

## Working conditions and leisure-time physical activity among waged workers in South Korea: A cross-sectional study

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**Abstract:** Working conditions and leisure-time physical activity among waged workers in South Korea: A cross-sectional study: Chungah Kim, *et al.* School of Public Health, Seoul National University, Republic of Korea—**Objectives:** Although waged workers' working conditions have notably diversified in South Korea, there is little research addressing this issue. This study explores the relationship between working conditions and engagement in leisure-time physical activities (LTPA) among waged workers in South Korea. **Methods:** Data from 19- to 64-year-old waged workers (men=2,562, women=1,627) from the 11th wave of the Korean Income and Labor Panel Study were included in this study. Multiple logistic regression analyses were conducted to assess the association between LTPA and working conditions by gender. **Results:** More than 75% of employed persons did not participate in any type of LTPA. For male workers, those in manual, precarious, overtime, and non-shift positions were less likely to engage in LTPA, while for female workers, only manual and overtime work positions were significant factors influencing a low level of LTPA. **Conclusions:** Some negative work-related factors were associated with low LTPA, especially for male workers. Further studies should be conducted to clarify the pathways and barriers precluding engagement in LTPA due to work-related factors.

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**Key words:** Gender difference, Leisure-time physical activities, South Korea, Working conditions

Sufficient physical activity is known to prevent chronic diseases, such as cardiovascular disease, a variety of cancers, type 2 diabetes, osteoporosis, and obesity<sup>1</sup>. Physical activity consists of leisure-time physical activity (LTPA), occupational physical

activity, household physical activity, and walking for commuting. LTPA is a critical predictor of perceived health status and all-cause mortality, even after controlling for other types of physical activity<sup>2</sup>. In contrast, the effect of occupational physical activity on health is more complex<sup>2,3</sup>.

Many factors reducing engagement in LTPA have been found<sup>4–6</sup>. However, there are few studies addressing the effects of work-related factors on LTPA. Employment and working conditions are conventionally considered aspects of socioeconomic variables such as occupational category and unstable income. However, working conditions can have an impact on physical activity, not indirectly through socioeconomic status, but directly through time management, the physical demands of work, and place of work<sup>7</sup>.

Several studies, predominantly in European countries, have explored the relationship between physical activity and work-related conditions. For instance, Shneider *et al.*<sup>8</sup> reported that several work-related factors, such as strenuous manual labor, overtime work, and shift work, were associated with poor LTPA. Longitudinal studies have also been performed: Taris *et al.*<sup>9</sup> and Smith *et al.*<sup>10</sup> reported that overtime work and low job control were associated with lower levels of LTPA; however, Lallukka *et al.*<sup>11</sup> found that high job demands, low job control, and overtime work were not related to lower physical activity levels. These inconsistent results may be due to the differences between standard and precarious workers, in addition to welfare policies, which vary by country<sup>12</sup>.

The aim of the present study was to evaluate the association between LTPA and working conditions in South Korea (hereafter “Korea”). Given that the effects of work-related factors largely rely on the nature of the labor market and welfare policies, a strong association between work-related factors and physical activity was expected because Korea has

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comparatively weak welfare programs for waged workers and a vulnerable labor market compared with the countries in previous studies. Studies have documented substantial health outcome discrepancies among workers in different employment categories in Korea<sup>12-16</sup>. However, LTPA has rarely been studied in Korea, particularly the association between LTPA and the working conditions of waged workers. As a measure to overcome the recent economic crisis in Korea, the government has implemented policy to increase labor market flexibility, which has resulted in dramatic diversification of the labor market for waged workers since the early 2000s<sup>12</sup>.

## Method

### Data

This study used data from the 11th wave of the nationwide Korean Labor and Income Panel Study (KLIPS), which selected a representative panel sample of Korean households and individuals aged 15 or older residing in urban areas. The survey was conducted by the Korean Labor Institution and was approved by the ethical review board of Statistics Korea. Since 1998, the KLIPS has been conducted annually to collect information on income, expenditures, education, job training, economic activities, and health-related issues. The first panel included 5,000 households and 13,321 individuals selected by a two-stage stratified sampling method, and the sample was formed based on the 1995 Korea Census. During the early stages (until the 4th wave), the attrition rate was approximately 28%. From the 4th wave onward, the average attrition rate of was approximately 1%, and the remaining panel size was 64.6% at the 11th wave.

