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The Effect of Long Work Hours on Workers' Health in Korea

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THE EFFECT OF LONG WORK HOURS ON WORKERS' HEALTH IN KOREA

A Thesis
Presented to
the Graduate School of
Clemson University

In Partial Fulfillment
of the Requirements for the Degree
Master of Science
Applied Sociology

by
Sang In Jung
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Accepted by:
Dr. William Haller, Committee Chair
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Dr. Victoria Prieto Rosas

ABSTRACT

This study examines the association between long work hours and health status of Korean workers. Korea has atypically long weekly working hours, which raises concerns about workers' health. To explore the impact of long work hours, I analyzed data from the 4th Korean Working Conditions Survey (KWCS) conducted by Korean Occupational Safety and Health Agency (KOSHA) in 2014. This survey collected data on various characteristics of a nationally representative sample of 50,000 economically active workers. KWCS aimed to estimate several parameters of the working population in Korea, including demographic characteristics, exposure to hazards, and health problems among workers aged 15 and older. In this study, the dependent variable, subjective health status, is an ordinal-level variable rated on a 5-point scale.

Korean workers are known as one of the hardest working people in the world. Still, from the analysis from the KWCS in 2014, nearly half of Koreans (44.5%) work more than 48 hours a week. This study also revealed that long work hours have an adverse effect on health in Korean society. Working overtime has negative effect on workers' health after controlling several workers' characteristics. Working excessive overtime has an even stronger negative effect on self-rated health than working overtime. Surprisingly, contrary to our expectation, the adverse effect of overtime work on health is stronger for men than for women.

Keywords: Korean workers, long work hours, ill health, KWCS

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“If you thought you worked long hours, consider 39-year-old Lee from South Korea. A civil servant at the ministry of agriculture and fisheries, Lee gets up at 5:30 a.m. every day, gets dressed and makes a two-hour commute into Seoul to start work at 8:30 a.m. After sitting at a computer for most of the day, Lee typically gets out the door at 9 p.m. or even later.”

(Olson, P. 2008. The world’s hardest-working countries. Forbes)

INTRODUCTION

Do long workhours have a negative impact on workers’ health? In 2004, the Korean government reduced legal working hours from 44 hours to 40 hours per week to lessen possible increases in costs for employers and to improve quality of life for workers. However, Koreans typically work longer than many other country’s workers. According to the Organization for Economic Cooperation and Development (OECD), Koreans on average worked 2,113 hours in 2015. This is 347 hours longer than the average of OECD countries, which was 1,766 hours per year. Korea’s annual working hour average is the third longest after Mexico (2,246) and Costa Rica (2,230). Among 37 countries (the 35 OECD member countries, plus Costa Rica and Russia), Korea ranked third in longest working hours annually. Germany ranked last, averaging only 1,371 hours. Although the Korean government introduced the revised Labor Standard Act in 2004 to reduce work times, Koreans still work longer than the average worker globally.

The culture of working long hours in Korea raised concerns about workers’ health. Numerous studies have highlighted that long working hours can result in health problems

(Van der Hulst, 2003; Sparks et al., 1997; Caruso et al., 2006). Other scholars have pointed out that overtime hours of work are associated with a higher accident rate due to fatigue (Vernon, 1921; Schuster, & Rhodes, 1985). Some findings indicate that long hours can lead to preterm birth (Mozurkewich et al., 2000), while other studies found associations between work hours and stress or fatigue (Park et al., 2010). Growing numbers of scholars have argued that long work hours are associated with unhealthy life styles such as smoking and insufficient exercise. (Maruyama & Morimoto, 1995; Sparks et al., 1997; Van der Hulst, 2003). These behaviors can lead to ill health (Maruyama et al., 1995). Smoking intensity was positively related with working more than 8 hours a day (Westman, 1985); and in Japan alcohol consumption has become “an integral part of the long work hour culture” (Kawakami, 2003).

Most studies on the association between long working hours and health have been conducted in specific occupational groups such as managers and nurses or in specific work environment like hospitals or manufacturing plants (Caruso et al., 2006). Moreover, there is no convincing evidence to support the long work hour effect on workforces generally since the definitions of overtime are different across countries. (Bannai & Tamakoshi, 2014). Even though Koreans are one of the hardest working peoples in the world, there has not been many studies on long work hour effects on Korean workers. Therefore, I will analyze workers’ representative data that contains information on both health outcomes and work hours to explore the adverse effect of overtime work. Additionally, I will examine whether there is any gender difference in long work hours

effect on workers' health. The purpose of this study is to examine the association between long work hours and health status of workers in Korea and its gender differences.

