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Long-Term Health Effects of Work Trajectories Among Middle-Aged and Older Adults: The Mediating Role of Work, Material, and Social Environments

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ABSTRACT

Using data from 14 waves (2003–2016) of the Korean Labor and Income Panel Study (KLIPS) ($N = 1,627$ individuals aged 45–64; 22,778 observations), in this study, we conducted sequence analysis and a multi-categorical variable mediation analysis (1) to examine to what extent long-term work histories exhibit varying degrees of de-standardization and precariousness using sequence analysis (2) to explore the potential mediating effects of work, material, and social environments in the association between multiple work sequences and self-rated health. We found the coexistence of a relatively stable long-term employment pattern and a high prevalence of precariousness. The health and economic risks of precarious work fall disproportionately on older workers. Future researchers should continue to analyze whether the COVID-19 pandemic will lead to long-term changes in the workforce to improve our understanding of and response to working in later life and its health effects.

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Introduction

The aging of populations in many developed countries has driven increasing interest among policymakers and scholars in how to make a longer work-life possible. Consequently, the concept of retirement has evolved from its traditional definition of complete withdrawal from the workforce to include many forms of modified work patterns in old age, including downshifting from full-time to part-time work, or what some refer to as “bridge employment” (Beehr, 2014; Cahill et al., 2016). Increasingly, research has adopted a life-course perspective on working late in life, in which various forms of labor market involvement covering an extended timeframe bridge the transition toward complete retirement (Calvo et al., 2017; George, 2013; Wahrendorf et al., 2018).

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Although there has been substantial research conducted to understand the heterogeneity in long-term work trajectories, most of the research has been conducted in Western countries, including Europe and the U.S (Warner et al., 2010; Abrams, Clarke, & Mehta, 2022; Blossfeld et al., 2006; Wainwright et al., 2019; Ogg & Renaut, 2019; Abrams, Clarke, & Mehta, 2022; Ebbinghaus & Hofäcker, 2013). Scholarly attention to documenting long-term work trajectories in the Asian context remains sparse. In a few international comparative studies (Ebbinghaus & Hofäcker, 2013; Hofäcker et al., 2016), for example, an Asian country was only briefly reviewed as one among multiple nations. The “productivist welfare state” (Holliday, 2000) based on Confucian culture with rapid changes in family structures can provide an excellent opportunity to understand the link between work trajectories and subsequent health outcomes in East Asian countries.

As an economically advanced country, Korea provides a unique context for empirical inquiry into the mechanism underlying the link between later-life work trajectories and health. The precariousness and high levels of job insecurity in later-life work is an important factor to consider. Korea ranked first in its employment rate for the 65-and-over age group among the OECD countries (male 42.1%, female 23.5%), and it ranked second in effective age of retirement, as men fully leave the labor market at the age of 71.1 years and women do so at 69.8 years (OECD, 2016). The fundamental reason for the high rate of later-life work may be low public pension income replacement and coverage rates, leaving older people with no choice but to work to cover their living costs. Many older adults are concentrated in low-skilled and low-wage jobs, as the transition to a service economy has sparked demand for labor in the service sector (Esping-Andersen, 2004). Cumulative research attests to the negative health effects of precariousness in work, but little is known about how it affects older workers.

We aim to extend the literature on later-life work trajectories by focusing on two understudied aspects. First, we investigate the extent to which long-term work patterns in middle and old age are associated with health in old age. Existing evidence about the link between later-life work and health is inconclusive (van der Heide et al., 2013), due to conceptual ambiguity (e.g., what constitutes precarious work) and static approaches to work experiences (e.g., short-term examination of transitions or changes in working status). We attempt to incorporate a dynamic perspective into examining the link between later-life work and health outcomes with an explicit focus on variations in precariousness and gender differences.

Second, this study examines potential pathways between long-term work trajectories and subsequent health with a focus on work, material, and social conditions following the framework proposed by Benach et al. (2014, 2016). In particular, we focus on the negative effects of precarious work (i.e., unstable and insecure jobs among various work trajectories). Even with theoretical implications, the empirical examination of the model is still limited, especially for older adults.

Precarious work, health, and the gender perspective

Despite the promise of initial evidence about work histories and their relationship with health, the pathways through which long-term work histories relate to health remain a “black box.” Focusing on transitions between unstable and insecure jobs, often referred to as “precarious” employment, a growing line of research has examined the deleterious health effects of transitions among various work categories in old age. “Precarious employment” refers to various employment statuses characterized by high levels of job insecurity and the overall erosion of workers’ employment and working conditions (Quinlan et al., 2001; Scott, 2004), and it is referred to using various other terms such as “atypical employment,” “contingent employment,” “flexible employment,” “temporary work,” “casual work,” “nonstandard work arrangements,” and “informal work” (Benach et al., 2014). Several studies have showed that precarious employment is one of the social determinants of a population’s health and health inequalities (Benach et al., 2014, for a review), while a long duration of employment in a high-skill occupation during midlife was associated with better cognitive health in old age (Kobayashi & Feldman, 2019).

The literature suggests several major pathways through which precarious work can negatively affect workers’ health (Benach et al., 2014; Park & Baek, 2019) (Figure 1). First, precarious workers experience higher exposure to poor working environments (e.g., physically demanding workloads and toxic exposure), which may increase the likelihood of occupational injuries and deterioration of health (Im et al., 2012). Precarious employment can be related to more experiences of job insecurity, feelings of powerlessness, and a sense of being out of control than among permanent, secure workers, which, in turn, leads to negative health consequences. The second pathway is related to the material consequences of precariousness. Work histories, particularly those including unstable and insecure

