

## Research Article



# The association between long working hours and marital status change: middle-aged and educated Korean in 2014–2015

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## ABSTRACT

**Background:** We investigated the association between long workhours and marital status change from married to divorced or separated status that might have bad health effects.

**Methods:** A total of 40,654 participants with married status in 2014 were followed up in 2015. Weekly workhours were categorized into four groups:  $\leq 40$ , 41–52, 53–60, and  $> 60$  hours per week. Univariate and multivariate logistic regression analyses were performed to determine the relationship between groups of workhours and marital status change after adjusting for age, total monthly household income, working type, and depression with sex stratification.

**Results:** The study populations consisted of 8,346 (20.5%) females and 32,308 (79.5%) males. Odd ratios (ORs) of marital status change for females working for more than 60 hours per week was 4.26 (95% confidence interval [CI]: 1.25–14.5), when working less than or equal to 40 hours per week was used as reference in the crude model. ORs of working more than 60 hours per week was 4.57 (95% CI: 1.02–20.5) in female workers when considering age, total household earning per month, working type of daytime, and depression in a dose-response manner. However, for male workers, long workhours were not significantly related to change of marriage status.

**Conclusions:** Long workhours for more than 60 hours per week had significantly higher risk of divorce or separation in females, but not in males. Further follow-up studies are needed to evaluate long term effects of long workhours on divorce risk.

**Keywords:** Long workhours; Marital status; Korean female workers

## BACKGROUND

Long workhour has become an important issue over the past few years in Korea. Koreans worked the second longest hours (2,124 hours per year in 2014) according to the Organization for Economic Cooperation and Development (OECD) report [1]. The Korean government implemented the new Labor Standards Act to limit the maximum work hours per week from 68 to 52 hours in 2018 [2]. Adverse health effects of overtime work have been investigated in recent studies. It has been shown that overtime work can increase risk of weight gain [3], atrial fibrillation [4], and metabolic syndrome [5]. The

### Abbreviations

ORs: odds ratio; CI: confidence interval; OECD: Organization for Economic Cooperation and Development; KRW: Korean won; CES-D: Center for Epidemiological Studies-Depression Scale.

### Competing interests

The authors declare that they have no competing interests.

### Authors contributions

Conceptualization: Kim H, Suh BS; Data curation: Kim H, Lee WC; Investigation: Kim H, Lee WC; Project administration: Suh BS, Lee WC; Supervision: Suh BS, Lee WC; Writing - original draft: Kim H; Writing - review & editing: Suh BS, Lee WC, Jung HS, Son KH, Nam MW, Kim HC.

longer the work hour, the higher the risk of stroke and coronary heart disease [6]. Long work-hour is associated with psychologic factors such as depression, anxiety symptoms [7,8], and reduced sleep quality [9,10]. It also adversely influences worker's family [11,12]. Furthermore, overtime work is related to higher occupational injuries than jobs without having long workhours [13,14].

After the Korea financial crisis in 1997, divorce risk has increased at a rapid speed [15]. Divorce, one of the most traumatic events in life, has negative physical influences. It can induce considerable risk for all-cause mortality and significantly increase the risk for early death compared to married counterparts [16]. Divorced men and women are known to have higher risk of suicide [17,18]. Divorce not only negatively impacts divorced men and women themselves, but also increases risk of early alcohol initiation [19], depression, and social functioning of in adolescence of their children [20].

Compared to male workers, female workers in Korea are generally responsible for most of the housework [21,22]. OECD reported that females spent more hours caring for their children than males, with the largest differences in Korea [23]. Although women's marital satisfaction was negatively associated with their household affair burden in Korea as already seen in Western countries, Korean women often experienced conflicts with their husbands about housework because housework was not equally distributed in Korea compared to that in China [24].

Various factors including shift work [25], depression [26], and financial strain [27] can negatively influence marital stability. However, the relationship between working time and the negative impact on marital status change such as divorce or separation has not been studied in Asian countries strongly influenced by Confucianism such as Korea [28]. Therefore, the objective of this study was to investigate the association between long workhours and marital status change by sex in Korea.

