing than others, and what this implies for the health of older women and men. The paper begins with a review of relevant research, followed by an outline of our methods and results. A final section discusses the implications of our findings for research and policy on extended working lives.

2. Background: work and health in later life

As we know of no research on health and employment trajectories in the Third Age, our background review focuses on the much more abundant studies of retirement. Conceptually, they paint a complex picture of its association with health (Calvo, Sarkisian, & Tamborini, 2013). For instance, retirement may trigger health decline through the loss of financial, psychological and social resources associated with employment. Conversely, leaving behind the negative aspects of work upon retiring (e.g., job stress and occupational risk) may have the opposite effect on health. Timing may also matter in the sense that retirement that is ‘on-time’ or congruous with dominant cultural practices may result in better health than ‘off-time’ or early exits. Many older workers leave the labour force via some form of bridge employment (Cahill, Giandrea, & Quinn, 2015). Defined in a multitude of ways (Beehr, 2014), it encompasses the idea of a process that leads from full-time work to full-time retirement, often by reducing work hours. It is thought that gradual exit may foster well-being by permitting the continuity of accustomed activities and social networks, while, at the same time, establishing a post-work life (Kim & Feldman, 2000).

Existing empirical research on retirement and health is ambiguous. Among generalizable studies, some report negative associations between retirement and physical health/functioning or self-assessed health (Dave et al., 2008; Moon et al., 2012; Stenholm et al., 2014). However, the authors of a review of 22 longitudinal studies determined that existing evidence was inconclusive (van der Heide et al., 2013).

Research on retirement timing that could tell us something about the role of cultural norms is sparse, and results are mixed as well: early retirement may foster health (Jokela et al., 2010) or dampen it (Alavinia and Burdorf, 2008; Calvo et al., 2013), but continuing to work past traditionally expected retirement age may offer no health benefits (Calvo, Sarkisian, & Tamborini, 2013; Di Gessa et al., 2017).

Equivocal results also characterize the scant research on bridge employment and health. For example, Calvo and colleagues (Calvo, Haverstick, & Sass, 2009) found no differences in well-being between those who self-reported as having retired or partially-retired from one observation period to the next. However, Dave et al. (2008) reported negative associations between health and partial retirement (retired, but continuing to work part-time), although they were smaller than those for full retirement. Other studies show the opposite. Authors of an Australian panel study, for instance, observed that self-assessed health improved three years after the transition to retirement among those who retired gradually (reduced hours or unretired), compared with those who experienced an “abrupt” transition (stopped working full-time or part-time) (De Vaus, Wells, Kendig, & Quine, 2007). Similarly, Zhan, Wang, Liu and Shultz (2009) found that bridge employment (being partly retired) was associated with fewer major diseases and functional limitations than full retirement. Looking at changes in well-being as latent states, Wang (2007) reported that those in bridge employment were more likely to exhibit stable psychological health over time. However, gradually leaving the labour force may have no health benefit over continuing to work (Zhan et al., 2009).

Some argue that the ambiguity in existing retirement research stems from not adequately taking into account health selection, that is, that poor health may be a cause, rather than a consequence, of labour market withdrawal (Bound, Schoenbaum, Stinebrickner, & Waidmann, 1999). Indeed, worse self-rated health and a range of physical limitations are all related to early exit (e.g., Börsch-Supan, Brugiavini, & Croda, 2009; Mein et al., 2000). Well-designed studies that account for health selection find that retirement either has no impact or confers physical health benefits (Bound & Waidmann, 2007; Coe & Zamarro, 2011; Hessel, 2016; Westerlund et al., 2009; but see Behncke, 2012; Dave et al., 2008).

Studies of retirement and health that consider gender also show mixed results. Some find that, upon retirement, men are more likely to report poor self-assessed health, mobility limitations and chronic conditions (Dave et al., 2008), while others uncover no differences (Moon et al., 2012). Stenholm et al. (2014) did not detect gender disparities in physical functioning among those who continued to work, although retired women reported more health problems than their male counterparts. As mentioned, however, one of the concerns about this research from a gendered perspective is that a focus on retirement includes only those who were employed at the beginning of the study or, at least, had substantial histories of paid work.

In sum, existing research on health and later-life employment focuses on the transition to retirement and results are equivocal. Our interest in long-term patterns enables us to consider stability and change in employment which, themselves, provide the contexts of retirement. It allows us to bring in women (and men) who did not adhere to the then-conventional male life course of full-time work until state pension age. Using data from the Health and Retirement Study (HRS), our paper has two aims. First, it employs sequence analysis to describe employment trajectories between ages 52 and 69. Second, it estimates the associations between these long-term employment patterns and health when people are in their early 70s. For both aims, we also consider the role of gender.

3. Methods

3.1. Data

The HRS is a nationally-representative survey of more than 26,000 Americans aged 50+ conducted biennially since 1992. It includes

repeated health measures, along with detailed current and retrospective information on employment/activity periods and a range of socio-demographic and other relevant variables. We used both the publicly-available HRS data (Heeringa & Connor, 1995) and those generated by the RAND Corporation (Chien et al., 2014). We work with the original 1992 HRS cohort (born 1931–1941), following them until all had reached their early 70s, the age at which our health outcome was measured. The youngest members of the cohort were in their early 70s in the 2012 wave. We also restrict analyses to respondents with information on the health outcome and labour market states for the majority of the years between ages 52–69 (N = 6522; 45.8% men; 54.2% women). The bottom age cut-off was chosen (somewhat arbitrarily) because it represents ten years prior to early state pension age eligibility in the US (62 years), and the top age cut-off (69 years), because very few people of this cohort remain in the labour force in their 70s (Warner, Hayward, & Hardy, 2010).

3.2. Measures

3.2.1. Health

The health outcome is a dichotomous measure of poor self-rated health (1 = yes; 0 = no). Respondents were asked to rate their general health on a five-point scale collapsed as follows: yes = poor, fair; and no = good, very good, excellent (poor health = 25.7% for men and 26.8% for women). The variable was assessed at the first interview after the respondent's 70th birthday.

3.2.2. Later-life LMI trajectory

We used a novel approach to construct the focal independent variable that captures long-term patterns of labour market involvement (LMI). Using data on employment/activity histories, we first coded, for each of 18 annual time points (ages 52–69), a set of categorical variables representing whether a respondent was primarily employed full-time (30+ hours/week or 36+ weeks/year), part-time (less than 30 h/week), or not at all that year. To make analysis feasible while also retaining the integrity of these labour market sequences, we grouped them using a modification of optimal matching analysis, dynamic Hamming (DH) (Lesnard, 2010). DH emphasizes the age-graded temporal patterning of various employment states in a sequence (Fasang, 2010; Lesnard, 2010). Thus, it accords well with our interest in the timing of retirement and other employment transitions such as downshifting from full-time to part-time work (see Appendix A for additional details).