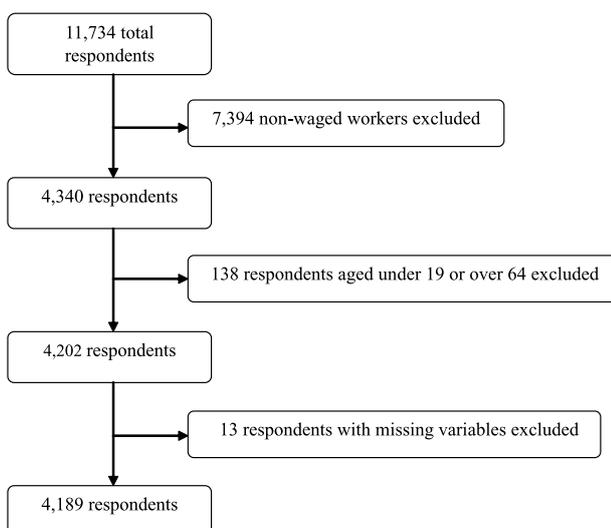
The survey was conducted using interviews by

trained staff. Although the KLIPS is a longitudinal survey, questions about physical activity were not included in the survey until the 8th wave. Thus, in this study, only data from the 8th wave were used because there were not enough time-variant independent variables from the 8th to the 11th waves. Of the 11,734 individuals in the 11th wave, data from 4,189 respondents who were waged workers between the ages of 19 and 64 years were analyzed; other occupational categories, such as self-employed and professional, were excluded (Fig. 1).

### Measures

Employment conditions were categorized into four dimensions. First, two groups, manual and nonmanual, were formed based on the strenuousness of work; service and sales workers were included in the manual category. Second, shift workers were distinguished from non-shift workers. Third, because the definition of precarious work remains controversial<sup>12,14,17</sup>, this study defined precarious workers using the following criteria, which were drawn from several guidelines recommended by the KLIPS and studies on irregular workers<sup>12,13,17</sup>: 1) temporary/daily work status (n=863), 2) self-declared precarious worker (n=392), 3) working at a dispatched or subcontracted company (n=44), 4) working on independent contracts (n=19), 5) working at home (n=7), 6) part-time work of less than 36 hours per week (n=8), and 7) working on a fixed-term contract (n=68). Thus, 33.4% of participants were categorized as precarious workers. Fourth, overtime work was defined as working 60 hours or more per week. In many countries, more than 60 hours of work is categorized as “extreme overtime work”<sup>18</sup>. However, this is not the case in Korea. The average number of hours worked per week in Korea is very high; indeed, in 2008, 45 hours per week was defined in the labor law as the “standard working hours”, and the maximum number of working hours, including all possible overtime, was defined as 68. The average number of hours worked by the respondents in this study was 50.9 hours, and the proportion of those working 60 hours or more was 21.8%. Considering the average hours worked in Korea, we set the threshold at 60 hours. These work-related factors are clustered because they are all regarded as characteristics of disadvantaged work. However, these characteristics reflect different aspects of disadvantaged employment conditions.

The dependent variable, LTPA, was assessed with the question, “Do you exercise regularly?” This question was asked to those who chose “exercise” as an answer to the question, “On a daily basis, what do you do to maintain your health? Please mark three options in the order of frequency”. The options



**Fig. 1.** Sample inclusion criteria flow chart.

included (1) exercise, (2) dietary control, (3) reduced consumption of cigarettes or alcohol, (4) herbal medicine or nutritional supplements, (5) baths, sauna, steam baths, etc., (6) getting enough rest and sleep, (7) periodic medical checkups, (8) other, and (9) nothing. Respondents who selected “exercise” were then given the options of (1) “regularly”, (2) “irregularly” and (3) “hardly”. Those who answered “regularly” or “irregularly” were categorized as “exercisers”, and those who did not select “exercise” in the first question or chose “hardly” in the second question were categorized as “non-exercisers”. The questions in the survey did not specify the type of physical activity encompassed by the term “exercise”. However, we concluded that “exercise” meant LTPA. It is unlikely that people would consider occupational physical activity and usual physical activity at home as “exercise” because the meaning of exercise includes intentional willingness.