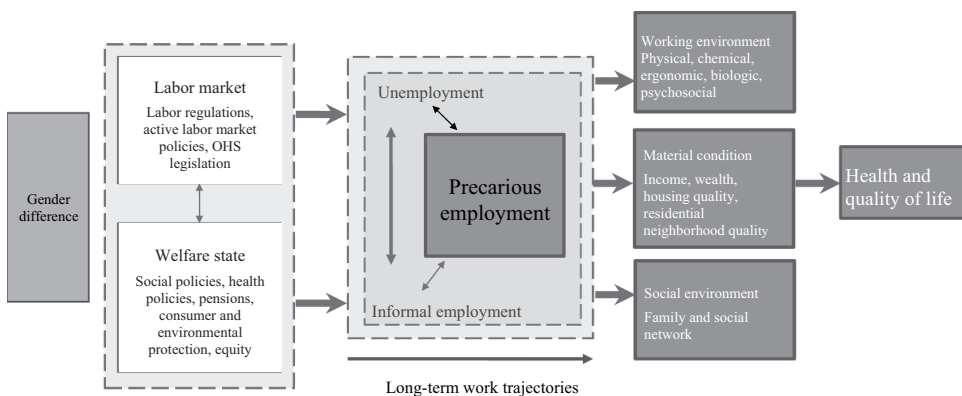


Figure 1. Conceptual Framework.

employment over time, may lead to lower income, which, in turn, may affect various social determinants of health outside the immediate sphere of production (e.g., access to health care, adverse lifestyles, and unhealthy housing conditions). In particular, precarious forms of employment result in under-protection from the main social risks, such as a lack of coverage from the national pension program and/or health insurance (J. Lee & Kim, 2017, author citation). The last factor is the social environment. Precarious employment is known to negatively affect workers' personal lives and family relations (Benach et al., 2014). Social support, the resources available within a social network, is an important determinant of later-life health (Liu, Gou, & Zuo, 2016). Social support is known to play a mediating role in the relationship between life stress and mental health (Xie, Peng, Yang, Zhang, Sun, Wu, & Su, 2018) and between job control and psychological stress (Blanch, 2016).

Furthermore, life-course studies have found gender-specific differences in labor market opportunities and work-related expectations and preferences. Under the social institutions that divide labor between genders (public, paid labor for one gender, and unpaid caring and domestic labor for the other) in many countries, women have long been subject to diverse career paths and exits from the labor market due to marriage, child-rearing, and other caregiving (Fisher et al., 2016; Han & Moen, 1999) during adulthood. Many women who leave the labor force return to work in part-time positions or remain outside the labor force permanently (Madero-Cabib, 2015; Tang & Burr, 2015). The career path of older women is more likely than that of their male counterparts to involve various forms of labor market participation (e.g., part-time, early withdrawal, non-employment), while higher shares of men continue to work full-time (Calvo et al., 2017; Worts et al., 2016; Tang & Burr, 2015; Wahrendorf et al., 2018). A few life-course studies have focused on women to examine the association between family care, work, and health in adulthood and old age (Benson et al., 2017) and the relationship between work history in midlife and cognitive health in old age (Kobayashi & Feldman, 2019).

South Korean context

As an economically advanced country, Korea provides a unique context for inquiry into the mechanisms underlying the association between the long-term work trajectory and the health of the elderly population. Korea ranks first in the rate of employment for those 65 and over among the OECD countries and has the second-highest retirement age (71.1 years of age for men and 69.8 years for women) (OECD, 2016). Korean seniors tend to remain in the labor market longer to avoid poverty (Y. Kim, 2015)) amid rapid demographic change and immature social security programs.

Evidence regarding the long-term patterns of later-life work in Korea is limited. Using retrospective information about retirement status, Hong and Kim (2010) examined the long-term retirement path among middle-aged and older men (aged 45 and older). They found eight distinctive patterns: (1) those who never worked, (2) early-retiring wage workers, (3) early-retiring self-employed individuals, (4) those who retired around age 60 (conventional retirement type) among self-employed individuals, (5) those who retired around age 60 (conventional retirement type) among wage workers, (6) self-employed workers working past age 60, (7) wage workers working past age 60, and (8) those working past age 70. The key finding was that the unconventional work groups had a lower average economic status and education level than the conventional retirement groups. Mirroring the literature on later-life work in general, the literature on precarious work usually focuses on the key economically active population, ranging from 15 to 64 years of age (Baek, 2014; Shin, 2013).

Work histories have typically been categorized in a simplistic way (i.e., full-time vs. non-full-time employees and wage workers or not). No specific consideration has been given to precariousness. In terms of stability or job security, there are four major categories of precarious wage employment in Korea: i) fixed-term contract work, ii) atypical employment, which includes dispatched workers, iii) subcontract and on-call work, and iv) part-time work (Park & Baek, 2019). In 2014, 68% of wage workers over the age of 60 were atypical workers, meaning they suffered from insecurity (KOSIS, 2015). Among wage workers who earned less than the minimum wage, 25.6% were over 55 (T. Kim, 2015). Importantly, in Korea, non-wage workers work much more irregularly than wage workers, and they are more likely to be excluded from social insurance. The majority of Korean workers over the age of 65 are non-wage workers, including self-employed or unpaid family workers. Therefore, it is important to use comprehensive work categories to best capture the work histories of middle-aged and older workers. In addition, the extent to which long-term work histories among middle-aged and older women are de-standardized and transitioned into groups of precarious workers is still unknown.