The result is a 13-category classification of employment trajectory 'types': 1 = Full-time throughout; 2 = Part-time throughout; 3 = Full-time, part-time around 65 (full state pension eligible); 4 = Full-time, part-time around 62 (early/partial state pension eligible); 5 = Full-time, exit around 65; 6 = Full-time, part-time around 57, Exit around 65; 7 = Part-time, exit around 65; 8 = Full-time, exit around 62; 9 = Part-time, exit around 62; 10 = Full-time, exit around 57; 11 = Part-time, exit around 57; 12 = Non-employed throughout; 13 = Other (not easily classified). Underlying these model or reference trajectories is the view of later-life employment as a complex and variable process involving both stability and change at institutionally-relevant aged-graded turning points (Appendix A). Although many of the trajectories involving part-time work were rare for men (i.e., trajectories 2, 6, 7, 9, and 11; see Table 1), we retained the diversity because of our interest in gender comparison. It is important to note that individuals in each of the 13 groups are *mostly/always* employed full-time or part-time or non-employed *around* the ages indicated because cases are matched to their closest model sequence, and many actual sequences will not match exactly in every detail.

3.2.3. Controls

Because health data are not collected at precisely the same age for all individuals, all models control for *age at health measure* (usually

quite close to 70) and *year of birth*. In addition to these basic controls, we include two other groups of measures that are not the focus of the analyses, but may affect health at older ages (Dave et al., 2008; Hyde, Ferrie, Higgs, Mein, & Nazroo, 2004; Moon et al., 2012; Stenholm et al., 2014). One group is socio-demographics and household resources, and the other is prior health. Socio-demographics include: *member of a racial/ethnic minority*, which differentiates Blacks and Hispanics (1 = yes; 0 = no) from non-Hispanic whites; *education* (1 = less than high school; 2 = high school or equivalent; and 3 = at least some post-secondary schooling); and marital status (*married*: 1 = yes; 0 = no) when the health outcome was measured (early 70s). Household resources include *household income* when the health outcome was measured; along with an indicator of long-term financial circumstances—*household wealth* when respondents were in their early 60s. Income and wealth were assessed in 2015 dollars, adjusted for household size and logged to normalize the distribution (the 1.5% of the sample with zero household wealth were assigned a value of 0.001 before the log transformation). Finally, we included *age at which household wealth was measured* because wealth was not assessed at exactly the same age for everyone.

A final group of controls is prior health. Ideally, variables that can account for health selection ought to be measured before age 52 when the assessment of employment trajectories began. However, data limitations are such that only one variable, derived from retrospective information on employment/activity status, is available: *left work due to illness or disability ages 48–51* (1 = yes; 0 = no). Because age at study entry was 51–61 years, two other health indicators were measured at the earliest age at which information was provided for the majority of sample members, that is, the first interview after the respondent's 60th birthday. They are: *poor self-rated health*, based on the same question as the outcome (1 = yes; 0 = no); and *functional limitations* (1 = yes; 0 = no). In both cases, the *age at which the health variable was assessed* is also included to cover any discrepancies in timing. Descriptive statistics for control variables are provided in Supplementary Table 1.

3.3. Analysis

3.3.1. Statistical analyses

We employ nested logistic regression analyses to examine associations between later-life LMI type and poor health in the early 70s. All regressions are run using Stata `-logistic-` in conjunction with `-mi estimate-` to adjust standard errors and accommodate the uncertainty associated with multiple imputations. Estimates are weighted using the population/design/attrition weights supplied with the survey. Using regressions estimates, we also calculate predicted probabilities of poor health for each LMI trajectory at the means of continuous covariates and modal values of categorical controls. This permits the full range of comparisons between groups, rather than only those with respect to a single reference used in the regression analyses.

3.3.2. Imputations

The dynamic Hamming algorithm used to classify labour market trajectories requires complete data on the sequence variables (Halpin, 2014). (The alternative is to treat missingness as a category in its own right and construct model biographies that take this into account. However, the meaning of such a category is difficult to interpret.) To retain as many cases as possible, we imputed any parts of a sequence that were missing (affecting 29% of cases in the analytic sample—see Appendix A for details on the two-fold fully conditional multiple imputation specification used). As outlined in the *Data* section, however, we dropped cases with missing information on half or more of their LMI sequence data points to avoid excessive reliance on imputed values. We also note here, that, for both women and men, there was no overall difference in health in the early 70s among those with imputed sequence variables, versus those without. There was some variation by LMI group in later-life health among men and women with and without

Table 1
Weighted percent distributions of LMI trajectories, by gender.

Variable	Description ^a	Percent	
		Men N = 2986	Women N = 3536
LMI type			
1. Full-time throughout	Employed full-time ages 52–69	21.09	9.72
2. Part-time throughout	Employed part-time ages 52–69	2.13	3.96
3. Full-time, part-time 65	Employed full-time ages 52–64; employed part-time ages 65–69	7.75	4.55
4. Full-time, part-time 62	Employed full-time ages 52–61; employed part-time ages 62–69	6.52	5.57
5. Full-time, exit 65	Employed full-time ages 52–64; non-employed ages 65–69	14.14	9.87
6. Full-time, part-time 57, exit 65	Employed full-time ages 52–56; employed part-time ages 57–64; non-employed ages 65–69	1.75	2.54
7. Part-time, exit 65	Employed part-time ages 52–64; non-employed ages 65–69	0.41	1.94
8. Full-time, exit 62	Employed full-time ages 52–61; non-employed ages 62–69	17.56	14.08
9. Part-time, exit 62	Employed part-time ages 52–61; non-employed ages 62–69	0.66	3.12
10. Full-time, exit 57	Employed full-time ages 52–56; non-employed ages 57–69	9.09	9.91
11. Part-time, exit 57	Employed part-time ages 52–56; non-employed ages 57–69	0.55	3.95
12. Non-employed throughout	Non-employed ages 52–69	8.04	20.95
13. Other	A mix of patterns that do not closely match any of the above	10.30	9.88

^a Descriptions refer to the model sequences used to assign cases to an LMI group. Individuals in each group will be *mostly/always* employed full-time/part-time or non-employed *around* the ages indicated because cases are matched to their closest model sequence and many actual sequences will not match in every detail.

imputations; however, these differences suggest that, had we not needed to impute, our main findings would actually have been stronger for both men and women (the best-health groups had worse health among the imputed than among the non-imputed).

Following optimal matching, missing values for all independent variables were also imputed, this time using chained equations (White, Royston, & Wood, 2011) in Stata `-mi impute-`. As is standard practice, these equations included the variables in the analysis models, along with a range of other measures associated with the variables being imputed (mother had less than high school education; blue/white collar/no main job; age at 1st child; age at 1st marriage; ever had a marriage end by age 52; and whether had dependent children at age 52).

4. Results

4.1. Labour market involvement trajectories: descriptive statistics

Table 1 shows weighted percent distributions of later-life LMI type. Among men, only 14% followed a ‘conventional’ trajectory involving full-time work and withdrawal around age 65 (trajectory 5). More often, they acted in line with recent policy initiatives and engaged in extended full-time work (trajectory 1–21%), or they did the opposite and withdrew in their early 60s (trajectory 8–18%). Modest proportions (7%–9%) stayed in the labour force by downshifting from full-time to part-time work (trajectories 3 and 4) or, at the opposite extreme, left work in their late 50s (trajectory 10) or even earlier (trajectory 12). Rare among men (2% or less) are those pathways involving earlier histories of part-time work (trajectories 2, 6, 7, 9 and 11). The employment sequences of 10% of men are not a good match to any of the pre-defined biographies (trajectory 13).