Several socioeconomic and demographic variables were controlled. Income and education were included as socioeconomic variables. As advised by the KLIPS, household disposable income was calculated by adding the income provided in response to questions about earnings, interest, rents, and dividends. Total household income was divided by the square root of the number of household members. The specific calculation method is available on the KLIPS website<sup>19)</sup>. This figure was scaled from the highest quartile (the number below which 75% of the data lie) to the lowest (the number below which 25% of the data lie). Categories for educational levels were “9 years or less” (junior high school or less), “10 to 12 years” (at least some high school), “13 to 14 years” (at least some junior college), and “15 years or higher” (some university or higher). Age was divided into four categories: 19–29, 30–39, 40–49, and 50–64 years. Marital status was categorized into currently married or currently unmarried. We also controlled for the health behavioral variables of smoking, drinking alcohol, body mass index (BMI), and self-rated health status. Respondents were classified as current smokers or nonsmokers, current drinkers or nondrinkers, and having a BMI above 25 or 25 and below. The responses to self-rated health status were collapsed into two categories: excellent/good and fair/poor/very poor<sup>20)</sup>. Any missing variables were deleted according to the criteria explained in Fig. 1.

#### Statistical analysis

For the analysis, subjects were divided by gender because physical activity behaviors and the conditions in the labor market differ between males and females in Korea. To confirm the effect size and offset effects, logistic regression was conducted to estimate

odds ratios (ORs). Models were analyzed using a progressive design by dividing the independent variables into several parts. Model 1, which was the null model, included only work-related variables (occupational categories, shift work, precarious work, and overtime work). In Model 2, socioeconomic variables (education and income) were added to the null model. In Model 3, health behavioral variables (smoking and alcohol use) were added to the null model. Finally, all of the independent variables were included in Model 4. Descriptive and multivariate analyses were weighted to estimate the population parameters, employing weights provided by the KLIPS<sup>21)</sup>. All statistical analyses were conducted using SAS version 9.3 (SAS Institute Inc., Cary, NC, USA), and significance was set at  $p < 0.05$ .

#### Results

Table 1 shows the gender-specific weighted percentage distribution of engagement in LTPA by each independent variable. Approximately one-fourth of respondents reported engagement in LTPA. Among male workers, 28.82% of respondents reported engaging in LTPA, compared with only 17.82% of female workers. For males who were manual, overtime, non-shift, or precarious workers, engagement in LTPA was low. Females showed a similar pattern as males, except that non-shift workers engaged in more LTPA than shift workers. For males (see Table 1), old age, being married, high income, high education, nonsmoking, nondrinking, high BMI, and good self-rated health were related to high engagement in LTPA. For females, old age, married, high income, high education, non-smoking, high BMI, and good self-rated health were also associated with high LTPA (Table 2); however, nondrinking status was not significantly related.

The results of the gender-specific logistic regression models exploring the relationship between the independent variables and LTPA are described using ORs (Table 3 and Table 4). For males, when all of the work-related factors were considered and demographic variables were controlled in Model 1, manual, overtime, and precarious workers had lower ORs (OR 0.444, 0.713, and 0.525, respectively) while shift workers had higher ORs (OR 1.718). In Model 2, the ORs of the work-related factors included in Model 1 were attenuated when education and income were considered. In Model 3, the inclusion of health behaviors also affected the ORs; specifically, working conditions, smoking, and BMI were significantly related to LTPA. Finally, in Model 4, all of the occupational factors considered in the previous models remained significantly related to LTPA (OR manual=0.698; overtime=0.788; precarious=0.679; and shift=1.580).

