WILEY **Journal of Occupational Health**

Job characteristics as risk factors for early retirement due to ill health: The Korean Longitudinal Study of Aging (2006-2014)

Mo-Yeol Kang MD, PhD iD | **Jun-Pyo Myong MD, PhD** iD | **Hyoung-Ryoul Kim MD, PhD** iD

Department of Occupational and
Environmental Medicine, College of
Medicine, The Catholic University of
Korea, Seoul, Republic of Korea

*Correspondence
Hyoung-Ryoul Kim, Department of
Occupational and Environmental Medicine,
College of Medicine, The Catholic
University of Korea, Seoul, Republic of
Korea.
Email: cyclor@catholic.ac.kr

Abstract

Objectives: To investigate work-related factors that contribute to early retirement due to ill health (ERIH) in middle-aged and elderly people in Korea.

Methods: Data were collected from a sample from the first through the fifth phases of the Korean Longitudinal Study of Aging which was conducted biennially from 2006 to 2014. ERIH was defined as the retirement of workers due to health problems before their scheduled or regular retirement age as reported in one of the follow-up surveys. Three broad subdomains of working conditions were examined: work arrangements, physical working conditions, and job satisfactions. Hazard ratios of ERIH were estimated by Cox regression.

Results: Females, older people, unskilled manual workers, and day laborers were more likely to experience ERIH. In adjusted Cox proportional hazard models, the risk for ERIH in male workers was significantly higher among those with the following conditions: high physical demands, awkward posture, dissatisfaction with the working environment, and no industrial compensation insurance or retirement benefits. However, no significant association was found among female participants.

Conclusions: Occupational class, physical working conditions, job satisfaction, and work arrangement were the potential risk factors for ERIH among male workers in Korea. Moreover, our results revealed gender differences in the risk for ERIH.

KEYWORDS
early retirement due to ill health, gender difference, occupational class, work arrangement, working conditions

1 | INTRODUCTION

The aging of the workforce in most developed countries is unavoidable but predictable. Life expectancy is increasing along with low birth rates, which means that there are fewer workers in the labor market to cover the rising health care and social security costs of an aging society.[1] Therefore, there is a societal need for workers to prolong their working lives. The issue of preventing the exit from working life as well as limiting voluntary early retirement is receiving more attention from different research fields, including epidemiology, medicine, psychology, and social sciences, in Korea and most other Organisation for Economic Co-operation and Development (OECD) countries that face a similar demographic challenge.

To develop successful interventions to keep aging worker populations at work in a healthy, productive, and sustainable way, it is necessary to gain more insight into the main determinants that prompt workers to leave paid employment due to ill health.

In previous studies, many factors influencing exit from the labor market have been identified. These factors include demographic predictors like age and gender[2] as well as behavioral and lifestyle risk predictors such as physical inactivity and smoking,[3,4] socioeconomic status,[5,6] chronic diseases,[3,4] welfare arrangements,[7] working conditions,[8] and so on. As Schultz proposed, these factors can be seen as "push" and "pull" factors.[9] Typically, push factors, such as poor health, lack of job satisfaction, changes in work and work organization, work fatigue, are negative and lead individuals toward retirement. In contrast, pull factors are usually positive factors that motivate employees to retire early and might include having more time for hobbies, wanting to spend more time with a spouse who has already retired, having the opportunity for an early retirement pension, and wanting to volunteer. Push and pull factors interact in complex ways to influence a person's intention to retire.[9] This study focused specifically on health-related factors, a type of push factor. Until now, the most widely studied individual predictors related to health have been age, behavioral and lifestyle risks, and chronic diseases.

A relatively small number of studies have examined the relationship between the working environment and retirement due to ill health.[5,10-13] Although previous studies have revealed that working conditions are associated with retirement due to a disability, their results were based on specific occupational groups[11,14-16] and often included limited risk factors. To the best of our knowledge, no previous studies have investigated occupational differences or the effect of working conditions on the risk for early retirement due to ill health (ERIH) in an Asian population. Thus, the aim of our study was to investigate the work-related factors that contribute to ERIH in middle-aged and elderly people in Korea using nationally representative longitudinal data.