Women are less likely than men to have engaged in extended working on a full-time or part-time basis (trajectories 1–4—totalling 24% vs. 38% for men). Notably, less than half as many women worked full-time throughout (trajectory 1–10%). Conversely, percentages in the various groups involving initial part-time work (trajectories 2, 7, 9 and 11) are higher than for men (totalling 13% vs. 4% for men). Although women, like men, more often retired from full-time work around age 62 (trajectory 8–14%) than age 65 (trajectory 5–10%), the largest proportion (21%—more than double that found for men) was largely non-employed over the observation period (trajectory 12). As we saw for men, 10% of women’s trajectories are not a good match to any of the reference sequences. Because its character is not clear and, thus, not interpretable, we do not consider the residual biography (trajectory 13)

further in the presentation of results. We next explore the links between these long-term employment patterns and subsequent health.

4.2. Labour market involvement and health

Figs. 1 and 2 show the proportions reporting poor health around age 70 across the various LMI trajectories for men and women. The distribution for men points to several trends, even though overlapping 95% confidence intervals across some of the groups preclude definitive statements. Those downshifting to part-time work around age 65 (trajectory 3) are less likely than almost all other groups to report poor health in their early 70s. For the most part, the opposite is the case for men with weak ties to the labour market (trajectories 11 and 12). With the exception of long-term part-time employment (trajectory 2), men who continued to work (trajectories 1, 3 and 4) and those who retired from full-time work around age 65 (trajectory 5) were less likely to report subsequent poor health than those who left the labour force early or experienced extended non-employment (trajectories 10, 11 and 12). Those biographies rare among men (trajectories 6, 7, 9, and 11) have wide, and sometimes overlapping, confidence intervals.

Health patterns across employment trajectories are more readily discernible among women, again, notwithstanding the issue of overlapping confidence intervals for some groups (Fig. 2). Proportions in subsequent poor health among those who continued to work in some capacity—the first four trajectories—are smaller than those for women with all other biographies, including those who retired “abruptly” from full-time work at various ages (trajectories 5, 8, and 10). Like their male counterparts, women who were non-employed throughout (trajectory 12) had the highest percentage reporting poor health in their early 70s.

Further investigation gives us some idea of who men and men with the best and worst health are (Supplementary Table 2). For men, those who downshifted around age 65 are among the most advantaged. They are more likely to be white, college-educated and in better health in their late 40s/early 50s and early 60s; and have greater household wealth and income than most other groups. Men who continued to work full-time share some, but not all, of these advantages. For example, they are better educated than other men; however, relative to downshifters they are not as well-educated, they are more likely to be black or Hispanic, and they have lower wealth. These differences raise questions about the extent to which financial need is driving the engagement pattern of those who continue to work full-time. The relative disadvantage of men with the weakest labour market ties (i.e., trajectories 11 and 12) is striking. They are considerably more likely than others to be of minority status, not married in their early 70s and in

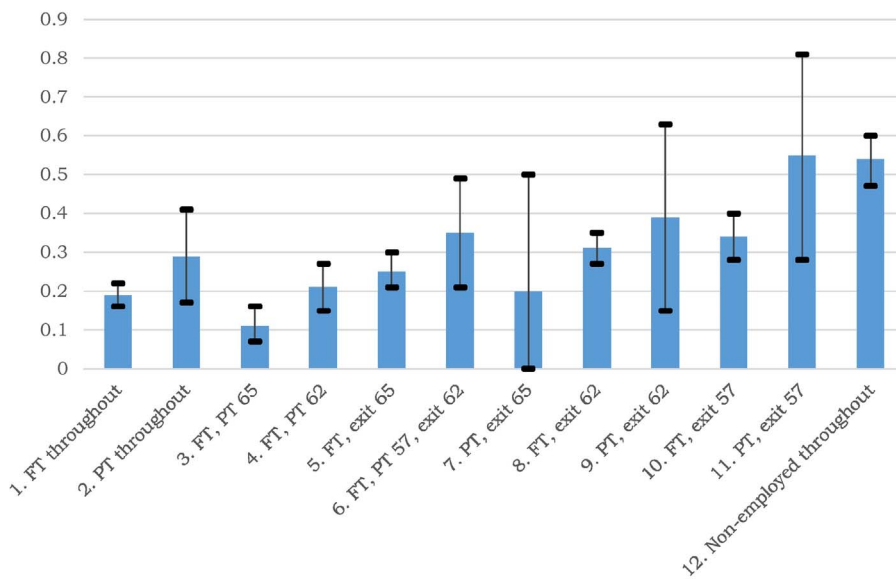


Fig. 1. Proportion of men reporting poor self-rated health by LMI trajectory with 95% confidence intervals.

poor health earlier in the life course; and, perhaps not surprisingly, they have the lowest median household income and wealth.

Like men, women in employment trajectories associated with the best and worst health are also divided in terms of advantage (Supplementary Table 2). For example, those with a long history of part-time work are more likely than many other groups to be highly-educated, white and married in their early 70s; and they have greater household income and wealth. They are also in better health in their late 40s/early 50s and early 60s. Like their male counterparts, women who continued to work full-time are considerably more likely to be of minority status and have lower household wealth than the seemingly healthiest group (long-term part-timers, in this case), and a larger proportion are non-married in their early 70s. However, most disadvantaged on all fronts are women who were mainly non-employed throughout.

Tables 2 and 3 present odds ratios derived from nested multivariate logistic regressions with poor health in the early 70s as the dependent variable. Model 1 examines the relationship between LMI trajectories and subsequent health, net of age, birth year, sociodemographic factors and exogenous health. Model 2 adds household economic resources; and Model 3 controls for health in the early 60s. Because we have no a priori reasons to choose one employment sequence over others as the

reference group, the modal employment sequence for each gender—employed full-time throughout for men (trajectory 1) and not employed throughout for women (trajectory 12)—serves in that capacity.