## METHODS

### Study populations

In South Korea, the Industrial Safety and Health Law requires annual or biennial health screening examinations for all employees free of charge. The Kangbuk Samsung Health Study was a cohort study of Korean females and males. The study population for the Kangbuk Samsung Health Study consisted of South Korean men and women aged 18 years or older who underwent a comprehensive health examination. More than 80% of participants were employees of various companies or local governmental organizations and their spouses. For this study, study participants were those who completed questionnaires of weekly workhours and marital status from 2014 to 2015.

We excluded 128,506 participants for the following reasons: those with missing data of marital status and weekly workhours ( $n = 59,587$ ), those whose marital status of unmarried, divorced, separated, or widowed in 2014 ( $n = 17,195$ ), and those who did not revisit in 2015 ( $n = 51,724$ ). The final number of subjects eligible for this study was 40,654 (Fig. 1). This study was approved by the Institutional Review Board of Kangbuk Samsung Hospital (approval number: 2018-08-030).

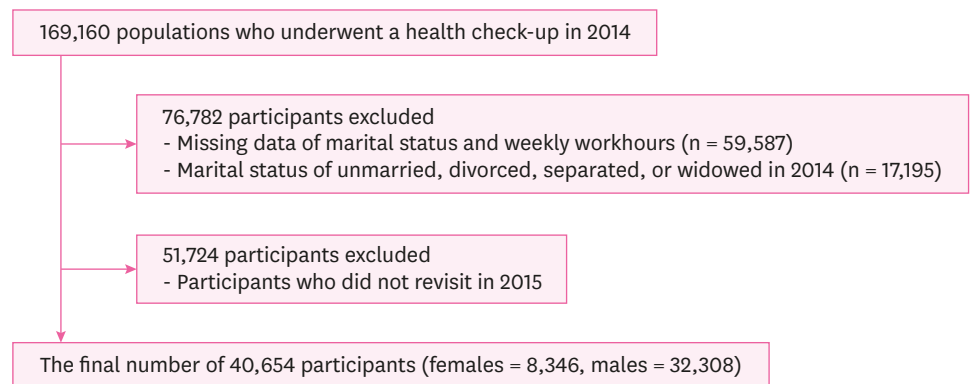


Fig. 1. Flow chart of study participants.

### Measurements

Baseline and follow-up data were collected at Kangbuk Samsung Hospital Total Healthcare center. Data of sociodemographic variables (educational status, total monthly household income, and marital status), occupational variables (weekly workhours and working type), and a psychological variable (depression) were collected through standardized, self-administered questionnaires.

Age were classified into the following groups: < 30, 30–39, 40–49, 50–59, and  $\geq 60$  years. Marital status in 2014 and 2015 for the study population was asked and classified as “unmarried,” “married,” “separated,” and “widowed.” Educational status was categorized into below middle school graduate, high school graduate, and above college graduate. Total household income per month included several portions including all earned income, real estate income, government subsidy, allowance from family members, and other income. It was determined among eight classifications between < 0.5 million Korean won (KRW) per month and  $\geq 6$  million KRW per month. The number of subjects earning more than or equal to 6 million KRW per month was higher than that of those earning less than 6 million KRW per month. Since the group with more than or equal to 6 million KRW was the highest among eight answers, 6 million KRW was determined as criteria of two groups to make the number of each group as even as possible.

According to the first clause of Article 50 (Work Hours) of the Korean Labor Standards Act, work hours shall not exceed 40 hours a week, excluding hours of recess. Also, under the second clause of Article 51 (Flexible Work Hours System), work hours in any particular week or in any particular day shall not exceed 52 or 12 hours, respectively [2]. Therefore, the sum of total workhours per week is up to 52 hours under the Korean law. Moreover, under Korean Enforcement Decree of the Industrial Accident Compensation Insurance Act and Public Notice of Korean Ministry of Employment and Labor, cerebrovascular and cardiovascular diseases by chronic overwork are approved as occupational diseases when the average of workhours per week during 12 weeks right before an event of the diseases exceeds 60 or 52 hours with aggravated factors of overwork [29]. Therefore, study subjects were categorized into the following groups by weekly workhours: less than or equal to 40 hours, from 41 to 52 hours, from 53 to 60 hours, and more than 60 hours. Weekly workhours were determined by the answer to the question “In the past year, how many hours did you work including overwork on average in a week?”. Work performed between 06:00 to 18:00 was considered as daytime work, and work performed outside this time zone was categorized as non-daytime work.