2 | MATERIALS AND METHODS

2.1 | Data collection and participants

Data were collected from a sample from the first through the fifth phases of the Korean Longitudinal Study of Aging (KLoSA) conducted by the Korean Labor Institute and Korean Employment Institute Information Service. These surveys were administered in 2006, 2008, 2010, 2012, and 2014. The KLoSA targeted Koreans aged 45 years or older and their families. A multistage stratified probability sampling based on geographical area was used to randomly select a total of 10 000 households. Regions were stratified into urban and rural areas based on the 15 metropolitan cities and provinces of Korea. Of these 10 000 households, successful interviews were conducted with 6171 households; the household response rate was 70.7% and the individual response rate within the households was 75.4%. After 6 months (July-November 2006) of in-home, face-to-face interviews, the KLoSA had assembled a panel of 10 254 respondents. These participants underwent biennial follow-up. The second phase of the interviews was conducted from July to November 2008, the third from October to December 2010, the fourth from July to December 2012, and the fifth from September to November 2014. The second survey in 2008 was a follow-up that included 8688 respondents who represented 86.9% of the original sample; the third survey in 2010 was administered to 7920 respondents, which was 77.2% of the original sample. In 2012, the fourth survey was given to 7486 respondents representing 73.0% of the original sample, while in 2014 the fifth survey was completed by 7029 people representing 68.5% of the original sample.

The KLoSA is a national public database; all personally identifiable information has been removed from the data to allow for anonymous analysis. Ethics approval for this study was not required because we used national statistical data that is free of personally identifiable information. Trained interviewers conducted interviews with each family and provided information about the study objective, methods, potential risks and benefits, and mode of compensation, and an informed consent was obtained from all participants prior to their participation. The participants also agreed to take part in future scientific research. All participants were interviewed face-to-face using the Computer-Assisted Personal Interviewing method using Blaise®, a software system developed by Statistics Netherlands that was designed for use in official statistics (http://www.blaise.com/onlinehelp). The interviewers asked the participants to read the questions and enter their answers themselves.

The following inclusion/exclusion criteria were used: (i) during the first phase, workers (n = 3,888) were selected from the total sample size (N = 10,254) and (ii) we restricted our sample to paid employees (n = 1,875). (iii) We also excluded those who were 70 years of age and older at baseline (n = 34). Our final evaluation included 1830 eligible participants (Figure 1).

2.2 | Study variables and measurements

The date of retirement was collected from the questionnaire responses. New cases of ERIH were defined as those who retired due to health problems before their scheduled or regular retirement age as reported on one of the follow-up surveys. Any workers who died from a disease before retirement were also included as an event of ERIH. Cases of retirement
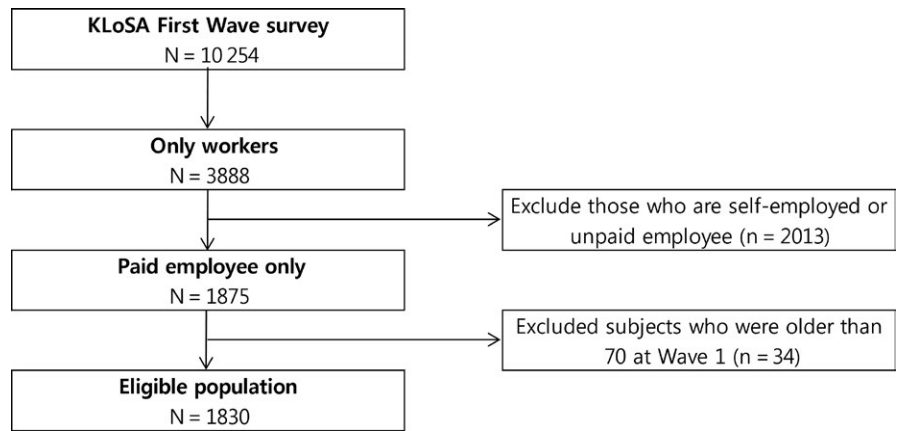
FIGURE 1 Schematic diagram depicting study population

due to other reasons (eg, becoming a caregiver for a family member) were not considered as events but as censored data instead. The follow-up period was calculated as the difference between the date of the first survey and the date of the survey-identified ERIH. We organized the respondents in ascending order by length of follow-up. If a respondent had more than one retirement event during the study period, we used the first event for the calculation of the follow-up period length. Any working respondents lost to follow-up across the second to fourth waves of the surveys were all regarded as censored data, and their follow-up period was calculated as the difference between the date of the first survey and the date of the final survey that they completed. For the remainder of the respondents who did not experience an event or were not lost to follow-up, the follow-up period was calculated as the difference between the date of the first survey and the last date of the fifth survey.