**Table 1.** Distribution of leisure time physical activity among a nationally representative sample of Korean male workers

Male	Exercisers		Non-exercisers	
	(%)	(N)	(%)	(N)
Total	28.82	706	71.18	1856
Occupation				
Manual	21.09	299	78.91	1,115
Nonmanual	37.62	407	62.38	741
Hours worked				
<60	30.84	572	69.16	1,371
≥60	22.41	134	77.59	485
Shift				
Non-shift	28.44	600	71.56	1,649
Shift	31.57	106	68.43	207
Employment				
Non-precarious	32.75	578	67.25	1,281
Precarious	18.24	128	81.76	575
Age				
19–29	23.02	85	76.98	308
30–39	25.82	239	74.18	694
40–49	30.56	191	69.44	472
50–64	34.88	191	65.12	382
Marriage				
Married	32.59	568	67.41	1,251
Unmarried	21.14	138	78.86	605
Income				
4th quartile	41.99	254	58.01	386
3rd quartile	31.77	198	68.23	443
2nd quartile	21.08	138	78.92	495
1st quartile	19.16	116	80.84	532
Education				
≥15	39.13	333	60.87	582
13 to 14 yr	25.23	111	74.77	339
10 to 12 yr	22.39	204	77.61	670
≤9	16.40	58	83.60	265
Smoking				
No	38.14	393	61.86	689
Yes	21.48	313	78.52	1,167
Alcohol				
No	31.12	115	68.88	285
Yes	28.40	591	71.60	1,571
Body mass index				
≤25	27.31	515	72.69	1,462
>25	34.15	191	65.85	394
Self-rated health				
Good	30.78	544	69.22	1,296
Poor	23.97	162	76.03	560

Weights provided by the KLIPS were applied in the calculation of percentage distributions. Sample sizes were unweighted.

**Table 2.** Distribution of leisure time physical activity among a nationally representative sample of Korean female workers

Female	Exercisers		Non-exercisers	
	(%)	(N)	(%)	N
Total	17.82	260	83.18	1367
Occupation				
Manual	13.69	165	86.31	691
Nonmanual	21.37	95	78.63	676
Hours worked				
<60	19.01	232	80.99	1,131
≥60	11.35	28	88.65	236
Shift				
Non-shift	18.02	244	81.98	1,271
Shift	15.04	16	84.96	96
Employment				
Non-precarious	19.06	161	80.94	769
Precarious	16.14	99	83.86	598
Age				
19–29	15.73	66	84.27	385
30–39	17.35	66	82.65	361
40–49	19.01	76	80.99	375
50–64	20.04	52	79.96	246
Marriage				
Married	18.85	159	81.15	828
Unmarried	16.41	101	83.59	539
Income				
4th quartile	24.78	96	75.22	308
3rd quartile	17.57	63	82.43	346
2nd quartile	17.21	61	82.79	345
1st quartile	11.39	40	88.61	368
Education				
≥15	20.87	86	79.13	350
13 to 14 yr	22.12	60	77.88	252
10 to 12 yr	14.47	72	85.53	468
≤9	14.31	42	85.69	297
Smoking				
No	17.83	256	82.17	1,349
Yes	17.46	4	82.54	18
Alcohol				
No	16.10	113	83.90	667
Yes	19.47	147	80.53	700
Body mass index				
≤25	17.67	239	82.33	1,249
>25	19.52	21	80.48	118
Self-rated health				
Good	18.37	170	81.63	840
Poor	16.90	90	83.10	520

Weights provided by the KLIPS were applied in the calculation of percentage distributions. Sample sizes were unweighted.

**Table 3.** Results of logistic regression exploring the association between engagement in LTPA and work-related factors among males