Center for Epidemiological Studies-Depression Scale (CES-D) consisting of 20 questions was used for depression screening. Total scores were added. A score of 16 or higher was considered as having high risk for clinical depression while a score of 15 or lower was considered as having normal limits.

### Statistical analysis

All statistical analyses were performed after sex stratification. The  $\chi^2$  test was conducted to determine statistical associations among weekly workhours, marital status change (2014–2015), and possible confounding variables. In this study, dependent variable set as the marital status in 2015 was divorce or separation. Univariate and multivariate logistic regression analyses were performed to understand the statistical association between weekly workhour and the dissolution of marital relationship. Odds ratios (ORs) and 95% confidence intervals (CIs) were calculated in 2 models: i) Model 1, adjusted by age, total monthly household income, and working type; and ii) Model 2, adjusted by age, total monthly household income, working type, and depression. IBM SPSS statistics for Windows 24.0 (IBM Corp., Armonk, NY, USA, released 2016) was used for all statistical analyses with significance level set at  $p < 0.05$ .

### Ethics statement

This study was approved by the Institutional Review Board of Kangbuk Samsung Hospital (approval number: 2018-08-030).

## RESULTS

The study group consisted of 8,346 (20.5%) female participants and 32,308 (79.5%) male participants. Age, educational status, total monthly household income, weekly workhours, working type, and depression were significantly different between female and male workers (**Table 1**). Proportions of above college graduates in females and males were 80.8% and 90.3%, respectively. Above 60% of females and males earned more than 6 million KRW per month. The highest percentage of weekly workhours was working  $\leq 40$  hours in females (64.8%) and working 41–52 hours in males (43.6%).

Age, educational status, total monthly household income, and working type were significantly different and associated with the categories of weekly workhours in both females and males (**Tables 2 and 3**). The proportion of weekly workhours less than or equal to 40 hours was higher in older, less educated, lower total monthly household income, non-daytime, and non-depressive group in females and males. The proportion of long working hours over 60 hours a week was higher in younger, less educated, higher total monthly household income, non-daytime, and depressive group in females and males.

The number of divorced or separated females and males were 32 (0.383%) and 74 (0.229%), respectively from 2014 to 2015 (data not shown). In both females and males, total household earning per month and depression were significantly associated with marital status change. Divorce or separation risk were statistically higher in those whose monthly income was  $< 6$  million KRW and those who were depressive in females and males (data not shown). **Table 4** shows the relationship between weekly workhours and the risk of marital status change from married to divorced or separated status (**Table 4**). When working  $\leq 40$  hours a week was considered as a reference group in the crude model, ORs (95% CI) of marital status change for working more than 60 hours were 4.26 (1.25–14.5) in females and

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**Table 1.** Baseline characteristics of study participants by sex