Three broad subdomains of working conditions were examined: occupational class, work arrangements, physical working conditions, and job satisfactions. Occupations were classified into six groups: "managers and professionals," "office workers," "service and sales workers," "agriculture, forestry, and fishery workers," "craft, device and machine operators, and assembly workers," and "unskilled manual workers." The work arrangements were further divided as follows: (i) weekly working hours were measured as the actual number of hours the respondent worked per week (excluding mealtimes) at all jobs. Working-hour groups were defined as 0-29 h/wk, 30-39 h/wk, 40-49 h/wk, 50-59 h/wk, 60-69 h/wk, and ≥70 h/wk; (ii) employment status was categorized as those with permanent or temporary contracts or day laborers; (iii) work schedules were categorized by those with full-time or part-time jobs as well as whether respondents (iv) held industrial compensation insurance or not and received (v) retirement benefits.

Physical working conditions were measured based on the participants' responses to questions about the respondents' opinion about their own jobs: (i) My job requires lots of physical effort ("Physically demanding"); (ii) My job requires the lifting of heavy loads ("Lifting"); (iii) My job requires

stooping, kneeling or crouching ("Awkward posture"); and (iv) My job requires me to work with a computer ("Computer use"). The job satisfactions were also measured using questions about the respondents' opinions about their own jobs: (i) I am satisfied with the working environment of my job ("Satisfaction with the working environment"); (ii) I am satisfied with the job I do at my current job ("Satisfaction with the task"); (iii) My job is stressful ("Job stress"); and (iv) I am satisfied with my current job ("Global job satisfaction"). The dummy variables employed in the regression analyses that followed had a value of one if the answer to the question was positive (either "Always or almost all of the time" or "Most of the time") and zero if the response was negative (either "Some of the time" or "None or almost none of the time").

The KLoSA survey includes questions about a wide array of characteristics. We used age, gender, household income level, and property value as covariates. The income level was defined as the total annual household income among individuals in the study population. The value of property was computed by adding up the net values of all types of assets, such as an owned house, deposits for a rental house, various financial assets, and cash.

2.3 | Statistical analyses

We listed the frequencies of the respondents' baseline characteristics and prevalence of ERIH according to demographic characteristics and working conditions by gender. To explore whether working conditions affected ERIH, we compared them to each categorized variable and analyzed the distribution of each group using chi-square tests.

Cox proportional hazard models were employed to evaluate the effects of working conditions on ERIH for each gender. The models were both crude and adjusted for age, household income, and property. Models were fitted to yield hazard ratios (HR) and their 95% confidence intervals (95% CI), indicating the risk for ERIH among those who experienced adverse working conditions. The validity of the proportional

hazards assumption was assessed using two approaches. First, we examined graphs of the log-minus-log-survival functions and found that the plots had grossly parallel lines. Second, time-dependent covariates were used to confirm proportionality, and we found that no time-dependent covariates were statistically significant, suggesting that the hazard was reasonably constant over time.

Statistical analysis was performed using SAS (Version 9.3, SAS Institute, Cary, NC). A two-tailed $P < 0.05$ was considered statistically significant.

3 | RESULTS

The mean age (and corresponding standard deviation [SD]) of the participants was 53.53 (6.71) years, and 65.25% of them were male. Table 1 shows the results obtained from the preliminary analysis of the prevalence of ERIH according to each variable. Females, older people, unskilled manual workers, and day laborers were more likely to experience ERIH. Additionally, ERIH was common among those with the following conditions: high physical demands, frequent lifting of heavy loads, awkward postures, dissatisfaction with their working environment, and low job satisfaction. Male workers with temporary jobs, part-time work schedules, or high job stress also had a higher prevalence of ERIH than others, although we could not observe these differences among female participants. The remaining descriptive characteristics of the study population are listed in Table 1.

The results of the gender-stratified analyses are presented in Tables 2 and 3. The hazard risk ratios of ERIH according to working conditions in this crude model had a pattern similar to the results in Table 1. However, after adjusting for age, household income, and property, the risk ratios were somehow attenuated. Among male respondents, crafters, device machine operators, and assembly workers or unskilled manual workers were at increased risk for ERIH. In addition, there were statistically significant associations suggesting an increased risk of ERIH among those who were day laborers, had no industrial compensation insurance or no retirement benefits, and reported high physical demands, awkward postures, and dissatisfaction with their working environment (Table 2). Unskilled manual workers had the highest hazard ratio in this analysis (HR = 4.143, 95% CI = 1.689-10.158). In addition, marginally significant relationships were observed between ERIH and other working condition characteristics, including long working hours ($\geq$70), short working hours (<30), temporary employment, frequent lifting of heavy loads, dissatisfaction with task, and low job satisfaction. Among female respondents, however, no significant association was found in the adjusted model, although some working conditions were closely associated with an elevated risk of ERIH in the crude model (Table 3). Of the working

conditions, only dissatisfaction with the working environment and dissatisfaction with task had marginal significance on female workers' ERIH after adjusting for age, household income, and property (HR = 1.384, 95% CI = 0.928-2.064 and HR = 1.349, 95% CI = 0.901-2.020, respectively). One notable finding of our analysis was that doing computer work was inversely associated with ERIH in both men and women.