Table 2, Model 1 shows only one group of men—those who downshifted around age 65 (trajectory 3)—with significantly lower odds of reporting poor health (OR 0.49) than the reference sequence. All other significant estimates for LMI type are indicative of greater health risk than working full-time throughout. More specifically, the trajectories associated with elevated risks are characterized by less ‘conventional’ male employment histories, including exits around age 57 from either full-time (OR 2.16) or part-time employment (OR 4.68); or being non-employed (OR 3.72) or working part-time throughout (OR 2.18). Some LMI estimates are attenuated when household income and wealth are added (Model 2)—usually not by much, but more so among those with a weak attachment to the labour forces (trajectories 11 and 12). Some estimates diminish even more when health around age 60 is controlled—again, especially among those with trajectories 11 and 12 (Model 3). Other estimates, including those for men who downshifted around age 65 (trajectory 3) or who worked part-time throughout (trajectory 2), are relatively unaffected by the adjustments. In this final model, less than college education, along with lower household wealth and poor health in the early 60s, raised the odds of subsequent poor

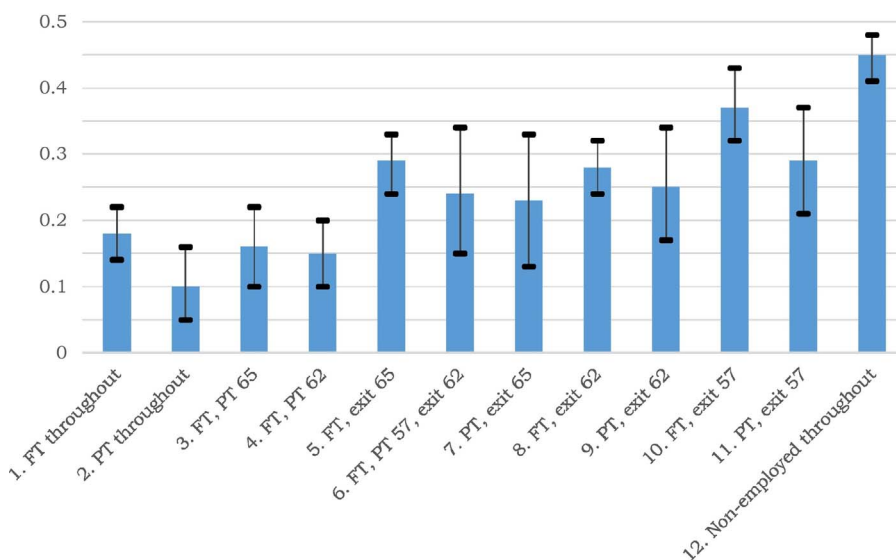


Fig. 2. Proportion of women reporting poor self-rated health by LMI trajectory with 95% confidence intervals.

Table 2
Logistic regression estimates (odds ratios) of the relationship between poor self-rated health and labour market involvement trajectories among men (N = 2937).^a

	Model 1 OR	Model 2 OR	Model 3 OR
LMI Trajectory:			
1. Full-time throughout (reference)			
2. Part-time throughout	2.18*	2.11*	2.14*
3. Full-time, part-time 65	0.49**	0.50**	0.46**
4. Full-time, part-time 62	1.25	1.21	1.17
5. Full-time, exit 65	1.33	1.25	1.19
6. Full-time, part-time 57, exit 65	1.95	1.86	1.75
7. Part-time, exit 65	0.91	0.87	0.67
8. Full-time, exit 62	1.66	1.57**	1.29
9. Part-time, exit 62	2.29	2.14	1.88
10. Full-time, exit 57	2.16***	2.01***	1.40
11. Part-time, exit 57	4.68**	3.69*	2.14
12. Not employed throughout	3.72***	3.15***	1.69*
Year born	0.98	0.98	0.95**
Minority Status	1.41**	1.16	1.23
Education:			
Low	4.57**	3.39***	2.45***
Intermediate	2.39***	2.00***	1.72**
Married ~ age 70 ^b	0.73**	0.96	0.96
Any Disability (48–51 years)	1.61	1.21	0.83
Household Income ~ age 70 ^b		0.85*	0.89
Household Wealth ~ age 60 ^c		0.87***	0.92*
Poor Self-Rated Health ~ age 60 ^c			5.12***
Functional Limitations ~ age 60 ^c			1.72***

^a All models adjust for the age at which the health outcome was measured.

^b Measured when health outcome assessed.

^c Models adjust for the exact age at measurement.

* p < 0.05.

** p < 0.01.

*** p < 0.000.

Table 3
Logistic regression estimates (odds ratios) of the relationship between poor self-rated health and labour market involvement trajectories among women (N = 3584).^a

	Model 1 OR	Model 2 OR	Model 3 OR
LMI Trajectory:			
1. Full-time throughout	0.32***	0.38***	0.60*
2. Part-time throughout	0.21***	0.23***	0.29***
3. Full-time, part-time 65	0.29***	0.33***	0.50*
4. Full-time, part-time 62	0.29***	0.32***	0.42**
5. Full-time, exit 65	0.61*	0.63*	0.86
6. Full-time, part-time 57, exit 65	0.50*	0.54*	0.67
7. Part-time, exit 65	0.57	0.66	0.76
8. Full-time, exit 62	0.61**	0.66**	0.76
9. Part-time, exit 62	0.57*	0.62	0.67
10. Full-time, exit 57	0.86	0.90	0.84
11. Part-time, exit 57	0.66	0.68	0.57*
12. Non-employed throughout (reference)			
Year born	1.00	0.99	0.98
Minority Status	1.70***	1.41**	1.24
Education:			
Low	3.12***	1.92***	1.22
Intermediate	1.48**	1.14	0.90
Married ~ age 70 ^b	0.54***	0.91	0.92
Any Disability (48–51 years)	4.27***	3.53***	2.71**
Household Income ~ age 70 ^b		0.72***	0.72***
Household Wealth ~ age 60 ^c		0.84***	0.90**
Poor Self-Rated Health ~ age 60 ^c			5.34***
Functional Limitations ~ age 60 ^c			2.41***

^a All models adjust for the age at which the health outcome was measured.

^b Measured when health outcome assessed.

^c Models adjust for the exact age at measurement.

* p < 0.05.

** p < 0.01.

*** p < 0.000.

health. Although the timing of the prior health measures precludes definitive statements about health selection (two are measured after the observation of employment histories began), the results suggest that poor health may have selected men into early exit around age 57 or ongoing non-employment throughout their 50s and 60s, and this may be part of the reason for their poorer subsequent health.

Among women, almost all employment pathways are associated with a significantly lower risk of poor health than being non-employed throughout, after controlling for exogenous variables (Table 3, Model 1). This is especially the case for continuing to work in some capacity (trajectories 1–4); but women with employment histories that included retiring from full-time or part-time work around ages 62 or 65 (trajectories 5, 6, 8, and 9) were also less likely to report poor health. As with men, differences in later-life health by employment biography are partly accounted for by household economic resources, though changes are relatively small (Model 2). When endogenous health controls are added (Model 3), biographies involving labour force exit are no longer associated with significantly better health in the early 70s than the reference group—with one exception (trajectory 11). However, the lower odds of poor health among women who continue to work either full-time or part-time persist. Odds associated with long periods of part-time work (trajectory 2) remain especially low; women who traced this trajectory were just over a quarter as likely (OR 0.29) to report poor health in their 70s as their continuously non-employed counterparts. In the fully-adjusted model, lower household income and wealth, as well as poor health earlier in the life course raise the odds of poor health when women reach their 70s.

Table 4 shows predicted probabilities of poor health for men and women for each LMI trajectory type, along with their confidence intervals, based on the fully-adjusted regression models (Tables 2 and 3). Most striking for men is that those who remain employed by shifting to part-time work in their mid-60s (trajectory 3) are in the best shape in their early 70s (probability of poor health = 0.10). Men with nearly every other trajectory had a significantly higher probability of subsequent poor health than this group. (For three trajectories—6, 7 and 9—wide confidence intervals that overlapped with those of

Table 4
Predicted probability^a of reporting poor self-rated health by LMI trajectory for men and women.