LITERATURE REVIEW

Work Hours in Korea

To better understand long work hours, the definitions of '*normal work hours*' and '*overtime work hours*' need to be reviewed. There is no universal agreement on defining either '*normal work hours*' or '*overtime work hours*'. Although the definition of these terms varies throughout the world, '*normal work hours*' are usually between 35 and 44 hours with a median of around 40 hours (Spurgeon, Harrington & Cooper, 1997). The International Labor Organization (ILO) states that employee's working hours shall not exceed forty-eight in the week (Hours of Work, Convention No.1, 1919). This has become the standard of many nations' laws for weekly work hours of 48 hours or less. In other words, '*normal work hours*' are only up to 48 hours per week. On the other hand, the meaning of '*overtime*' is also indefinite since it depends on how '*normal work hours*' is regarded (Vernon, 1921). The ILO defines '*overtime*' as all works in excess of normal work hours (Reduction of Hours of Work, Convention No.6, 1962). Even though the term '*overtime*' is defined many ways by the culture, the threshold between normal work hours and overtime work hours is regarded internationally to be '*48 hours per week*'.

Then, how many Koreans work overtime? Nearly half of Koreans work beyond 48 hours per week which is defined as overtime by ILO. Lee and his colleagues (2007) found that 49.5% of employees in Korea worked more than 48 hours per week. Park (2010) also revealed, in analysis of Korean Working Condition Survey (KWCS) in 2010, the proportion of workers who work more than 48 hours per week is 49.5%. This result is consistent with the Lee's finding mentioned before. This proportion found in the 2010

survey is 4.5% higher than the previous KWCS in 2006 which found that 45.0% of Koreans worked overtime.

Additional evidence shows Seoul, the capital city of South Korea, has exceptionally long work hours among 55 cities in the world. The Union des Banques Suisses studied labor hours in cities (Sutcliffe, 2001). In this study, Seoul is the 5th longest working city after Hong Kong, Mexico City, Istanbul and Bombay. (Sutcliffe, 2001). The annual work hour gap between Seoul (2,200 hours per year) and Berlin (1,660 hours per year) is approximately 540 hours per year.

The culture of long work hours in Korea

Why do Koreans work longer than the global average? Every worker might have their own reasons of working longer hours. Some people need to earn more money by working more hours, while others may enjoy their work and working longer hours on their own. Some might have a massive workload while others need to demonstrate their fidelity to their company. Individual reasons, however, are not the only explanatory factors. Other than these individual reasons, Korean society does have social and cultural factors influencing longer labor hours.

First, relatively high overtime pay rate in Korea attracts employees to work more hours. Spurgeon et al. (1997) points out that overtime premium attracts employee to spend more time at work. The advantage of overtime work for employees is that employers often pay extra salary at premium rates for the overtime work (Spurgeon et al., 1997). Moreover, overtime premium rate in Korea is higher than many other countries. For example, in Korea, employers pay 50% more for overtime whereas Japanese

companies pays 25% premium on overtime hours. Park and her colleagues (2010) argued that overtime work attracts employees with 50% of premium rate, and this might be the reason half of Koreans are still working longer hours than legally specified. According to the Samsung Research Institute (2008), allowance for overtime work consists of 10% of monthly pay in manufacturing industry in 2004. Thus, reducing work hours reduces income.

Table 1. Overtime Work Premium Rate

Overtime Work Premium Rate by Nations						
	Korea	U.S.	Japan	U.K.	Germany	France
Overtime Work	50%	50%	25%			35-43hrs/week: 10%,
Holiday Work	50%	Labor- Management Negotiation	35%	Labor- Management Negotiation	Labor- Management Negotiation	More than 44hrs/week: 50%