4 | DISCUSSION

The main findings of this study were that in a representative population in Korea, individuals with a low-status occupation had a higher risk for ERIH than those in high-status occupations. In addition, physical working conditions, job satisfactions, extremely long working hours, and insecure employment contracts were associated with ERIH. These findings were significant only among male workers. The results of this study are largely in concordance with the results of previous studies featuring a similar outcome. A Finnish study also reported that physical and psychological working conditions played a significant role in occupational differences seen in disability retirement.[16] Studies using outcomes other than disability retirement also have reached findings similar to our study; physical and psychosocial factors are relevant to the risk of long-term sickness absences,[17] intentions to leave the job,[18] and early exits from the labor force.[19,20]

There are various ways in which occupational class may affect health, work ability, and subsequent disability retirement. One possible explanation for these occupational differences in ERIH is the differences noted in work-related exposure levels among occupational classes. Occupational class is closely associated with physical working conditions and job satisfactions, which contribute to working capacity not only through ill health but also through the job requirements expected from a person depending upon his or her occupational position.[5,21] A study from Norway examined the association between occupational class and the subsequent awarding of disability pension among middle-aged men and women, as well as to what extent work-related factors accounted for this association.[22] The authors found that workers in skilled and unskilled manual classes had a substantial and unexplained risk for receiving a disability pension. Work-related factors only had a moderate impact on the disability risk, and the association between occupational status and disability retirement was largely mediated through the accumulation of hazards in the manual working classes. In a Finnish study, the associations were largely mediated through the physical workload among men and women, as well as by hazardous exposures, particularly among men.[16] Unhealthy behaviors have also been identified as key factors for occupational differences in retirement due to ill health. Such commonly reported predictors

TABLE 1 The prevalence of early retirement due to ill health according to demographic characteristics and working conditions

Characteristics	Male			Female		
	N[a]	%	P-value	N[a]	%	P-value
Demographics						
Age						
<50	10/395	2.53	<0.001	33/268	12.31	<0.001
50-55	23/301	7.64		23/166	13.86	
55-60	31/218	14.22		15/96	15.63	
60-65	24/163	14.72		21/63	33.33	
≥65	41/117	35.04		15/43	34.88	
Occupation						
Managers and professionals	10/299	3.34	<0.001	8/88	9.09	0.259
Office workers	8/138	5.80		5/29	17.24	
Service and sales workers	1/286	2.86		40/205	19.51	
Agriculture, forestry, and fishery workers	3/17	17.65		3/14	21.43	
Crafters, device machine operators and assembly workers	39/343	11.37		11/82	13.41	
Unskilled manual workers	68/362	18.78		40/218	18.35	
Work arrangements						
Weekly working hours (missing=10)						
<30	20/83	24.10	<0.001	17/94	18.09	0.505
30-40	7/77	9.09		12/58	20.69	
40-50	42/581	7.23		38/250	15.20	
50-60	20/170	11.76		16/85	18.82	
60-70	10/138	7.25		9/77	11.69	
≥70	30/145	20.69		15/72	10.83	
Employment status						
Permanent	76/905	8.40	<0.001	54/363	14.88	0.135
Temporary	19/95	20.00		21/129	16.28	
Day laborer	34/194	17.35		32/144	22.22	
Work schedule						
Full-time	106/1051	10.09	0.030	77/454	16.96	0.885
Part-time	23/143	16.08		30/182	16.48	
Industrial compensation insurance (missing=4)						
Yes	49/747	6.56	<0.001	28/225	12.44	0.071
No	79/445	17.75		79/409	19.32	
Retirement benefits (missing=5)						
Yes	42/669	6.28	<0.001	24/194	12.37	0.041
No	87/525	16.57		83/437	18.99	
Physical working conditions						
High physical demands						
Yes	89/645	13.80	<0.001	83/473	17.55	0.406
No	40/549	7.29		24/163	14.72	
Frequent lifting of heavy loads						
Yes	66/492	13.41	0.015	62/331	18.73	0.180
No	63/702	8.97		45/305	14.75	

(Continues)

TABLE 1 (Continued)