LMI Trajectory	Predicted Probability (95%CI) ^b
MEN	
1. Full-time throughout	0.186 (0.151–0.221)
2. Part-time throughout	0.286 (0.161–0.410)
3. Full-time, part-time 65	0.099 (0.058–0.139)
4. Full-time, part-time 62	0.215 (0.150–0.280)
5. Full-time, exit 65	0.220 (0.178–0.263)
6. Full-time, part-time 57, exit 65	0.274 (0.123–0.424)
7. Part-time, exit 65	0.158 (0.000–0.386)
8. Full-time, exit 62	0.265 (0.225–0.306)
9. Part-time, exit 62	0.304 (0.096–0.512)
10. Full-time, exit 57	0.307 (0.245–0.369)
11. Part-time, exit 57	0.472 (0.211–0.734)
12. Non-employed throughout	0.426 (0.348–0.504)
WOMEN	
1. Full-time throughout	0.155 (0.114–0.196)
2. Part-time throughout	0.099 (0.040–0.159)
3. Full-time, part-time 65	0.139 (0.081–0.196)
4. Full-time, part-time 62	0.133 (0.080–0.185)
5. Full-time, exit 65	0.228 (0.181–0.275)
6. Full-time, part-time 57, exit 65	0.207 (0.117–0.298)
7. Part-time, exit 65	0.243 (0.122–0.363)
8. Full-time, exit 62	0.244 (0.201–0.286)
9. Part-time, exit 62	0.239 (0.148–0.330)
10. Full-time, exit 57	0.314 (0.257–0.370)
11. Part-time, exit 57	0.244 (0.160–0.328)
12. Non-employed throughout	0.365 (0.325–0.405)

^a Predicted probabilities derived from models with all control variables.

^b Confidence intervals are based on a normal approximation; values outside range (0,1) have been cropped.

downshifters are the product of extremely small numbers of men in these groups.) At the other end of the spectrum, the higher probability of poor health for men with the non-employed throughout biography (trajectory 12 = 0.43) stands out when compared with those who had a strong attachment to the labour force (trajectories 1, 3, 4, 5 and 8).

Among women (Table 4, lower panel), those in ongoing part-time employment (trajectory 2) had a significantly lower probability of poor health (0.10) than most other biographies involving labour market exit or long-term non-employment. Downshifting in their 60s (trajectories 3 and 4) and continuing to work full-time (trajectory 1) are relatively beneficial as well. Women non-employed throughout (trajectory 12) had a higher probability of poor health in later life (0.37) than those in extended working (trajectories 1–4), as well as those who left the labour force “abruptly” in their 60s (trajectories 5 and 8) or gradually beginning around their late 50s (trajectory 6).

In a final analysis of the pooled sample of women and men, we examined whether the associations between labour market trajectories and self-assessed health varied by gender (results not shown). Only one gender interaction—that involving continual part-time work (trajectory 2)—was statistically significant, net of all controls. Relative to other trajectory types, long-term part-time employment was associated with lower odds of poor health for women, but not for men. This finding is perhaps not surprising, given the breadwinner/caregiver division of labour in marriage (common for this generation) that makes part-time work ‘conventional’ for women but not for men. As a result, women in this cohort may have engaged in long-term part-time work by choice or because it was more available to them, while the instigator for men may more often have been compromised health.

5. Discussion

Using a life course approach focussing on broad, long-term patterns, this paper set out to describe the work trajectories of Third Age women and men and investigate their relationships with self-rated health. Optimal matching analysis allowed us to map employment biographies in relation to potential typologies indicative of patterns of later life employment of a cohort of Americans born between 1931 and 1941. For both men and women, retiring around early state pension age was more common than leaving ‘on time.’ This finding is consistent with Warner and colleagues’ (Warner et al., 2010) estimation of 62 years as the modal retirement age among HRS participants. Employment biographies are, however, clearly gendered. Men more often engaged in extended working, especially on a full-time basis, while women were more likely to work part-time during their 50s and 60s or not at all.

In and of themselves, these results are not surprising. Other studies that chart employment pathways among older adults from similar cohorts show a stronger labour-force attachment among older men, compared with women. Tang and Burr (2015), for example, used HRS data to identify the prevalence of latent work-retirement statuses biennially from 1998 to 2004. Although the gender gap narrowed over time, more men than women were in a full-time worker latent class, while a greater share of women were in latent classes indicating part-time employment or not working at all. However, their study of later-life employment, like others (Kail & Warner, 2013; Pleau, 2010; Radl, 2013; Warner & Hofmeister, 2006), is based on event history/survival models that focus on transitions. Exploring the complexity of labour market involvement through extended biographical sequences allowed us to distinguish various pathways of continuing employment on the basis of stability and change at substantively significant ages related to state pension eligibility. It also allowed us to broaden the temporal terrain in which changes, such as retirement, occurred. Notably, we were able to consider not only the timing of retirement, but also its occurrence in relation to histories of full-time or part-time work. Last, but not least, it enabled us to include those without stable work histories—mostly women—who are usually left out in studies of retire-

ment. Bringing this complexity to the analysis of self-assessed health led to findings that, to our knowledge, have not been reported previously. Although our study design precludes a causal interpretation, our results suggest that the most beneficial LMI trajectory for later life health among men may be downshifting from full-time to part-time employment in their mid-60s. All else equal, women had the best health if they remained employed, either on a full-time or part-time basis after their early to mid-60s. In contrast to men, though, they appeared to benefit most when part-time hours were part of a longer-term pattern.

As noted, those in these LMI trajectories (i.e., downshifting and long term part-time work for women only) were more socioeconomically advantaged and in better earlier health than those who followed many other biographies. Conditioning on these factors did not fully account for their better health around age 70, but it is possible that other dimensions of social advantage not included in our models would be important in explaining the association and, thus, worth exploring in future research. An obvious candidate is the nature of the part-time work undertaken. Those who continue to work part-time may be a select group with access to quality jobs with high control, low strain or few physical demands, characteristics that are associated with higher levels of well-being (Stansfeld, Shipley, Head, Fuhrer, & Kivimaki, 2013) and a lower likelihood of retiring for health reasons or via a disability pension (Krause et al., 1997; Laine et al., 2009).

At the other extreme, being mostly non-employed from ages 52–69 stands apart from other more “attached” biographies in having a higher likelihood of poor health for both women and men. What is especially troubling about this finding for women is that prolonged non-employment was, by far, the most prevalent trajectory among them (21%). Although health selection into long-term non-employment did not fully explain its association with later-life health for either men or women, the gender division of labour suggests that family care among women might be an important consideration. To that end, we explored a range of marital, parental and work histories over the prime adult years (results not shown), but they had no impact on the LMI-health relationship. However, the strong likelihood that older adults’ labour market trajectories follow from their paid work experiences at younger ages (Han & Moen, 1999), and that those experiences are shaped by ties to family (Arber, Davidson, & Ginn, 2003) suggest that this avenue is worth exploring further with more detailed data than were available in the HRS.