Male	Model 1	Model 2	Model 3	Model 4
Manual workers <sup>1)</sup>	0.444 (0.366–0.540)	0.665 (0.533–0.828)	0.491 (0.401–0.596)	0.698 (0.558–0.872)
Working hours ≥60 <sup>2)</sup>	0.713 (0.572–0.890)	0.794 (0.634–0.994)	0.716 (0.577–0.902)	0.788 (0.628–0.989)
Shift workers <sup>3)</sup>	1.718 (1.303–2.264)	1.663 (1.258–2.200)	1.627 (1.203–2.109)	1.580 (1.189–2.098)
Precarious workers <sup>4)</sup>	0.525 (0.418–0.659)	0.666 (0.525–0.844)	0.550 (0.420–0.670)	0.679 (0.535–0.862)
Age <sup>5)</sup>				
19–29	0.612 (0.432–0.866)	0.493 (0.338–0.719)	0.583 (0.409–0.843)	0.483 (0.328–0.709)
30–39	0.507 (0.396–0.649)	0.420 (0.319–0.551)	0.508 (0.447–0.693)	0.433 (0.328–0.573)
40–49	0.679 (0.534–0.862)	0.622 (0.482–0.804)	0.696 (0.545–0.889)	0.645 (0.497–0.837)
Unmarried <sup>6)</sup>	0.702 (0.553–0.892)	0.715 (0.560–0.912)	0.744 (0.583–0.950)	0.755 (0.589–0.968)
Income <sup>7)</sup>				
3 <sup>rd</sup> quartile		0.863 (0.684–1.090)		0.863 (0.681–1.093)
2 <sup>nd</sup> quartile		0.569 (0.439–0.738)		0.569 (0.437–0.742)
1 <sup>st</sup> quartile		0.592 (0.452–0.774)		0.606 (0.461–0.798)
Education <sup>8)</sup>				
≤9		0.359 (0.241–0.533)		0.402 (0.269–0.602)
10 to 12 yr		0.558 (0.435–0.714)		0.615 (0.477–0.792)
13 to 14 yr		0.739 (0.569–0.960)		0.795 (0.61–1.037)
Drinking <sup>9)</sup>			1.103 (0.863–1.409)	1.052 (0.819–1.352)
Smoking <sup>10)</sup>			0.508 (0.394–0.655)	0.540 (0.449–0.650)
BMI>25 <sup>11)</sup>			1.228 (0.997–1.512)	1.201 (0.973–1.483)
Self-rated health <sup>12)</sup>			0.737 (0.601–0.904)	0.787 (0.640–0.969)

Values in parentheses represent 95% confidence intervals. <sup>1)</sup>Reference category: nonmanual workers. <sup>2)</sup>Reference category: working hours<60. <sup>3)</sup>Reference category: non-shift workers. <sup>4)</sup>Reference category: non-precarious workers. <sup>5)</sup>Reference category: 50–64. <sup>6)</sup>Reference category: married. <sup>7)</sup>Reference category: 4th quartile, <sup>8)</sup>Reference category: ≥15. <sup>9)</sup>Reference category: nondrinker. <sup>10)</sup>Reference category: nonsmoker. <sup>11)</sup>Reference category: BMI≤25. <sup>12)</sup>Reference category: Good.

A different pattern was observed in the models for females. Specifically, unlike the male workers' model, in Model 1, only manual and overtime work were negatively associated with LTPA (OR 0.451 and 0.626, respectively). In Model 2, inclusion of the socioeconomic factors reduced the ORs of manual and overtime work (OR 0.624 and 0.645, respectively).

Another difference from the male workers' model was that when health behavior variables were considered in Model 3, drinkers were more likely to engage in LTPA nondrinkers. In the full model, the effects of manual and overtime work remained significant, while some covariates, such as education, income, and drinking, were also significant.

**Table 4.** Results of logistic regression exploring the association between engagement in LTPA and work-related factors among females