Conceptual model and study questions

Based on the conceptual framework guided by the existing literature on precarious employment and health (Benach et al., 2007, 2014), we structured our research questions as follows. First, we examined the extent to which long-term work trajectories vary in terms of precariousness among Korean middle-aged and older adults. We expected that women's long-term work patterns would be more likely to exhibit precariousness than those of men. Second, we examined the relationship between long-term work patterns in middle and old

age and health later in life. We expected to find that precariousness would be related to worse health for both men and women. Third, we examined the pathway of the effect of precarious employment on health through the working environment, material conditions, and social environment. We expected to find that a substantial part of the effect of precarious work on health would be mediated through working, material, and social conditions (indirect effect) and that a greater level of precariousness in work trajectories would likely be associated with lower job satisfaction, worse material conditions, and lower levels of social support, which, in turn, are related to worse self-rated health. While we expected that there would be a significant indirect effect of work trajectories on health through the three conditions above, we expected that the extent to which the effects of conditions mediated would vary. We expected that the mediating role of material conditions would be greater than that of the others because the Korean elderly experience a high level of poverty amid an immature social security program. We then implemented all the analyses separately by gender because the literature summarized above suggests important gender differences in all considered relationships. We expected that the extent to which the path between work trajectories and health would be mediated by social environments would be greater among women than men because women tend to have a greater dependence on social support than men (Rupert, Stevanovic, Hartman, Bryant, & Miller, 2012) to maintain psychological health (Soman, Bhat, Latha, & Praharaj, 2016).

Data and sample

We used the Korean Labor and Income Panel Study (KLIPS), a longitudinal survey of a representative sample of Korean urban household members aged ≥ 15 years, to examine the impact of long-term work history on workers' subjective health. Conducted annually since 1998, the KLIPS contains detailed information on participants' labor market activity and demographic characteristics. A sample of 5,000 households was selected from the 1995 Korean Census to represent urban households.

We restricted our sample to respondents aged between 45 and 64 years in 2003 and followed them for 14 years. We also excluded those who were absent from the labor force at any point during the entire observation period. The sequence analyses used in this study to classify labor market participation patterns require complete cases (Halpin, 2014). Therefore, we restricted the analyses to those for whom there was information on labor market participation and outcome indicators for the entire study period. The final sample included 1,627 individuals and 22,778 observations from those who participated in all 14 waves (men: 839, women: 788). Selecting a sample with non-missing main variables permitted us to develop a more accurate picture of middle-aged and older workers' lives

than would have been possible if we had included workers who dropped out (Worts et al., 2013). We conducted robustness checks with fewer waves of participation (8 wave, 10 wave, 12wave, 14wave) for both genders. We also compared our sample with the imputed sample for categorical time series to reduce bias with attrition. A comparison of the other samples with our analytical sample showed similar distributions for the main variables. Hence, we are convinced that the results based on our sample accurately reflect the social patterning of individualization processes.

Measures

Independent variable

Working status was categorized into eight groups: 1) not in the labor force (i.e., retired or jobless but not looking for a job), 2) permanent: non-low-skill, 3) permanent: low-skill, 4) temporary/part-time, 5) self-employed: small business (i.e., with fewer than five employees), 6) self-employed: larger business (i.e., with more than five employees), 7) unpaid family worker, and 8) unemployed. This measure reflects employment status (i.e., full-time, permanent, and secure employment vs. atypical employment) and occupational class (higher-skill, including managers, professionals, technicians, and craft workers vs. low-skilled, such as machine operators and laborers or manual workers. The latter categorization follows the Korea Standard Industry Code derived from the International Standard Classification of Occupations (ISCO) (International Labour Office, 1990) for wage earners (International Labour Office, 1990; Y. Kim et al., 2018). As self-employed individuals with fewer than five employees have historically been considered precarious workers (Y. Kim et al., 2018), this study included two types of self-employed workers, depending on the number of people they employed. An “unpaid family worker” refers to those who work for a family business and are not paid. Unpaid family workers typically lack the protection offered to employees and are considered precarious workers (Perry et al., 2007). South Korea has a significant proportion of unpaid family workers, particularly women and adults over the age of 55 (OECD, 2008).

Dependent variable

Self-rated health was obtained from the last wave of this study and was measured based on a question in which respondents were asked to rate their current health on a five-point scale from excellent (= 1) to very poor (= 5).

Mediating variables

Six indicators of working environments, such as working conditions, material conditions, and social environments, were included as mediators in our analyses. To reflect working environments during our study period, the mean value of each mediator was included in our analyses. We used job satisfaction to assess the working conditions based on the “quality of life” perspective (Bauer, 1966; Piasna, Burchell, Sehnbruch, & Agloni, 2017). Job satisfaction was based on a nine-item measure with five-point response scales (1=very dissatisfied, 5=very satisfied) as a proxy for working conditions. The items included questions such as “I’m satisfied with the job I’m currently doing,” “I’m glad to have joined this company,” “I enjoy this job,” “I feel this job is personally rewarding,” and “I would like to continue this job if other things remain the same.” The mean score of the nine items was calculated in each wave, and the mean value across the 14-year study period was used in our analysis. For material conditions, we included three variables: the mean value of log-transformed *wage/non-wage monthly income* across 14 waves, whether a respondent received his/her *public pension* benefit or *private family financial support* during the last wave, and the mean value of *satisfaction with family relations* and *social relations* (1=very dissatisfied, 5=very satisfied) across all waves used for social environments.

Covariates

We controlled for various demographic and socioeconomic factors that could influence the outcome variable, self-rated health. Age and number of household members were measured as continuous variables. Education included eight categories, but it was ordinal and treated as a continuous variable (1=no schooling, 8=graduate school (doctoral level)). Metropolitan area was coded binarily as metropolitan (= 1), including seven major cities: Seoul, Busan, Daegu, Daejeon, Gwangju, Incheon, and Ulsan, versus non-metropolitan (= 0). We used the log-transformed total household assets. Before the log transformation, we added 0.1 value to each income value to address zero values in the data. Following previous studies (Do, 2008; Elliott et al., 1999; Wahrendorf et al., 2018), we also controlled the health condition of the respondent by using the variables of the number of functional limitations a respondent had at age 58 and the inability to work due to illness/disability of the respondent.