Characteristic	Total	Female (n = 8,346)	Male (n = 32,308)	p-value*
Age (years)				< 0.001
< 30	134 (0.3)	85 (1.0)	49 (0.2)	
30–39	7,299 (18.0)	2,266 (27.2)	5,033 (15.6)	
40–49	27,431 (67.5)	5,284 (63.3)	22,147 (68.5)	
50–59	5,425 (13.3)	676 (8.1)	4,749 (14.7)	
≥ 60	365 (0.9)	35 (0.4)	330 (1.0)	
Educational status				< 0.001
≤ Middle school	121 (0.3)	44 (0.5)	77 (0.2)	
High school	4,616 (11.4)	1,558 (18.7)	3,058 (9.5)	
≥ College	35,830 (88.3)	6,724 (80.8)	29,106 (90.3)	
Total monthly household income (KRW)				< 0.001
< 6 million	12,530 (35.8)	2,240 (32.2)	10,290 (36.7)	
≥ 6 million	22,469 (64.2)	4,714 (67.8)	17,755 (63.3)	
Weekly workhours (hours)				< 0.001
≤ 40	15,250 (37.5)	5,410 (64.8)	9,840 (30.5)	
41–52	16,190 (39.8)	2,094 (25.1)	14,096 (43.6)	
53–60	6,706 (16.5)	639 (7.7)	6,067 (18.8)	
> 60	2,508 (6.2)	203 (2.4)	2,305 (7.1)	
Working type				< 0.001
Daytime	38,964 (96.2)	7,636 (92.1)	31,328 (97.2)	
Non-daytime	1,542 (3.8)	654 (7.9)	888 (2.8)	
Depression				< 0.001
Yes	2,890 (7.2)	795 (9.8)	2,095 (6.6)	
No	37,077 (92.8)	7,356 (90.2)	29,721 (93.4)	

Data shown are number (%).

KRW: Korean won.

\*p-value by  $\chi^2$  test.**Table 2.** Baseline characteristics of study participants by weekly workhours in female

Characteristic	Weekly workhours				p-value*
	≤ 40	41–52	53–60	> 60	
Age (years)					< 0.001
< 30	35 (41.2)	39 (45.9)	6 (7.1)	5 (5.9)	
30–39	1,305 (57.6)	713 (31.5)	195 (8.6)	53 (2.3)	
40–49	3,535 (66.9)	1,226 (23.2)	397 (7.5)	126 (2.4)	
50–59	507 (75.0)	113 (16.7)	39 (5.8)	17 (2.5)	
≥ 60	28 (80.0)	3 (8.6)	2 (5.7)	2 (5.7)	
Educational status					< 0.001
≤ Middle school	30 (68.2)	4 (9.1)	6 (13.6)	4 (9.1)	
High school	1,088 (69.8)	325 (20.9)	102 (6.5)	43 (2.8)	
≥ College	4,279 (63.6)	1,761 (26.2)	530 (7.9)	154 (2.3)	
Total monthly household income (KRW)					< 0.001
< 6 million	1,638 (73.1)	414 (18.5)	138 (6.2)	50 (2.2)	
≥ 6 million	2,834 (60.1)	1,360 (28.9)	402 (8.5)	118 (2.5)	
Working type					< 0.001
Daytime	4,875 (63.8)	1,994 (26.1)	594 (7.8)	173 (2.3)	
Non-daytime	494 (75.5)	94 (14.4)	39 (6.0)	27 (4.1)	
Depression					< 0.001
Yes	467 (58.7)	202 (25.4)	91 (11.4)	35 (4.4)	
No	4,810 (65.4)	1,847 (25.1)	537 (7.3)	162 (2.2)	

Data shown are number (%).

KRW: Korean won.

\*p-value by  $\chi^2$  test.

1.07 (0.40–2.85) in males, respectively. In Model 1 after adjusting for age, total household income per month, and working type, ORs (95% CI) for working more than 60 hours were 4.53 (1.01–20.3) in females and 1.61 (0.58–4.46) in males. In Model 2 after adjusting for variables of Model 1 plus depression, ORs (95% CI) for workhours more than 60 hours

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**Table 3.** Baseline characteristics of study participants by weekly workhours in male