Comparing our findings with those of other population-based studies of employment and health in later life is difficult because of differences in design. For example, De Vaus and colleagues (De Vaus et al., 2007) also found that gradual retirees were in better physical health than their counterparts who retired abruptly, but they excluded those who continued to work. One study that took account of the latter group reported that gradually leaving the labour force offered no health benefit over remaining in full-time work (Zahn et al., 2009), while another observed that retirement of any kind, be it full or gradual, was worse for health than not retiring at all (Dave et al., 2008). Significantly, none of these studies examined employment and retirement separately for women and men. The mixed results of this small body of work highlight the need to consider the full complexity of later-life employment pathways in future research. This could also include greater differentiation of the timing of downshifting (i.e., the age at which it occurred) than undertaken in the current paper.

Our contributions should be viewed in light of several limitations. First and foremost is that measuring the prior health of the sample when they were in their early 60s, rather than before the beginning of the LMI biography (age 52) likely prevented us from fully accounting for health selection. This shortcoming reflects data constraints. Specifically, information on health, unlike labour market states, was not collected retrospectively (with the exception of having had a work-related disability); and the timing of wave 1 (1992) means that many individuals in our sample were first interviewed well into their 50s or later (i.e., the cohort was 51–61 years in 1992). These issues imply that

our results may underestimate the role of prior health in selecting people into LMI trajectories that are associated with later health. Nevertheless, it is unlikely that earlier measures, even if they explained more of the later-life LMI-subsequent health links, would have fundamentally altered the story about gendered patterns.

A second limitation is the necessary sacrifice of some precision in the construction of the later-life labour market groups. We clustered individuals whose trajectories are similar but not identical, and cannot say whether this ‘muddied’ associations with subsequent health or with other independent variables. This constraint is, however, inseparable from the study’s two main strengths: the ability to address life course considerations by modeling broad, long-term trajectories rather than immediate labour market states or discrete transitions (i.e., leaving or re-entering the labour force); and the ability to include all women, regardless of prior work status, and thus to more fully assess gender differences in the links between later-life LMI and subsequent health.

A third consideration is that imputations introduced some uncertainty into the labour market sequences. While this is of concern, we minimized its impact by running 20 imputations and appropriately adjusting standard errors. Moreover, more than 70% of sequences were complete, and our sensitivity analysis using a sample without any missing labour market information did not alter our major conclusions (see [Appendix A](#)).

Notwithstanding the limitations described above, the study findings are suggestive of health benefits of part-time employment, but in ways that are gendered. Downshifting from full-time work around normal state pension age was clearly associated with the best health among men in their early 70s, while working part-time throughout their 50s and 60s was most salutary for women. That the latter trajectory appeared to dampen men’s health relative to downshifting is likely indicative of cultural norms that sustained a gendered attachment to the labour force for the cohort we examined. What this picture might look like among more recent cohorts for whom breadwinning and caregiving may be less gendered remains to be determined.

Although we cannot go beyond the bounds of the descriptive nature of our study, it raises provocative questions about the need for flexible employment policies that foster opportunities for part-time work—a flexibility that many workers currently lack ([Hardy, 2008](#)). Indeed, only 8% of men and 4% of women in our sample traced the downshifting or part-time throughout trajectories associated with the best health for their respective gender. That said, part-time opportunities should not come at the expense of wage rates, which, along with benefits, seem to suffer when older workers shift from full-time to part-time work ([Cahill et al., 2015](#); [Johnson, Kawachi, & Lewis, 2009](#)). Moreover, despite an apparent interest in working fewer hours among older employees ([Rix,](#)

[2011](#)), recent research suggests that the work hours of older workers have been increasing across successive cohorts ([Cahill et al., 2016](#); [Gendell, 2008](#)). What this trend implies for the relationship between labour market trajectories and health in later life is a worthy goal for future research.

Conflicting interests

None.

Contributions of authors

All named authors have made a substantial contribution to: (a) the conception and design, analysis and interpretation of data; and (b) the drafting of the article or revising it critically for important intellectual content. All approved the version submitted for review.

Ethical approval

Ethics Approval Not Required: The Ethics Review Board at the University of Toronto (the site at which the data analysis was conducted) does not require ethics approval for the use of secondary data, the type of data used in the submitted paper.

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Appendix A

Labour market sequences were constructed for each individual using 18 years of data (ages 52–69); these were then grouped using dynamic Hamming (DH) distances ([Lesnard, 2010](#)). DH distances belong to a class of measures representing the ‘cost’ of converting one person’s sequence (i.e., their set of labour market states at each age) to another’s. As such, they quantify how alike or distinct individual biographies are, one from another ([Abbott & Tsay, 2000](#)). Cases can then be grouped on the basis of these distances. DH is distinguished from other methods, such as traditional optimal matching ([Abbott, 1995](#); [MacIndoe & Abbott, 2004](#)), by its exclusive reliance on substituting one state for another in the sequence (and not inserting or deleting states) during the ‘conversion’ that determines distances. Avoiding insertions and deletions ensures that the timing of transitions to alternate states is preserved in the calculation of distances between sequences. It also avoids the arbitrariness of researcher-based cost assignment for insertions and deletions; rather, substitution costs are data-driven—based on the frequency of transitions between the two states in question, at the age under consideration. Higher costs are assigned to substitutions mimicking transitions that are rare at a given age, such as substituting employment for retirement at ages when few persons in the sample ‘unretire.’ Conversely, lower costs are attached to substitutions reflecting transitions that are more common, such as substituting retirement for employment at or near state pension age ([Fasang, 2010](#)). DH was implemented in Stata 13 using the `-sadi-` program ([Halpin, 2014](#)).

To group sequences, we calculated distances relative to a set of 12 ‘model’ later-life labour market biographies that were constructed using existing knowledge of employment and non-employment among older women and men in the US (e.g., [Cahill et al., 2015](#); [Cahill et al., 2016](#); [Calvo et al., 2013](#)). Model sequences were developed separately by all authors, and later inspected for overlap (found to be substantial) and unique patterns of theoretical interest. We were especially interested in capturing long-term employment trajectories that would reflect *process*, including continuity and change. Examples of the former are employment states that were (mainly) stable over many years, such as being employed full-time or part-time throughout, or being non-employed throughout. Change was built into the model biographies in two ways. One was through sequences in which

Table A1
Within group variance for each LMI trajectory, by gender.

	Men	Women
1. Full-time throughout	0.016	0.023
2. Part-time throughout	0.023	0.031
3. Full-time, part-time 65	0.010	0.016
4. Full-time, part-time 62	0.016	0.022
5. Full-time, exit 65	0.012	0.015
6. Full-time, part-time 57, exit 65	0.011	0.011
7. Part-time, exit 65	0.016	0.018
8. Full-time, exit 62	0.011	0.017
9. Part-time, exit 62	0.018	0.020
10. Full-time, exit 57	0.011	0.013
11. Part-time, exit 57	0.008	0.015
12. Non-employed throughout	0.011	0.013

incumbents ‘downshifted’ around state pension age, that is, went from full-time to part-time employment and continued to work. Another way we incorporated change was by specifying retirement at ages that reflected state pension eligibility (i.e., off-time—57, early—62, or full—65), and combining those exits with various work-hour pathways (i.e., downshifting before early pension eligibility and then retiring; or retiring from longer-term part-time or full-time work). Thus, our approach allowed us to incorporate the complexity of later-life employment trajectories, including various retirement processes that involved abrupt or gradual exits.