Analytical strategies

We adopted sequence analysis (Aisenbrey & Fasang, 2010) and mediation analysis to examine the relationship between long-term work history and health between the ages of 45 and 64. We used sequence analysis to convert

employment history sequences into clusters representing prototypical employment trajectories that accounted for the order, timing, and duration of employment states. The analyses were performed in two steps. First, we applied sequence analysis to group those with similar later-life employment histories into empirically distinct clusters (Abbott, 1995; Aisenbrey & Fasang, 2010). More specifically, we used sequence analysis to compare each individual's employment history to all other histories and calculated the differences (pairwise distances) between each individual sequence and the others. For each year between ages 45 and 64, we measured eight categories of work status (not in the labor force, permanent non-low-skill, permanent low-skill, temporary/part-time, self-employed in a small business, self-employed in a large business, unpaid family work, and unemployed).

Once all individuals' trajectories were defined for work history, we used the Dynamic Hamming distance as the means of assessing the "distance" of each sequence from every

other. Differences (or "distances") are calculated based on the number of operations necessary to make one sequence identical to another. The similarity comparison results in a matrix that summarizes the distance between all possible sequence pairs. We ran our sequence analysis using other algorithms (OMA with different insertion/deletion costs).

Consistent with previous research (Halpin, 2014), we found that the trajectories identified with the various algorithms were very similar. The Dynamic Hamming algorithm builds on the Hamming distance measure, which manipulates and transforms sequences until they are turned into one another by substituting one element for another. The fewer substitutions required, the more similar the sequences are deemed to be (Lesnard, 2010). Ultimately, this generates a "distance matrix" that quantifies the distances between each pair of individuals in the sample. This matrix can then be used in cluster analyses, enabling the identification of empirically homogeneous groups with similar sequences. Calculations and graphs are based on the sq-Package of Brzinsky-Fay and Kohler (Brzinsky-Fay et al., 2006).

Drawing on the pairwise distance matrix, cluster analysis was used to identify empirically homogeneous groups with similar sequences. Ward's (1963) hierarchical minimum variance method was applied to obtain information about the ideal number of clusters in the sample. The number of clusters was determined using multiple criteria (Milligan & Cooper, 1987): (a) an atypical decrease in overall between-cluster variance (R^2) and increase in within-cluster variance (Ward, 1963), with no reverse trend in subsequent steps; (b) simultaneous elevation of the pseudo- F statistic over the pseudo- T^2 statistic; and (c) a peak in Searle's cubic clustering criterion. We then created graphs illustrating individual sequences and sequence types. Individual sequences portray the sequences of each individual composing a sequence type, whereas sequence types gather individual sequences into a more holistic

and abstract cluster. (Full information about sequence analysis is provided in the technical appendix.)

Second, we investigated the potential mediating effects of work, material, and social environments in the association between multiple work sequences and self-rated health.

In the mediation analysis, we conducted a multi-categorical variable mediation analysis to test the indirect effect of potential mediators in a regression model using the nonparametric resampling bootstrapping procedure of Hayes and Preacher (2014). In the present analyses, the mediating effects of the respective environments were obtained based on the nonparametric bootstrapping method with 5,000 resamples to calculate the 95% confidence interval. Six independent mediation models (i.e., job satisfaction/work environment, income level, receipt of old-age pension and private transfer in the material environment, satisfaction with family relations, and satisfaction with social environment relations) were run by gender. All statistical analyses were performed using STATA 15.

Results

Sample

Table 1 presents the characteristics of the sample. The total sample included more men than women (839 vs. 788). The gender difference in the overall pattern of working at the baseline (year 2003) was clear: Among men, 4.89% of the respondents were not in the labor force, while the proportion was much higher among women, at 17.64%. The proportion of temporary/part-time jobs was similar, but men showed a much higher rate (17%) of working in permanent low-skill jobs than women (11%). The biggest difference was, not surprisingly, found in unpaid family work: less than 2% of men worked in a family business without pay, while 22% of women had a nonpaying job as a family worker. In addition, there were clear gender disparities in socioeconomic and health status: women had a lower level of education and assets. More women (3.05%) than men (1%) reported that they had to discontinue working because of health problems.

Work sequence and cluster analysis

Sequence analysis identified prototypical work trajectories. Six work sequences were identified for men, whereas four were identified for women (Figure 2 for men, Figure 3 for women). Chronograms (left) and sequence index plots (right) were produced to illustrate the clusters. The chronograms provided the cumulative frequency of each work type in percent, and sequence index

Table 1. Characteristics of the study sample, the Korean Labor and Income Panel Study (KLIPS), 2003–2016.

Characteristics (%, mean (sd))	First wave (yr. 2003)			Last wave (yr. 2016)	
	All wave	Men (N = 839)	Women (N = 788)	Men (N = 839)	Women (N = 788)
Work status					
Not in labor force	5358 (23.52%)	41(4.89%)	227 (27.06%)	139 (17.64%)	349 (44.29%)
Permanent:non-low skill	2622 (11.51%)	162 (19.31%)	77 (9.18)	109 (13.83%)	39 (4.95%)
Permanent:low skill	2544 (11.17%)	142 (16.92%)	93 (11.08%)	88 (11.17%)	37 (4.70%)
Temporary/Part time	3998 (17.55%)	126 (15.02%)	154 (18.36%)	134 (17.01%)	162 (20.56%)
Self-employed: small	5876 (25.80%)	316 (37.66%)	265 (31.59%)	141 (17.89%)	108 (13.71%)
Self-employed: large	257 (1.13%)	28 (3.34%)	12 (1.43%)	2 (0.25%)	0
Unpaid family worker	1988 (8.73%)	15 (1.79%)	11 (1.31%)	170 (21.57%)	93 (11.80%)
Unemployed	135 (0.59%)	9 (1.07%)	0	5 (0.63%)	0
Work environment					
Job satisfaction (1–5)	3.02 (0.35)	2.93 (0.54)	2.86 (0.49)	3.13 (0.46)	3.10 (0.45)
Material environment					
Wage/non wage income (log transformed)	1.48 (1.34)	1.18 (1.82)	1.75 (1.52)	1.13 (2.36)	0.68 (1.24)
Receipt of public pension	64.99%	7%	57.21%	9%	59.64%
Private transfer from families/relatives/ friends	55.20%	11%	65.55%	13%	73.35%
Social environment					
Satisfaction with family relation (1–5)	3.57 (0.36)	3.41(0.60)	3.65 (0.54)	3.35 (0.60)	3.40 (0.54)
Satisfaction with social relation (1–5)	3.41 (0.32)	3.63(0.60)	3.45 (0.56)	3.55 (0.66)	3.56 (0.57)
Self-rated health (1–5)	3.14 (0.81)	3.34(0.82)	3.23 (0.80)	3.01 (0.87)	3.03 (0.79)
Controls					
Age	59.52 (6.91)	53.08(5.61)	66.08 (5.61)	52.96 (5.62)	65.96 (5.62)
Married	80%	91.90%	88.20%	78.68%	64.72%
Education (1–8)	4.21 (1.29)	4.61(2.87)	4.64 (1.27)	3.74 (1.12)	3.77 (1.17)
# of household members	2.94 (1.22)	3.78(1.12)	2.56 (0.96)	3.47 (1.31)	2.22 (1.05)
Metropolitan area	53%	56.73%	51.85%	54.31%	51.40%
Asset (log transformed)	3.78 (2.90)	3.61(4.68)	5.33 (4.52)	2.97 (4.62)	4.54 (4.66)
Unable to work due to illness/disability	2.25%	1.31%	1.55%	3.05%	1.78%
Functional limitation at the age of 58	0.09 (0.28)	7.32%	0.07 (0.26)	11.17%	0.11 (0.31)