Female	Model 1	Model 2	Model 3	Model 4
Manual workers <sup>1)</sup>	0.451 (0.327–0.622)	0.624 (0.435–0.894)	0.444 (0.321–0.613)	0.615 (0.420–0.881)
Working hours $\geq 60$ <sup>2)</sup>	0.626 (0.415–0.943)	0.645 (0.427–0.977)	0.628 (0.417–0.948)	0.650 (0.429–0.984)
Shift workers <sup>3)</sup>	0.908 (0.534–1.544)	0.897 (0.524–1.535)	0.892 (0.524–1.518)	0.882 (0.515–1.512)
Precarious workers <sup>4)</sup>	0.958 (0.727–1.262)	1.070 (0.806–1.421)	0.955 (0.724–1.259)	1.065 (0.802–1.415)
Age <sup>5)</sup>				
19–29	0.428 (0.271–0.675)	0.307 (0.185–0.512)	0.383 (0.239–0.614)	0.274 (0.162–0.463)
30–39	0.481 (0.316–0.732)	0.388 (0.244–0.619)	0.443 (0.288–0.680)	0.353 (0.219–0.568)
40–49	0.772 (0.534–1.116)	0.697 (0.466–1.041)	0.721 (0.495–1.051)	0.645 (0.428–0.971)
Unmarried <sup>6)</sup>	0.956 (0.698–1.307)	1.061 (0.764–1.472)	0.955 (0.696–1.310)	1.044 (0.750–1.452)
Income <sup>7)</sup>				
3rd quartile		0.764 (0.543–1.076)		0.754 (0.534–1.063)
2nd quartile		0.794 (0.558–1.129)		0.810 (0.567–1.155)
1st quartile		0.489 (0.325–0.736)		0.494 (0.326–0.746)
Education <sup>8)</sup>				
$\leq 9$		0.585 (0.344–0.966)		0.550 (0.322–0.939)
10 to 12 yr		0.751 (0.510–1.107)		0.735 (0.498–1.085)
13 to 14 yr		1.232 (0.876–1.732)		1.250 (0.887–1.760)
Drinking <sup>9)</sup>			1.373 (1.066–1.769)	1.404 (1.085–1.816)
Smoking <sup>10)</sup>			0.952 (0.293–3.095)	1.087 (0.332–3.564)
BMI $>25$ <sup>11)</sup>			1.186 (0.758–1.855)	1.301 (0.827–2.038)
Self-rated health <sup>12)</sup>			0.918 (0.703–1.199)	0.974 (0.743–1.277)

Values in parentheses represent 95% confidence intervals. <sup>1)</sup>Reference category: nonmanual workers. <sup>2)</sup>Reference category: working hours $<60$ . <sup>3)</sup>Reference category: non-shift workers. <sup>4)</sup>Reference category: non-precarious workers. <sup>5)</sup>Reference category: 50–64. <sup>6)</sup>Reference category: married. <sup>7)</sup>Reference category: 4th quartile, <sup>8)</sup>Reference category:  $\geq 15$ . <sup>9)</sup>Reference category: nondrinker. <sup>10)</sup>Reference category: nonsmoker. <sup>11)</sup>Reference category: BMI $\leq 25$ . <sup>12)</sup>Reference category: Good.

## Discussion

The most important finding of this study was that some factors related to disadvantaged work were negatively associated with engagement in LTPA after controlling for covariates for both male and female workers, except that male shift workers, considered a

disadvantaged group, engaged in more LTPA than did male non-shift workers. In addition, the work-related factors were shown to explain males' LTPA behaviors better than females' LTPA behaviors.

Manual and overtime workers were less likely to engage in LTPA regardless of gender. It may be that the manual workers feel physically tired after work,

which diminishes their interest in physical activities, even though the activities are for fun and promote good health. Additionally, the association between working overtime and less LTPA engagement could be expected, since overtime work results in less time to engage in LTPA.

However, in the case of shift work and employment status, the effects were only significant for male workers. Specifically, it was revealed that male shift workers were 1.6 times more likely to engage in LTPA than non-shift workers were. This is contrary to the results of most other studies, which reported that shift work is not associated with physical activity<sup>8,22)</sup> and that non-shift workers are more likely to engage in LTPA. This unanticipated result may be attributed to the superior time management skills of shift workers compared with non-shift workers. Although both groups experience relatively similar time restraints for LTPA, shift workers may be better able to spare time to participate in LTPA. Other researchers have argued that a significant difference in the level of actual LTPA engagement may not be relevant because shift workers are more likely to be vulnerable to health-related issues, and thus may participate in physical activities for fitness management<sup>22,23)</sup>.