The model biographies were added to the dataset as reference sequences for the purposes of optimal matching, and discarded once cases had been matched to their closest model. Following matching, we generated a 13th (residual) group (10% of the sample) by pulling, from the original 12, cases deemed a less than ideal match to any reference sequence, based on their DH distance from the one to which they were closest (i.e., > 2 std dev from mean own group distance).

The validity of the model sequences was checked by examining within-group homogeneity and between-group heterogeneity using information on individuals’ ‘own-group’ distance measures. It bears repeating that because each individual is matched to their closest model biography (and many will not match in every detail), we speak of later-life labour market trajectory groups as comprising individuals who were *mostly* working full-time over a given age range, *mostly* working part-time, and so forth. Table A1 gives the within-group distance measure variance for each LMI group by gender. Although there are no statistical criteria for assessing absolute levels of variance, we can make several observations based on their relative values. For example, group 2 (part-time throughout) has the highest level of heterogeneity for both men and women. This suggests that there were more people in this group (than in others) whose sequences did not exactly match the part-time throughout reference sequence, but who were *closer* to that model biography than any other. This is not unexpected, given that part-time work, often precarious and short-term, may involve short spells of non-employment or full-time work when examined over an extended period. However, such spells would not have made these biographies a reasonably close match to any of the other reference sequences we defined. Other groups, such as those characterized by state-sanctioned exits (e.g., groups 5 and 8) are, not surprisingly, less heterogeneous. This is also the case for smaller groups in the sample (e.g., groups 6 and 11), where relative rarity means that reference sequences were more likely to be a fairly close match.

Between-group heterogeneity was assessed by comparing means on the distances from the ‘own-group’ model biography (diagonal) to means on distances from the same biography among individuals assigned to other LMI groups (off diagonal). Tables A2 and A3 present these values separately for men and women. Overall, the smaller values on the diagonal compared with those off the diagonal indicate that the LMI groups are well differentiated from one another. Off-diagonal cells with slightly lower mean distances involve pairs of biographies with turning points at age 62 vs. age 65 (e.g., groups 3 and 4; groups 5 and 8; and groups 7 and 9). These correspondences with respect to distances are to be expected since, with the exception of a fairly small (but substantively important) variation in timing, the reference sequences are otherwise identical to one another.

In addition to these validity checks, group-specific sample means for employment states at each age (Figs. A1 and A2) demonstrate for both genders that the original model biographies are well captured, and represent identifiable longer-term patterns in later-life labour market involvement. Groups 1, 2 and 12 show, respectively, mostly full-time, part-time and non-employment over the entire observation period. Groups 5, 8, and 10 (full-time-to-exits around ages 65, 62, and 57, respectively) show a steep drop-off from mostly full-time employment to mostly non-employment, with the exit occurring at progressively earlier ages. Groups 7, 9, and 11 have a similar pattern, but with exits preceded largely by part-time work. Groups 3 and 4 display a shift from mostly full-time to mostly part-time work around ages 65 and 62, respectively. And group 6 clearly passes through full-time, then part-time in the late 50s, then non-employment around the mid-60s. Finally, group 13 comprises those whose sequences were

Table A2
Mean distance from all LMI trajectories, men (assigned LMI on the diagonal).

Trajectory	1	2	3	4	5	6	7	8	9	10	11	12
1. Full-time throughout	0.10	1.85	0.54	0.82	0.53	1.32	1.83	0.81	1.84	1.32	1.84	1.85
2. Part-time throughout	1.78	0.14	1.30	1.02	1.79	1.01	0.63	1.81	0.93	1.83	1.44	1.91
3. Full-time, part-time 65	0.51	1.45	0.17	0.41	0.55	1.31	1.83	0.80	1.83	1.31	1.83	1.85
4. Full-time, part-time 62	0.87	1.10	0.44	0.20	0.85	0.99	1.51	0.87	1.78	1.31	1.83	1.84
5. Full-time, exit 65	0.51	1.85	0.57	0.82	0.15	0.92	1.44	0.40	1.43	0.91	1.43	1.43
6. Full-time, part-time 57, exit 65	1.31	1.13	1.27	1.08	0.87	0.31	0.73	0.82	0.88	0.90	1.32	1.37
7. Part-time, exit 65	1.82	0.56	1.76	1.51	1.44	0.70	0.23	1.42	0.46	1.44	0.97	1.44
8. Full-time, exit 62	0.86	1.87	0.87	0.90	0.36	0.85	1.36	0.13	1.10	0.54	1.06	1.07
9. Part-time, exit 62	1.81	0.96	1.82	1.81	1.30	0.84	0.44	1.02	0.17	0.97	0.56	1.04
10. Full-time, exit 57	1.32	1.89	1.33	1.34	0.81	0.90	1.37	0.51	1.06	0.16	0.63	0.60
11. Part-time, exit 57	1.82	1.45	1.83	1.84	1.30	1.29	0.92	0.99	0.61	0.56	0.19	0.54
12. Non-employed throughout	1.84	1.91	1.85	1.85	1.33	1.35	1.40	1.03	1.08	0.52	0.56	0.07

Table A3
Mean distance from all LMI trajectories, women (assigned LMI on the diagonal).

Trajectory	1	2	3	4	5	6	7	8	9	10	11	12
1. Full-time throughout	0.14	1.82	0.59	0.88	0.56	1.33	1.79	0.85	1.79	1.35	1.81	1.84
2. Part-time throughout	1.78	0.18	1.31	1.02	1.77	1.03	0.64	1.78	0.94	1.81	1.42	1.86
3. Full-time, part-time 65	0.56	1.42	0.20	0.44	0.59	1.31	1.80	0.81	1.80	1.31	1.81	1.83
4. Full-time, part-time 62	0.92	1.09	0.54	0.29	0.88	0.92	1.43	0.89	1.69	1.28	1.78	1.80
5. Full-time, exit 65	0.54	1.84	0.59	0.85	0.16	0.93	1.42	0.40	1.39	0.92	1.40	1.42
6. Full-time, part-time 57, exit 65	1.30	1.18	1.24	1.05	0.86	0.36	0.80	0.76	0.90	0.85	1.29	1.32
7. Part-time, exit 65	1.83	0.58	1.78	1.51	1.38	0.63	0.19	1.37	0.44	1.37	0.93	1.39
8. Full-time, exit 62	0.89	1.83	0.90	0.91	0.39	0.84	1.33	0.16	1.09	0.56	1.05	1.07
9. Part-time, exit 62	1.81	0.96	1.80	1.78	1.31	0.87	0.47	1.03	0.22	0.99	0.59	1.03
10. Full-time, exit 57	1.39	1.87	1.39	1.39	0.88	0.92	1.35	0.57	1.04	0.17	0.60	0.55
11. Part-time, exit 57	1.82	1.41	1.83	1.83	1.31	1.27	0.89	1.01	0.58	0.59	0.21	0.57
12. Non-employed throughout	1.86	1.89	1.87	1.87	1.35	1.36	1.37	1.04	1.07	0.54	0.56	0.06

not well matched to any of the model biographies and, as such, shows no regular over-time pattern. Further DH analyses (not shown) using model sequences derived from detailed inspection of the 13th (residual) group verified that no additional viable later-life LMI groups could be extracted. Notwithstanding our validity checks, it is wise to keep in mind that the later-life labour market model groups are not internally homogeneous, but rather, represent clusters of individuals with *similar* employment sequences.