plots visualized how fragmented individuals' employment trajectories and labor history across genders were.

Our labeling of work trajectory clusters is based on working status, which provides the ground of precariousness. For men, “self-employed in small

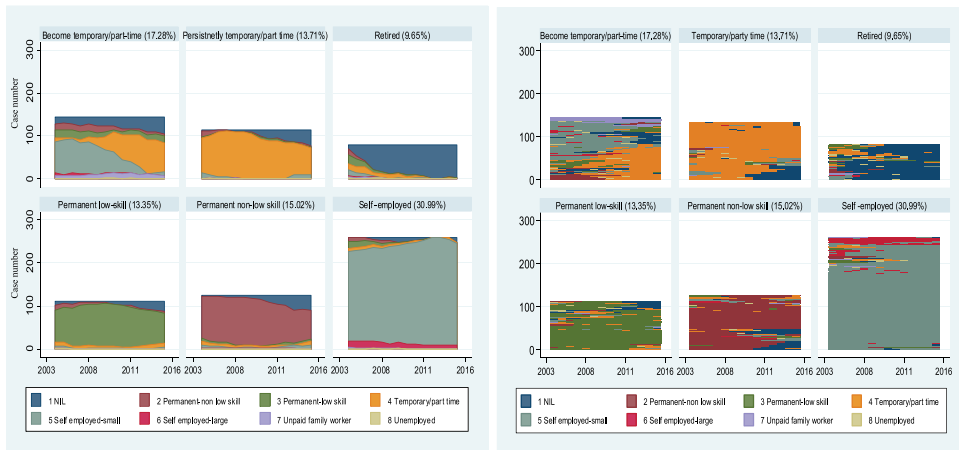


Figure 2. Work Histories of middle and old-aged men over the period of 14 years.

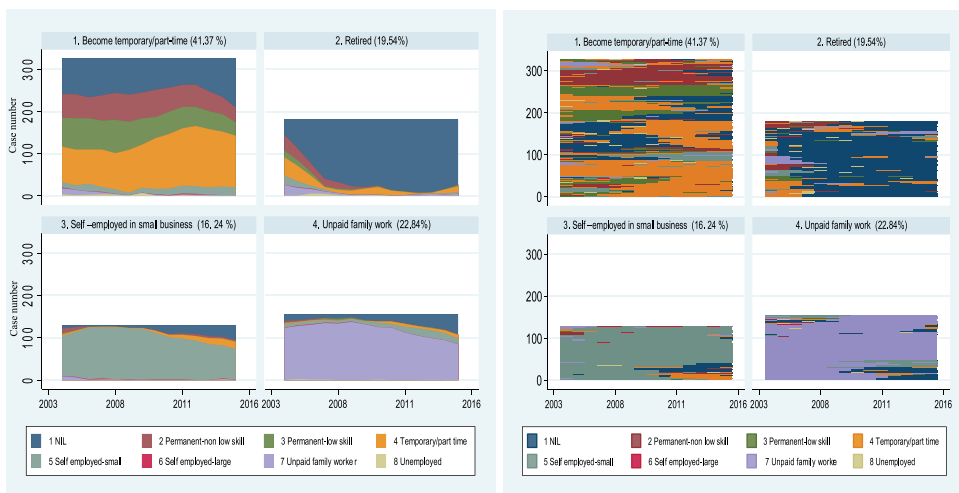


Figure 3. Work Histories of middle and old-aged women over the period of 14 years.

business” was the most prevalent employment path, followed by 30.99% of individuals. Here, most individuals were self-employed in small businesses and remained in this status until the end of the observation period. The second type, “become temporary/part-time,” was the employment trajectory followed by 17.28% of the sample and illustrated the transition to temporary/part-time work from self-employment and permanent-low skill jobs. The third type, “permanent/non-low skill” (15.02%), indicates individuals working steadily in the permanent/non-low skill area. This group experienced the highest job security in their life history in terms of job security and working environment. The fourth type, “persistently temporary/part-time,” representing 13.71% of the sample, reflects individuals who were persistently working as temporary/

part-time workers. This group experienced the most severe precarity regarding workers' employment and working conditions. The fifth type, "permanent/low-skill" (13.35%), included those persistently working in permanent low-skill jobs. People in this group experienced some degree of job insecurity, but they were more secure than those in the fourth group, persistently temporary/part-time. The last type, "fully retired" (9.65%), included people retiring from the labor force.