The association between precarious work and engagement in LTPA was significant among male workers, which is contrary to the results of research based in other countries that explored employment conditions and health effects after controlling for other independent variables<sup>8)</sup>. The mechanisms by which employment status affects lower physical activity levels are unclear, but we can hypothesize several possible pathways. First, we suggest that the unique circumstances in the Korean labor market, particularly its lack of regulation via intervening policies, may play a role<sup>24)</sup>. Even if it is assumed that the income levels of precarious and non-precarious workers are the same, the majority of precarious workers in Korea have no benefits or fewer compared with their counterparts<sup>25)</sup>. Fewer benefits mean that income is invisibly diminished, leaving a smaller portion for the costs of physical activity among precarious workers relative to non-precarious workers. Aside from the financial benefits, not taking advantage of other types of benefits, such as vacation time and holidays, could decrease the leisure time of precarious workers. For example, a Korean study noted that only 14 to 19% of precarious workers use paid vacation time, while 81 to 97% percent of non-precarious workers use such time<sup>26)</sup>. This can be ascribed to the undeniable strains of precarious workers, who are deprived of their guaranteed rights as workers. While Korean labor laws do not literally discriminate between non-precarious and precarious workers with respect to paid leave, regular

workers enjoy a long-term employment guarantee and ban on arbitrary dismissals, whereas most contingent workers sign 1-year labor contracts that enable possible dismissal<sup>25,26)</sup>. Second, income variability appears to be a factor that explains variations in engagement in LTPA. Although we controlled for income level among workers across employment conditions, the fact that the effects remained indicates that precarious workers spend less money because of their unstable employment. Recent economics research about income and consumption has indicated that sudden changes in income affect consumption<sup>27)</sup>. The quantitative model indicates that people who expect their income to decline save money instead of spending money<sup>27)</sup>. Future studies could explore this possibility.

In females, shift work and precarious employment were not significantly related to LTPA. Differential effects of work-related factors on engagement in LTPA by gender are unexpected because female workers are more likely than males to be disadvantaged in the Korean labor market. Additionally, many empirical studies on the differences in health outcomes—such as the prevalence of chronic disease, smoking, and mental health—between precarious and non-precarious workers have found said differences to be meaningful, although which health outcomes are affected varies by gender<sup>13,14,28,29)</sup>. Therefore, why was there no significant difference in engagement in LTPA regarding shift work and precarious employment found for female workers? To date, few studies have explained how employment conditions affect physical activity in female workers. Consequently, our explanation as to why employment conditions are less significant for women is hypothetical. It is possible that male workers are more sensitive to changes in employment conditions because of their position as breadwinners within families<sup>26)</sup>. Here, we assume that a woman's employment is considered secondary in many families, which may make women less responsive to changes in employment conditions. In other words, time management skills for female Korean workers may be more affected by their family circumstances than by their work. This fits with the doctrines of Confucianism—upon which Korean culture is heavily based—which dictates that wives must manage the household<sup>30)</sup>; thus, regardless of their work positions, most married female workers are still expected to fill their traditional roles<sup>30)</sup>.

Socioeconomic and health behavioral variables subtly decreased the effects and gradients of employment conditions. In several studies, smoking was shown to be negatively correlated with engagement in LTPA, while self-rated health was positively correlated with engagement in LTPA<sup>31)</sup>. Additionally, low income and educational level had a positive correla-

tion with disadvantaged working conditions. Hence, regulation of these variables seems to have reduced the negative effects of disadvantaged working conditions on engagement in LTPA.

The primary limitation of this study is that the data analyzed in the model were cross-sectional, which prevents any conclusions about causal relationships. In addition, reverse selection was also possible; for example, workers who engaged in LTPA might have been better at self-management, which might also have led to better employment conditions. To rule out this possibility, time variant variables need to be included in a longitudinal study. The second limitation is that different quantities and intensities of the dependent variable were not considered. The KLIPS questions focus on work characteristics and employment status. In addition to frequency, different aspects of LTPA—such as whether it involved walking or running and moderate or vigorous exercise, and the amount of time spent engaging in it—should be examined to better capture the LTPA construct. Finally, we only considered employment conditions; working environment was not included because information for it was not included in the data we used. Therefore, future studies could be designed to clarify the impact of work environment on LTPA.

Despite these limitations, this study confirmed that certain work characteristics of waged workers are associated with the frequency of LTPA, even after controlling for socioeconomic and health behavior factors. Future studies should address the pathways and barriers that preclude engagement in LTPA due to work-related factors.

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