Characteristic	Weekly workhours				p-value*
	≤ 40	41–52	53–60	> 60	
Age (years)					< 0.001
< 30	15 (30.6)	18 (36.7)	12 (24.5)	4 (8.2)	
30–39	1,339 (26.6)	2,092 (41.6)	1,091 (21.7)	511 (10.2)	
40–49	6,218 (28.1)	9,925 (44.8)	4,401 (19.9)	1,603 (7.2)	
50–59	2,080 (43.8)	1,974 (41.6)	529 (11.1)	166 (3.5)	
≥ 60	188 (57.0)	87 (26.4)	34 (10.3)	21 (6.4)	
Educational status					< 0.001
≤ Middle school	36 (46.8)	27 (35.1)	8 (10.4)	6 (7.8)	
High school	1,262 (41.3)	1,298 (42.4)	372 (12.2)	126 (4.1)	
≥ College	8,514 (29.3)	12,752 (43.8)	5,676 (19.5)	2,164 (7.4)	
Total monthly household income (KRW)					< 0.001
< 6 million	3,417 (33.2)	4,562 (44.3)	1,697 (16.5)	614 (6.0)	
≥ 6 million	5,027 (28.3)	7,717 (43.5)	3,599 (20.3)	1,412 (8.0)	
Working type					< 0.001
Daytime	9,496 (30.3)	13,744 (43.9)	5,925 (18.9)	2,163 (6.9)	
Non-daytime	307 (34.6)	318 (35.8)	136 (15.3)	127 (14.3)	
Depression					< 0.001
Yes	570 (27.2)	818 (39.0)	461 (22.0)	246 (11.7)	
No	9,062 (30.5)	13,110 (44.1)	5,526 (18.6)	2,023 (6.8)	

Data shown are number (%).

KRW: Korean won.

\*p-value by  $\chi^2$  test.**Table 4.** ORs and 95% CIs of marital status change according to weekly workhours

Weekly workhours	Crude		Model 1*		Model 2†	
	Female	Male	Female	Male	Female	Male
	ORs (95% CI)	ORs (95% CI)	ORs (95% CI)	ORs (95% CI)	ORs (95% CI)	ORs (95% CI)
≤ 40	1.00	1.00	1.00	1.00	1.00	1.00
41–52	0.82 (0.33–2.04)	1.19 (0.68–2.06)	0.68 (0.19–2.39)	1.38 (0.74–2.55)	0.67 (0.19–2.33)	1.46 (0.78–2.73)
53–60	1.79 (0.61–5.27)	1.21 (0.62–2.38)	2.97 (0.97–9.13)	1.44 (0.67–3.09)	2.71 (0.88–8.36)	1.47 (0.68–3.18)
> 60	4.26 (1.25–14.5)	1.07 (0.40–2.85)	4.53 (1.01–20.3)	1.61 (0.58–4.46)	4.57 (1.02–20.5)	1.55 (0.55–4.35)
p for trend	0.068	0.684	0.034	0.262	0.043	0.294

OR: odds ratio; CI: confidence interval.

\*Model 1: adjusted for age, total monthly household income, and working type after sex stratification; †Model 2: adjusted for age, total monthly household income, working type, and depression after sex stratification.

were 4.57 (1.02–20.5) in female workers and 1.55 (0.55–4.35) in male workers, respectively. Female workers working for more than 60 hours per week had statistically significant associations with marital status change after adjusting for covariates with a significantly positively linear trend dose-response relationship ( $p$  for trend = 0.043).

## DISCUSSION

This study showed the association between average weekly workhours and marriage dissolution of Korean female workers from 2014 to 2015. Working for more than 60 hours per week was significantly associated with marriage change to divorce or separation after adjusting for confounding variables with a dose-response relationship in female workers.

ORs of marital status change for working more than 60 hours per week increased in Model 1 and Model 2 compared to the crude model in females. While four confounding factors were considered one by one, only total monthly household income more than or equal to 6 million KRW decreased the risk of marital status change. Therefore, ORs of marital status change increased in Model 1 compared to the crude model increased because of total

monthly household income. ORs of marital status change in Model 2 compared to Model 1 after considering depression because depressive subjects could reduce their workhours and shortened workhours could decrease the risk of divorce or separation. Thus, total monthly household income could decrease the risk of divorce or separation and depression status could have a negative influence on marital status change through workhours in females. Further studies considering interaction among diverse confounders between long workhours and marital status change are needed.