Characteristics	Male			Female		
	N[a]	%	*P*-value	N[a]	%	*P*-value
Awkward posture						
Yes	80/553	14.47	<0.001	75/430	17.44	0.547
No	49/641	7.64		32/206	15.53	
Computer work						
Yes	12/427	2.81	<0.001	6/97	6.19	0.002
No	117/767	15.25		101/539	18.74	
Job satisfaction						
Dissatisfaction about working environment						
Yes	75/490	15.31	<0.001	60/283	21.20	0.008
No	54/704	7.67		47/353	13.31	
Dissatisfaction with task						
Yes	56/402	13.93	0.013	57/266	21.43	0.009
No	73/792	9.22		40/370	13.51	
High job stress						
Yes	65/728	8.93	0.009	58/326	17.79	0.504
No	64/466	13.73		49/310	15.81	
Low global job satisfaction						
Yes	63/442	14.25	0.003	49/262	18.70	0.289
No	66/752	8.78		58/374	15.51	
Total	129/1194	10.80		107/636	16.82	

[a]Numerators indicate number of case for early retirement due to ill health and denominators indicate number of subjects for each group.

of ERIH in low occupational classes include smoking, high alcohol consumption, physical inactivity, and high relative body weight.

Many previous studies have investigated work arrangements and reported that disability pension is more prevalent among those with evening and night work,[10] long working hours,[23] and part-time jobs.[24] As working more hours each week is generally associated with a higher income, individuals without functional limitations likely would not desire to work fewer hours, so they may have full-time work schedule. In our analysis, we also observed that extremely long working hours and having a part-time job were associated with an increased risk of ERIH, but this was not statistically significant after adjusting for household income and property. Moreover, the results of our analysis suggest that workers with insecure job characteristics, such as being a temporary or day laborer, having only part-time work schedules, and receiving no industrial compensation insurance or retirement benefits, have a higher risk for ERIH than those with a secure job position. Indeed, at least in Korea, job position with low security may be associated with poorer working conditions, which may in turn increase the risk for ERIH.

Our findings that physical working conditions and job satisfactions along with work arrangements affect workers'

risk for ERIH can be interpreted in the context of the Job-Demand-Resources (JD-R) model proposed by Bakker and Demerouti (2007).[25] When the JD-R model is applied to retirement research, the results regarding the influence of job characteristics on ERIH can be interpreted as the effects of an imbalance between job demands and resources. According to the JD-R model, work characteristics can be classified into two global categories: job demands and job resources. Job demands refer to those aspects of the job "that require sustained physical and/or psychological effort and are therefore associated with certain physiological and/ or psychological costs." Therefore, these demands include burdens such as the physical/mental workload or time pressures.[26] In contrast, job resources are positive aspects of the job characteristics that keep people healthy and motivate them to remain in the labor force even when they encounter high job demands. For example, social support and job security can act as job resource, which is related with some work arrangement variables in our study, such as permanent employment status or industrial compensation insurance. Furthermore, resources are functional in achieving work goals, reducing job demands and their associated costs (physiological and psychological costs), or stimulating personal growth, learning, and development. A recent

TABLE 2 Job characteristics influencing early retirement due to ill health in male employees

	Crude Model			Adjusted Model[a]		
	HR	95% CI		HR	95% CI	
Occupation						
Managers and professionals	1	Reference		1	Reference	
Office workers	2.110	0.681	6.543	1.592	0.508	4.990
Service and sales workers	1.566	0.189	13.010	1.109	0.133	9.239
Agriculture, forestry, and fishery workers	9.687	2.422	38.748	3.629	0.868	15.17
Crafters, device machine operators, and assembly workers	5.359	2.262	12.698	3.815	1.583	9.195
Unskilled manual workers	9.641	4.158	22.351	4.143	1.689	10.158
Work arrangements						
Weekly working hours						
<30	3.840	2.111	6.986	1.746	0.933	3.269
30-40	1.274	0.538	3.013	0.986	0.416	2.341
40-50	1	Reference		1	Reference	
50-60	1.609	0.908	2.851	1.263	0.709	2.250
60-70	1.290	0.642	2.590	0.910	0.450	1.840
≥70	3.437	2.098	5.633	1.655	0.983	2.788
Employment status						
Temporary (vs permanent)	2.819	1.632	4.868	1.485	0.848	2.603
Day laborer (vs permanent)	2.339	1.511	3.621	1.586	1.009	2.491
Part-time work schedule (vs full-time)	1.748	1.067	2.866	1.285	0.780	2.116
Industrial compensation insurance (No vs Yes)	3.325	2.258	4.896	1.790	1.167	2.745
Retirement benefits (No vs Yes)	3.384	2.263	5.060	1.802	1.157	2.807
Physical working conditions (Yes vs No)						
High physical demands	2.033	1.360	3.040	1.840	1.226	2.763
Frequent lifting of heavy loads	1.595	1.103	2.307	1.313	0.900	1.915
Awkward posture	2.074	1.416	3.038	1.763	1.200	2.591
Computer work	0.161	0.084	0.308	0.306	0.155	0.606
Job satisfaction (Yes vs No)						
Dissatisfaction with the working environment	2.395	1.645	3.486	1.728	1.174	2.545
Dissatisfaction about task	1.723	1.189	2.498	1.239	0.847	1.812
High job stress	0.681	0.470	0.985	0.982	0.672	1.433
Low global job satisfaction	1.768	1.222	2.557	1.342	0.921	1.956