For women, becoming temporary/part-time (41.37%) was the most prevalent trajectory, which reflects the paths of individuals who gradually moved to temporary/part-time work. The second type, unpaid family work (22.84%), indicates individuals working mostly in unpaid family work positions. The third type was the fully retired type (19.54%), and the last type was composed of those who were self-employed in small businesses (16.24%).

Direct effect of work sequences on self-rated health

Among older men, compared to those who became part of the temporary/part-time group, the members of the fully retired group were likely to have a lower level of self-rated health across all models, with different mediators (Table 2). Among older women, unpaid family workers were likely to have higher self-rated health ($b = 0.159, p < .01$) in the model with job satisfaction as a mediator. In both genders, the findings from the supplementary analyses with different reference groups showed fairly consistent results (results not shown).

Mediation effect of work, material, and social factors in the association between work sequences and self-rated health

Among older men, job satisfaction and satisfaction with family and social relations mediated the relationship between some of the work sequences and self-rated health. Three aspects of material conditions (wage/non-wage income, receipt of public pensions, and private transfers from families) had no effect. Job satisfaction significantly mediated the relationship between most work sequences and self-rated health, but not for the fully retired (Table 3). The "become temporary/part-time" group was used as a reference group.

Specifically, in terms of job satisfaction, "persistently temporary/part-time" was likely to have a lower level of job satisfaction ($b = -.145, p < .001$), which was associated with lower self-rated health (indirect effects = -0.058) compared to the "become temporary/part-time" group. "Permanent low-skill" ($b = 0.123, p < .001$), "permanent non-low-skill" ($b = 0.297, p < .001$), and "self-employed in small business" ($b = 0.103$, respectively) were likely to have a higher level of job satisfaction, which led to higher self-rated health (indirect effects = 0.049 , 0.119 , and 0.041 , respectively) compared to the "become temporary/part-

Table 2. Direct effect of work sequences on self-rated health among older men and women.

DV Sequence		Self-rated health											
		Job satisfaction		Wage/Non wage Income		Pension Receipt		Private Transfer		Family Satisfaction		Social Satisfaction	
		Coefficient	SE	Coefficient	SE	Coefficient	SE	Coefficient	SE	Coefficient	SE	Coefficient	SE
Older men	Estimate												
	Persistently temp/Part-time	-.053	.095	-.109	.096	-.113	.095	-.112	.094	-.064	.094	-.063	.093
	Fully Retired	-.271**	.114	-.277**	.112	-.259**	.108	-.259**	.108	-.246**	.107	-.228**	.106
	Permanent Low-Skill	-.054	.095	-.008	.095	-.005	.095	-.006	.095	-.008	.094	.003	.093
Older women	Permanent Non-low skill	-.103	.099	.011	.096	.014	.095	.014	.095	.006	.094	.004	.094
	Self-employed in small business	.044	.078	.084	.078	.085	.078	.086	.078	.073	.077	.072	.077
	Fully Retired	.088	.075	.011	.073	.006	.071	.004	.071	-.029	.070	-.021	.070
	Self-employed in small business	.039	.076	.023	.078	.022	.077	.021	.078	.019	.070	.014	.076
	Unpaid family workers	.159**	.076	.112	.077	.107	.076	.107	.076	.068	.075	.077	.075

Note: Reference for IV is Become temporary/part time group. Age, married, education, number of household members, metropolitan area, asset (log transformed), unable to work due to illness/disability, functional limitation at the age of 58 were used as control variables.

*** $p < .001$, ** $p < .01$, * $p < .05$.

Table 3. Indirect effects of mediating factors between work sequences and self-rated health among older men.

Independent variable (IV):	Mediator (M):	Dependent variable (DV):	IV on M		M on DV		IV on DV		Mediating effect of M					
			Effect of IV on M	SE	Effect of M on DV	SE	Direct effect of IV on DV	SE	Indirect effect	Boot SE	Boot LLCI	Boot ULCI		
Work environment: Job satisfaction														
Persistently Temporary/Part- time		Self-rated health	-.145***	.035	.402***	.09	-.053	.094	-.058**	.019	-.104	-.028		
Fully Retired			-.052	.043	.402***	.09	-.271**	.113	-.021	.019	-.062	.014		
Permanent Low – skill			.123***	.035	.402***	.09	-.054	.094	.049**	.018	.020	.094		
Permanent Non low – skill			.297***	.036	.402***	.09	-.103	.098	.119**	.034	.061	.197		
Self-employed in small business			.103***	.029	.402***	.09	.044	.077	.041**	.015	.016	.079		
Social Environment: Satisfaction with Family Relations														
Persistently Temporary/Part- time		Self-rated health	-.118***	.031	.408***	.090	-.064	.093	-.048**	.019	-.094	-.018		
Fully Retired			-.030	.040	.408***	.090	-.246**	.106	-.012	.019	-.055	.023		
Permanent Low – skill			.007	.035	.408***	.090	-.008	.093	.003	.015	-.027	.034		
Permanent Non low – skill			.020	.035	.408***	.090	.006	.094	.008	.015	-.019	.042		
Self-employed in small business			.031	.029	.408***	.090	.073	.076	.012	.012	-.008	.043		
Social Environment: Satisfaction with social Relations														
Persistently Temporary/Part- time		Self-rated health	-.100***	.034	.490***	.091	-.063	.092	-.049**	.019	-.092	-.016		
Fully Retired			-.062	.039	.490***	.091	-.228**	.105	-.030	.022	-.082	.008		
Permanent Low – skill			-.018	.035	.490***	.091	.003	.092	-.009	.017	-.046	.022		
Permanent Non low – skill			.022	.035	.490***	.091	.004	.093	.010	.017	-.020	.047		
Self-employed in small business			.029	.028	.490***	.091	.072	.076	.014	.015	-.013	.046		

Note: Reference for IV is Become temporary/part time group. Age, married, education, number of household members, metropolitan area, asset (log transformed), unable to work due to illness/disability, functional limitation at the age of 58 were used as control variables.