Our method requires complete data on the sequence variables. When data were missing, we imputed values to retain as many cases as possible and thereby minimize bias. Values were filled in using a two-fold fully conditional multiple imputation specification (van Buuren, Brand, Groothuis-Oudshoorn, & Rubin, 2006) implemented in Stata -ice-. Two-fold ice was designed specifically for panel data to impute using all cross-sectional data, plus prior and subsequent values, for variables with missingness. In brief, the method computes, for each missing value, its posterior distribution conditional on other variables in an imputation model. A value is then sampled from this distribution under the assumption that missingness is random given the values of the other variables in the model. The method uses a Markov chain Monte Carlo algorithm. After double iteration of the algorithm, a complete dataset is created, consisting of a mix of imputed and known values. Enough complete datasets are generated—20, in our case—to ensure the accuracy of substantive model estimates (Graham, Olchowski, & Gilreath, 2007). All analyses are based on the simultaneous investigation of these 20 data sets, averaging over them to obtain estimates and deriving standard errors according to Rubin’s rules (Rubin, 1987) in order to accommodate the uncertainty associated with imputation.

Although we imputed some sequence values for some cases, all individuals in the analytic sample had information on labour market states for at least half the years from ages 52–69. We performed a sensitivity analysis (available on request) using a sample restricted to cases with complete information on later-life LMI (N = 4613, or 70.73% of the analytic sample). This analysis shows a slightly larger proportion male (48.27% vs. 45.78%, with a smaller share of these being members of a racial/ethnic minority—14.77% vs. 16.77%). The non-missing sample also contains, especially for women, a larger share in the LMI group most likely to be in poor health in the early 70s: continual non-employment (9.80% vs. 8.04% for men and 24.92% vs. 20.95% for women). (This is because answering “no” to a question asking if a non-employed respondent had ever worked for pay allowed us to back-fill non-employment for all prior years in the sequence, even if the individual had missed interviews.) Nevertheless, the total proportions in poor health in their early 70s are very similar in the two samples (25.6% vs. 25.7% for men and 27.0% vs. 26.8% for women). Conclusions from the regression analyses are broadly the same for both analyses, although significance levels are sometimes lower for the non-missing sample; and there is some evidence that the *very few* men (0.3%) who worked part-time and left in their mid-60s had better subsequent health than those with other biographies, even after controlling for earlier health.

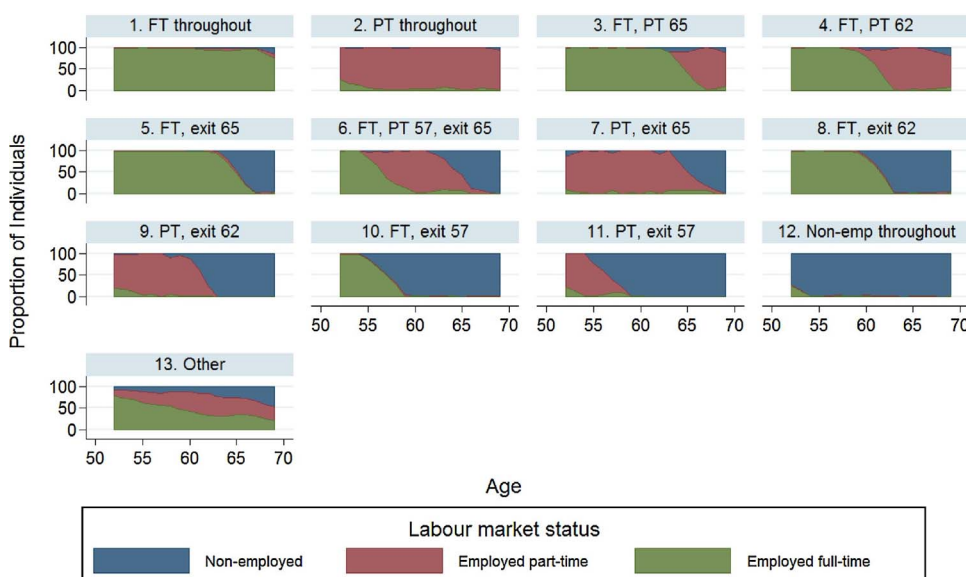


Fig. A1. Chronograms of labour market status, by LMI type for men in HRS born 1931 to 1941.

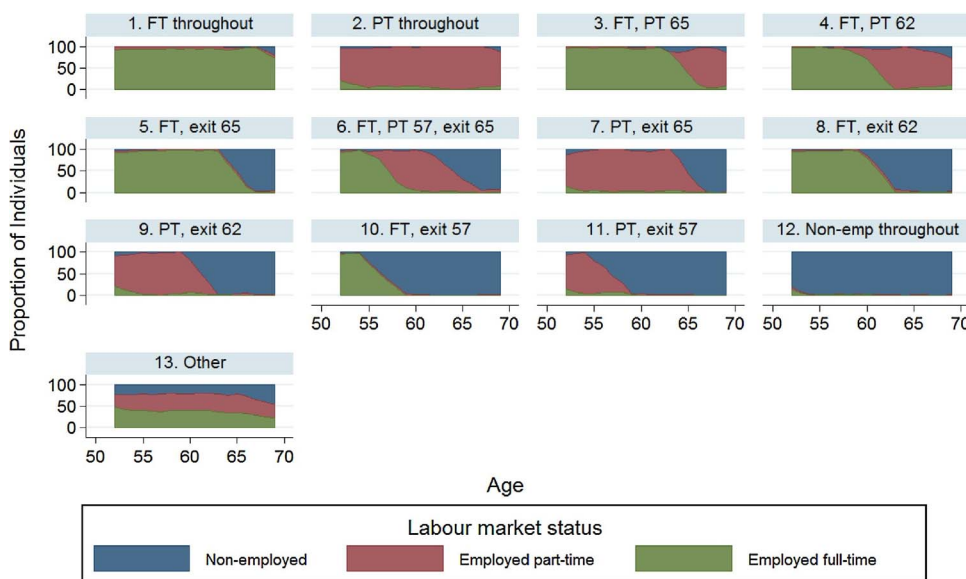


Fig. A2. Chronograms of labour market status, by LMI type for women in HRS born 1931 to 1941.

Appendix B. Supplementary data

Supplementary data associated with this article can be found, in the online version, at <http://dx.doi.org/10.1016/j.alcr.2017.09.002>.

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