[a]Adjusted for age, household income, and property.

qualitative study in older workers from 46 to 63 years of age who reported having poor health suggested that the influence of health on productivity depends on each individual's unique imbalance between demands and resources.[27] In addition, a prospective study in a population of Danish employees in elderly care revealed that high job demands and low resources explain the increase in early retirement intentions.[12]

One important issue that arose from our analysis was the clear gender differences in the association between working characteristics and the risk for ERIH. Female workers traditionally have a higher risk of ERIH than males, but the influence of working characteristics is only significant for male workers. Gender differences have been found in studies conducted in other Nordic countries.[24,28-30] For example, Thorsen et al identified gender differences in the association between psychosocial factors in the workplace and older workers' retirement plans.[13] When stratified by gender, psychosocial factors (ageism, lack of recognition, lack of development possibilities) were significant for men

TABLE 3 Job characteristics influencing early retirement due to ill health in female employees

	Crude Model			Adjusted Model[a]		
	HR	95% CI		HR	95% CI	
Occupation						
Managers and professionals	1	Reference		1	Reference	
Office workers	1.793	0.586	5.482	1.546	0.499	4.787
Service and sales workers	2.410	1.125	5.161	1.492	0.676	3.292
Agriculture, forestry and fishery workers	1.432	0.304	6.744	0.438	0.089	2.167
Crafters, device machine operators, and assembly workers	1.540	0.608	3.904	1.081	0.419	2.791
Unskilled manual workers	2.211	1.033	4.732	0.928	0.409	2.105
Work arrangements						
Weekly working hours						
<30	1.474	0.828	2.625	0.911	0.499	1.664
30-40	1.374	0.700	2.700	1.151	0.584	2.269
40-50	1	Reference		1	Reference	
50-60	1.193	0.662	2.150	0.958	0.529	1.736
60-70	0.814	0.392	1.691	0.726	0.348	1.513
≥70	1.449	0.781	2.687	1.151	0.618	2.142
Employment status						
Temporary (vs permanent)	1.265	0.757	2.114	1.038	0.617	1.745
Day laborer (vs permanent)	1.472	0.938	2.312	0.998	0.620	1.607
Part-time work schedule (vs full-time)	1.052	0.682	1.625	0.918	0.593	1.423
Industrial compensation insurance (No vs Yes)	1.790	1.153	2.778	1.280	0.808	2.025
Retirement benefits (No vs Yes)	1.720	1.089	2.717	1.243	0.774	1.996
Physical working conditions (Yes vs No)						
High physical demands	1.242	0.781	1.975	0.934	0.582	1.500
Frequent lifting of heavy loads	1.221	0.826	1.805	1.084	0.732	1.606
Awkward posture	1.059	0.697	1.607	0.769	0.502	1.179
Computer work	0.286	0.125	0.652	0.491	0.209	1.153
Job satisfaction (Yes vs. No)						
Dissatisfaction about working environment	1.779	1.205	2.627	1.384	0.928	2.064
Dissatisfaction with task	1.857	1.260	2.737	1.349	0.901	2.020
High job stress	1.145	0.777	1.686	1.180	0.800	1.740
Low global job satisfaction	1.265	0.858	1.865	0.939	0.630	1.399

[a]Adjusted for age, household income and property.