*** $p < .001$, ** $p < .01$, * $p < .05$.

time” group. Supplementary analyses with different reference groups (Figure S1) provided a richer set of findings. In terms of satisfaction with family and social relations, the “persistently temporary/part-time” group was likely to have a lower level of satisfaction with family relations ($b = -0.118$, $p < .001$) and social relations ($b = -0.100$, $p < .001$), which led to lower self-rated health (indirect effects = -0.048 and -0.049 , respectively).

Among women, job satisfaction and satisfaction with family relations mediated the relationships between some of the work sequences and self-rated health. Compared to the “become temporary/part-time” group, those who were unpaid family workers were likely to have lower job satisfaction ($b = -0.126$, $p < .001$), which led to a lower level of self-rated health (indirect effect = -0.045). In terms of family relations, the “fully retired” and “unpaid family worker” groups had higher satisfaction with family relations ($b = 0.072$, $p < .01$; 0.081 , $p < .01$), which led to higher self-rated health (indirect effects = 0.038 and 0.034). (Table 4).

Discussion

Drawing from precarious work and health literature, in this study, we examined the relationship between long-term work trajectories and health in a hitherto understudied non-Western context and explored the mediating roles of material, working, and social environment conditions. This study further examined the gender-specific effect of work trajectories and pathways on health. This study makes several key contributions to the literature on later-life work, providing (1) empirical knowledge about precarious work among middle-aged and older adults in understudied institutional and cultural contexts, (2) theory-based empirical examination of a complex pathway toward later-life health, and (3) an examination of gender differences in those associations.

First, we identified long-term work trajectories among middle-aged and older workers. We found a large proportion of workers in precarious jobs: those with persistently temporary (13.71%) and temporary (17.28%) jobs comprised more than 40% of the population among men. For women, temporary or part-time work (41.37%) and unpaid family work (22.84%) accounted for more than 60% of the population. Except for one group, “become temporary/part-time,” all other work groups showed a highly stable pattern of work status and nature throughout middle and old age. For both genders, the overwhelming majority were precarious workers: among men, 75.33% were either “become temporary/part-time,” “persistently temporary/part-time,” “permanent low-skill,” or “self-employed in small business.” Among the women, 80.45% were “become temporary/part-time,” “self-employed in small business,” or “unpaid family workers.”

Table 4. Indirect effects of mediating factors between work sequences and self-rated health among older women.

Independent variable (IV):	Mediator (M):	Dependent variable (DV):	IV on M		M on DV		IV on DV		Mediating effect of M			
			Effect of IV on M	SE	Effect of M on DV	SE	Direct effect of IV on DV	SE	Indirect effect	Boot SE	Boot LLCI	Boot ULCI
Work history												
Fully Retired	Work environment:	Self-rated health	-.064*	.030	.355***	.088	.050	.074	-.023	.015	-.059	.000
Self-employed in small business	Job satisfaction		-.047	.031	.355***	.088	.039	.076	-.016	.011	-.045	.001
Unpaid family workers												
Fully Retired	Social Environment: Satisfaction with	Self-rated health	-.126***	.031	.355***	.088	.159**	.076	-.045***	.017	-.085	-.017
Self-employed in small business	Family Relations		.072**	.029	.477***	.084	-.029	.069	.034**	.016	.007	.071
Unpaid family workers			.003	.032	.477***	.084	.019	.075	.001	.016	-.030	.035
			.081**	.031	.477***	.084	.068	.075	.038**	.015	.013	.074

Note: Reference for IV is Become temporary/part time group. Age, married, education, number of household members, metropolitan area, asset (log transformed), unable to work due to illness/disability, functional limitation at the age of 58 were used as control variables.

*** $p < .001$, ** $p < .01$, * $p < .05$.

The coexistence of relatively stable long-term employment and precariousness reflects the unique Korean context. Before the Asian financial crisis in 1998, which led to an explosion in early or involuntary retirement and job loss, Korean labor markets offered greater employment security and benefits to workers, especially those in large firms (K.-A. Lee, 2016) (Yu, 2009).; Simultaneously, the transition to a service economy sparked demand for service-sector jobs, which are often poorly paid (Esping-Andersen, 2004). The immature social security programs and rapid erosion of the traditional family system leading to a notable decrease in financial support from children have exacerbated poverty among the elderly and pushed older people to remain in the labor market, even if the jobs they can acquire are poorly paid and unstable. Consequently, the majority of current older workers appear to have continued their work in precarious jobs into old age. The predominance of self-employed small business owners also seems to reflect this phenomenon.

Consistent with our expectations, precariousness in long-term work trajectories was more pronounced among women, with a much higher proportion in the “become temporary/part-time” category (41.37% for women and 17.28% for men). The fact that this group is the largest subgroup of older women reveals the long-term vulnerability of female Korean workers. In Korea, it is well known that the employment trajectory among younger women has long been characterized by an M shape with a peak in the early 20s, interrupted by child-bearing and family care until the 40s and 50s (H. Y. Kim, 2010). After career interruptions, returning to the labor market with stable and secure jobs is desirable but it is difficult to achieve, so many women remain outside the labor force or work part-time or temporary jobs. In addition, there is a distinct over-representation of women working in family businesses without pay. Previous studies have consistently shown that unpaid family workers are mostly women and the coworkers of their spouses in Korea (Ahn, 2016; Moon & Kang, 2017).