A panel study tracking for three years from the beginning of marriage in America have reported no significant relation between workhours and divorce risk in male workers [30]. However, long workhours increased the probability of divorce in female workers [30]. Also, a retrospective study from the Netherlands has suggested that longer workhours is associated with greater risk of divorce in females but lower risk in males during the first year of marriage [31]. However, the overtime work group of males ( $\geq 50$  hours per week) and females ( $\geq 40$  hours per week) did not show statistically significant difference in divorce risk compared with the non-overtime work group of males ( $< 50$  hours per week) and females ( $< 40$  hours per week), respectively [31]. Results of our study are consistent with results of the above 2 studies, reporting that long workhours could increase the likelihood of divorce or separation in females in a dose-dependent way, not in males. We classified weekly workhours into 4 groups which was more detailed than the Netherlands study. Our study showed that overwork ( $> 60$  hours per week) increased the risk of divorce and separation.

Although how overwork could increase marriage breakdown in females is not fully comprehended yet, several hypotheses have been proposed. First, for female workers, time spent on work is the exchange of time used for their family because women are more likely to be in charge of household affairs and child care than men [22,30,32]. Couples are under more pressure within the household when both have no time to dedicate to each other or to family affairs [30]. Women's overtime working means the lack of family time which is necessary for improving communication and attachment between wife and husband [31,33]. Korean women experience more conflicts with their spouses regarding to housework [24]. Also, time difference spent on caring for their children is the largest in Korea [23]. Females working long hours in Korea might gain shorter family interaction time than female in other countries. Second, female workers financially independent from their spouses can easily break their marriage because their enough resources can help them escape from a bad marriage [30,34]. Also, financial strain has partial responsibilities for the divorce risk [31]. However, our study showed that females earning more than or equal to 6 million KRW per month had significantly lower risk of divorce or separation than those making less than 6 million KRW per month, even though total monthly household income of females might be their husbands' income (data not shown). The study subjects of 85.3% in females and 87.7% in males earned more than or equal to 4 million KRW per month. Compared to this study population, in the fourth Korean Working Conditions Survey in 2014, general Korean workers aged not less than 20 graduated college or above (50.8%) and earned more than 3 million KRW per month (23.4%) [35]. Thus, our study population may not represent other general Korean workers and further studies about the relationship between total monthly income and the risk of divorce are necessary. Finally, overtime work is associated with depression status [7,8]. Also, depression could have a bad influence on the stability of marriage [26]. Therefore, long workhours might increase the risk of marital status change through depression. Our results also determined that depressive women had significantly higher risk of divorce or separation than those not depressive (data not shown).

Other factors such as the presence of children and spouses' weekly workhours could affect the probability of divorce. Couples with children have lower risk of divorce than couples without children [31]. However, the effect of overtime work on marital instability is different by sex when there is the presence of children. An additional worktime by men decreases divorce risk, but an additional worktime by women increases divorce risk [30]. The risk of divorce is much higher in both spouses having jobs than in only one having a job [30]. Unfortunately, we were not able to consider the presence of children and spouses' workhours per week because our data did not include information about children and could not match the information between spouses. In this study, only after adjusting for age, working type, total monthly financial income, and depression, working for more than 60 hours a week still significantly increased the risk of divorce compared to working for less than or equal to 40 hours a week. Thus, further research considering the presence of children and spouses' weekly workhours is needed to understand the risk of divorce or separation.

Some limitations of this study should be considered. First, subjects of this study were mostly highly educated and middle-aged Koreans who underwent health check-ups on regular basis. Therefore, our results may not be generalized to other age groups, or less educated groups, or populations with different demographical factors. Second, marital status was primarily determined by a self-reported questionnaire which might be underestimated. Although there were a few limitations, this was one of few studies to identify the association between weekly working time and marital breakdown in Asian countries influenced by Confucianism to the best of our knowledge. In addition, a comprehensive inclusion of potential confounding factors including household earning, working type, and depression strengthened findings of this study, even though there are other confounding variables to consider.

## CONCLUSIONS

In conclusion, our study indicated that long workhours could increase the risk of divorce or separation in women after adjusting for various confounders in a sample of highly educated and middle-aged Koreans. This association was only revealed in female workers, not in male workers. Since our study only observed the follow-up of marital status change after 1 year, long term follow-up of marital status changes with reducing aforementioned limitations is needed in the future to determine the association between weekly long workhours and marital status change.

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