(OR: 1.15-1.25), but no association was significant in the female subgroup. These results may suggest that female workers are less affected by work characteristics with regard to exist from jobs than male workers. However, to the best of our knowledge, no studies have examined the possible causes for this difference yet. With regard to general gender differences in psychological well-being, differential exposure and the differential vulnerability to social roles and role characteristics have been suggested.[31] These gender differences in response to working characteristics can be explained in part by the collectivistic cultural value in Korea. The elderly people in Korea still hold onto traditional gender role stereotypes in general, even though the distinction of traditional gender roles has become ambiguous due to the increased economic activity of women. The traditional gender role expectations under patriarchal Confucianism assume that husbands take on the role of breadwinner and put greater value on the work domain, while wives are

primarily responsible for family demands. Especially, East Asian culture encourages husbands to dedicate prolonged years to their jobs to maximize the economic benefits for the family. Within the framework of the family ethic, a husband who delayed his decision to retire and temporarily sacrificed for the family would be perceived as "normal" and acceptable by the family members as long as his health allowed it, while wives' threshold for ERIH seems lower and less affected by working conditions. Further research on gender differences in ERIH is warranted.

The strengths of this study are its prospective design using a nationally representative sample of middle-aged and elderly workers and the fact that it was conducted in an Asian country for the first time. However, this study also has a few limitations. First, work-related characteristics were based on self-reports assessed with simple, non-validated questions, which could have produced a reporting bias on baseline work-related characteristics. Second, because this study was carried out within the Korean social welfare context, the results cannot be directly generalized to other countries. Therefore, caution should be taken when applying the current results to other countries with a different type of social welfare system. Third, the cumulative effect of exposure could not be investigated because of the relatively short follow-up period and the time-varying nature of the study variables. Finally, health status is in causal pathway between job characteristics to ERIH, but we cannot investigate how differently certain disease or health problem caused ERIH according to various job characteristics because reason for ERIH was not directly surveyed in our dataset.

In conclusion, this study found that occupational class, work arrangement, and physical and psychological working conditions were the potential risk factors for ERIH among male workers in Korea. Our results also revealed gender differences in the risk for ERIH. These findings have clear implications. The contribution of job characteristics to ERIH was evident, so interventions aimed at improving working conditions and job security are essential for preventing the early exit of aging labor forces from work due to ill health. Further and more specific studies will be needed to identify which additional factors influence ERIH according to occupation and disease groups.

DISCLOSURE

Approval of the research protocol: The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008. All study participants provided informed consent and all the authors have approved the manuscript and agree with submission to your esteemed journal. The dataset supporting the conclusions of this article is available on the KLoSA website (http://survey.keis.orkr/eng/klosa/klosa01.jsp). *Informed consent*: All study participants provided an informed consent. *Registry and the registration no. of the study/trial*: NA *Animal studies*: NA.

CONFLICT OF INTEREST

Authors declare no conflict of interests for this article.

AUTHORS' CONTRIBUTION

MYK conducted the analysis and wrote manuscript in collaboration with HRK. MYK wrote the first draft of the manuscript. HRK and JPM provided the feedback and suggestions. All authors read the manuscript and approved to submission.

ORCID

Mo-Yeol Kang https://orcid.org/0000-0002-1682-865X
Jun-Pyo Myong https://orcid.org/0000-0001-8674-1034
Hyoung-Ryoul Kim https://orcid.org/0000-0001-7535-3140

REFERENCES

1. Rechel B, Grundy E, Robine JM, et al. Ageing in the European Union. *Lancet*. 2013;381:1312-1322.
2. Claussen B, Dalgard OS. Disability pensioning: the gender divide can be explained by occupation, income, mental distress and health. *Scand J Public Health*. 2009;37:590-597.
3. Kang MY, Yoon CG, Yoon JH. Influence of illness and unhealthy behavior on health-related early retirement in Korea: Results from a longitudinal study in Korea. *J Occup Health*. 2015;57:28-38.
4. Kang YJ, Kang MY. Chronic diseases, health behaviors, and demographic characteristics as predictors of ill health retirement: findings from the Korea Health Panel Survey (2008–2012). *PLoS ONE*. 2016;11:e0166921.
5. Blekesaune M, Solem PE. Working conditions and early retirement: a prospective study of retirement behavior. *Res Aging*. 2005;27:3-30.
6. Bruusgaard D, Smeby L, Claussen B. Education and disability pension: a stronger association than previously found. *Scand J Public Health*. 2010;38:686-690.
7. Brinch CN. *The effects of benefits on disability uptake. Discussion Papers No. 576*. Oslo, Norway: Statistics Norway, Research Department; 2009.
8. Reeuwijk KG, de Wind A, Westerman MJ, Ybema JF, van der Beek AJ, Geuskens GA. 'All those things together made me retire': qualitative study on early retirement among Dutch employees. *BMC Public Health*. 2013;13:516.
9. Shultz KS, Morton KR, Weckerle JR. The influence of push and pull factors on voluntary and involuntary early retirees' retirement decision and adjustment. *J Vocat Behav*. 1998;53:45-57.
10. Friis K, Ekholm O, Hundrup YA. The relationship between lifestyle, working environment, socio-demographic factors and

expulsion from the labour market due to disability pension among nurses. *Scand J Caring Sci*. 2008;22:241-248.