For the second research question, we examined the extent to which long-term work patterns directly influence later-life health. For both men and women, we expected to find that a higher level of precariousness would be related to worse health. Contrary to our expectations, we did not find any noticeable direct effect of precarity on self-rated health. Among older men, when compared to the “temporary/part-time” group, the group with the greatest characteristic of precariousness, older men in the “fully retired” group were likely to have a lower level of self-rated health. Results from a series of additional analyses with different reference groups consistently indicated that the “fully retired” group was more vulnerable to poor health in old age. This finding suggests that regardless of work trajectories, the maintenance of working status may play a substantial role in health. This finding aligns with research indicating that early retirement is associated with a higher mortality rate (Bamia et al., 2008; Waldron, 2001) as maintenance of

employment is likely to improve mental health and life satisfaction (Behnck, 2009; Kuhn et al., 2011). Among older women, unlike older men, complete withdrawal from work (i.e., becoming fully retired) did not have any meaningful influence on health. Nevertheless, it is plausible that the labor market precarity of unpaid family workers, particularly women, might be diluted at the household level. Family workers may not be paid as individuals but may benefit from financial resources from the family business.

Lastly, we explored whether and to what extent work, material, and social environment conditions mediate work history and self-rated health. Among older men, two major findings emerged: compared to the “become temporary/part-time” group, (1) the “fully retired” group and the “self-employed in small business” group were likely to have higher self-rated health through job satisfaction compared to various types of work, and (2) the “persistently temporary/part-time” group was more likely to have lower self-rated health through job satisfaction and lower satisfaction with family and social relations (Figure S1, S2). Among older women, unpaid family workers had a lower level of job satisfaction, which was significantly related to lower self-rated health. In terms of family relations, fully retired people and unpaid family workers had higher satisfaction with family relations, which led to higher self-rated health. The importance of family relations emerged for both men and women, but the degree of the mediating role among women was slightly greater than among men, which supports our hypothesis.

Precarity is not necessarily related to worsened family relations among women. Compared to the “become temporary/part-time” group, fully retired people and unpaid family workers had lower job satisfaction but greater satisfaction with family relations. This contrasts with the case of men, where “persistently temporary/part-time” had lower job satisfaction and satisfaction with family and social relations. This points to important future research that can look into whether the mechanism linking work trajectories and health differs by gender.

In addition, it is interesting to note that the mediating role of satisfaction with social relations was only significant among older men but not older women. The gender differences found in the role of social relations may be linked to the broader cultural context in Korea. Compared to older women, older men are more likely to have stable and consistent opportunities to engage in various social activities, which mostly tend to come from the social network based on their job. Older women, on the other hand, tend to have limited opportunities for developing and engaging in various leisure activities due to the lack of equivalent social networks. Previous research has showed that older men in Korea are more likely to spend their time on work and social activities, while older women spend more time on housework or caregiving (D. Lee et al., 2011).

It is intriguing that material conditions (wage/non-wage income, receipt of public pensions, and private transfers) did not have any significant mediating role. We speculate that the lack of a relationship may be due to the lower proportion of older adults receiving public pensions in Korea. As in many other countries facing economic recessions, during the late 1990s, Korea pursued various employment policies that liberalized the labor market, which contributed to the expansion of early (often involuntary) exits from the labor market, unemployment, career breaks, and the creation of a host of precarious jobs. The fundamental reason for the high rate of working later in life in Korea is the limited welfare system for older people (i.e., low public pension income replacement and coverage rate), leaving older people no choice but to work to cover their living expenses.

The present study shows that in a society without a well-established income security system for old age such as Korea, later-life work is not “productive” or “successful,” as has often been suggested by literature, mostly from developed Western countries. Rather, the overwhelming majority of long-term work from middle age to old age in Korea is characterized by precariousness. The expansion of precarious work is a global trend that is shaping the changing nature of work. This trend can disproportionately affect precarious workers, especially in emerging welfare states such as Korea, which provides relatively limited coverage of workers through social policy and social insurance programs compared with other developed welfare states. Since the extreme economic and social consequences of COVID-19 have become apparent, in Korea, various support packages have been deployed for wage workers and the self-employed, including a new national-level effort to expand unemployment insurance to all wage workers and self-employed workers. However, unpaid family workers have not been included. Our findings point to the importance of labor laws and social policies that can increase stability and security for workers, reduce labor market inequalities, and ensure that workers in such jobs have access to social protections, including unemployment insurance, healthcare, and public pensions. Work and life balance policies and workplace interventions should promote better health through the pathway of satisfaction with family relations and job satisfaction.

This study had several limitations. First, this study followed individuals aged 45 to 64 for 14 years, and this wide time window of observation age may have resulted in within-group heterogeneity in terms of generations and age. Our decision regarding the age range of this sample was based on the existing literature, as well as being a reflection of the unique Korean phenomenon of a high rate of later-life work (Ahn & Yoo, 2020). Furthermore, we focused more on the gender differences in work trajectory and sought to gain sufficient observations to define sequences for men and

women. Korea has relatively high levels of gender inequality in terms of pay and employment compared to other OECD countries (OECD, 2017). Further studies are needed to examine gender and cohort/generational differences.

Second, there remains a possibility of selection bias and reverse causality, such as the healthy worker effect. This phenomenon suggests that healthier workers tend to work longer, whereas those with poorer self-rated health are more likely to retire earlier. To address these issues, we constructed a longitudinal research model that incorporated work trajectory and self-reported health in the last wave, rather than a cross-sectional research design. We also controlled for potential confounding variables, such as the number of functional limitations and the respondent's inability to work due to illness or disability. Such biases may provide avenues for future research.

Third, in this study, we focused on work status because our focus was primarily on identifying the long-term pattern of detailed work status. However, it was empirically challenging to combine the employment statuses of eight categories with various other indicators such as more details of occupations, industrial sectors, and wage/income levels. In addition, although we were aware of the importance of caregiving demands (M. Kim, 2018; Schulz, 2020; Y. Lee & Tang, 2015) and spousal labor force participation status on labor force behavior and health conditions, we could not include those variables due to data limitations.

The extreme economic and social consequences of COVID-19 disproportionately affect precarious workers within and across nations. There is considerable uncertainty about the course of the pandemic and its connection to ill-health of workers. Future research should continue to analyze whether the COVID-19 pandemic will lead to long-run changes in the workforce, ideally at different age groups across the life course, to improve our understanding and response to working in later life and its health effects.

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