11. Jebens E, Medbø JI, Knutsen O, Mamen A, Veiersted KB. Association between perceived present working conditions and demands versus attitude to early retirement among construction workers. *Work*. 2014;48:217-228.

12. Sejbaek CS, Nexo MA, Borg V. Work-related factors and early retirement intention: a study of the Danish eldercare sector. *Eur J Public Health*. 2013;23:611-616.

13. Thorsen S, Rugulies R, Løngaard K, Borg V, Thielen K, Bjorner JB. The association between psychosocial work environment, attitudes towards older workers (ageism) and planned retirement. *Int Arch Occup Environ Health*. 2012;85:437-445.

14. Oude Hengel KM, Blatter BM, Geuskens GA, Koppes LL, Bongers PM. Factors associated with the ability and willingness to continue working until the age of 65 in construction workers. *Int Arch Occup Environ Health*. 2012;85:783-790.

15. Rongen A, Robroek SJ, van der Heijden BI, Schouteten R, Hasselhorn HM, Burdorf A. Influence of work-related characteristics and work ability on changing employer or leaving the profession among nursing staff. *J Nurs Manag*. 2014;22:1065-1075.

16. Leinonen T, Pietiläinen O, Laaksonen M, Rahkonen O, Lahelma E, Martikainen P. Occupational social class and disability retirement among municipal employees–the contribution of health behaviors and working conditions. *Scand J Work Environ Health*. 2011;37:464-472.

17. Beemsterboer W, Stewart R, Groothoff J, Nijhuis F. A literature review on sick leave determinants (1984–2004). *Int J Occup Med Environ Health*. 2009;22:169-179.

18. Jensen JM, Patel PC, Messersmith JG. High-performance work systems and job control: Consequences for anxiety, role overload, and turnover intentions. *J Manage*. 2013;39:1699-1724.

19. Proper KI, Deeg DJ, van der Beek AJ. Challenges at work and financial rewards to stimulate longer workforce participation. *Hum Resour Health*. 2009;7:70.

20. van den Berg TI, Elders LA, Burdorf A. Influence of health and work on early retirement. *J Occup Environ Med*. 2010;52:576-583.

21. Stattin M, Järvholm B. Occupation, work environment, and disability pension: a prospective study of construction workers. *Scand J Public Health*. 2005;33:84-90.

22. Haukenes I, Mykletun A, Knudsen AK, Hansen HT, Mæland JG. Disability pension by occupational class–the impact of work-related factors: the Hordaland Health Study Cohort. *BMC Public Health*. 2011;11:406.

23. Krause N, Lynch J, Kaplan GA, Cohen RD, Goldberg DE, Salonen JT. Predictors of disability retirement. *Scand J Work Environ Health*. 1997;23:403-413.

24. Krokstad S, Johnsen R, Westin S. Social determinants of disability pension: a 10-year follow-up of 62 000 people in a Norwegian county population. *Int J Epidemiol*. 2002;31:1183-1191.

25. Bakker AB, Demerouti E. The job demands-resources model: State of the art. *Journal of Managerial Psychology*. 2007;22:309-328.

26. Kubicek B, Korunka C, Hoonakker P, Raymo JM. Work and Family Characteristics as Predictors of Early Retirement in Married Men and Women. *Res Aging*. 2010;32:467-498.

27. Leijten F, van den Heuvel S, Geuskens G, et al. How do older employees with health problems remain productive at work?: a qualitative study. *J Occup Rehabil*. 2013;23:115-124.

28. Albertsen K, Lund T, Christensen KB, Kristensen TS, Villadsen E. Predictors of disability pension over a 10-year period for men and women. *Scand J Public Health*. 2007;35:78-85.

29. Borg K, Hensing G, Alexanderson K. Risk factors for disability pension over 11 years in a cohort of young persons initially sick-listed with low back, neck, or shoulder diagnoses. *Scand J Public Health*. 2004;32:272-278.

30. Tausig M, Fenwick R. Unbinding time: alternate work schedules and work-life balance. *J Fam Econ Issues*. 2001;22:101-119.

31. Pugliesi K. Work and well-being: Gender differences in the psychological consequences of employment. *J Health Soc Behav*. 1995;36:57-71.