Source: C.E.O Information, Samsung Research Institute, 2008

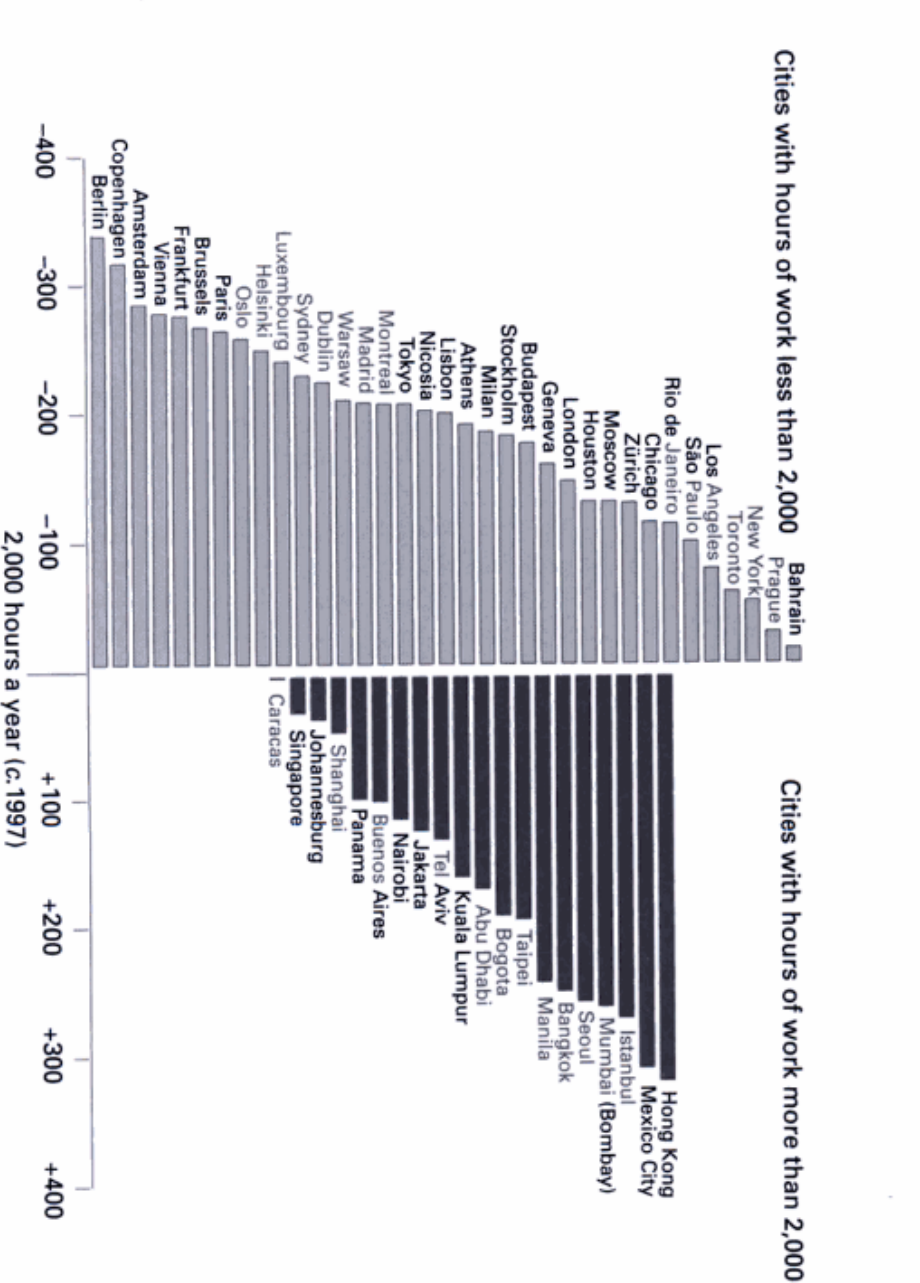
Second, long work hours are seen as commitment and loyalty to the job (Chandra, 2012, Bae & Chung, 1997). Korean culture is rooted in the Confucian tradition that values loyalty within social hierarchies, which includes elders, supervisors and workplaces. The cultural background might have influenced Korean workers' attitudes that individuals ought to be loyal to the firm. (Bae & Chung, 1997). Many show loyalty and commitment to their firm by staying longer hours at the office.

Figure 1. Annual Work Hours by Countries



Source: OECD (2017), Hours Worked, <http://dx.doi.org/10.1787/data-00303-en> (Accessed on Dec 2017)

Figure 2. Annual Work Hours by Cities



Source: Sutcliffe, 2010

Long work hours and health

What is the current status of the scientific evidence relating to the effects of long work hours? In recent years, there have been a growing number of studies identifying the effect of overtime work on health. Many of them have shown that longer working hours are strongly associated with employees' health. (Van der Hulst, 2003; Sparks et al., 1997; Caruso et al., 1997). To clarify the relation between extended work hours and health, Van der Hulst (2003) reviewed 27 empirical studies. He points out that long work hours are considered a factor in diverse ill health outcomes. He tested several health measurements and those are 1) cardiovascular disease, 2) diabetes, 3) disability retirement, 4) lower levels of subjectively reported physical health, 5) higher subjectively reported fatigue. In addition to that, he also mentioned some health-related behaviors, for example reduced sleep hours are associated with long work hours (Van der Hulst, 2003). In the particular case of 'subjective general health' criterion, his study demonstrated that extended work hours were associated with negative health generally. (Van der Hulst, 2003).

Sparks et al. (1997) reviewed existing literatures using both quantitative and qualitative methods. The results of both methods indicate that working long hours can cause detrimental health. She found that some moderating factors, such as types of jobs, working environments and age, play a role in the association between work hours and health (Sparks et al., 1997). The review also cites some evidence that working long hours may lead to an increase in maladaptive behaviors. These behaviors eventually can lead to ill health. (Sparks et al., 1997). "Maladaptive behaviors", which refers to types of

behavior that create rather than avoid health problems, are smoking cigarette and substance misuse.

Some evidence also indicates long work hours are associated with unhealthy life styles, including smoking and insufficient exercise. Then, these behaviors can lead to ill health. (Maruyama et al., 1995; Sparks et al., 1997; Van der Hulst, 2003). Maruyama et al. (1995) found that long work hours most significantly influenced sleep hours among several health practices. Life style indicators including drinking coffee, regularity of sleep or meals were also tested to examine the relationship between life style and long work hours. The study indicates that employees with longer work hours are more likely to have unhealthy behaviors than those with relatively shorter labor hours (Maruyama et al., 1995). Smoking intensity was positively related with working more than 8 hours a day (Westman, 1985). As mentioned previously, in Japan, alcohol consumption has become “an integral part of the long work hour culture” (Kawakami, 2003).

Long work hour and health by gender (Job stress model)

Women’s increasing economic involvement in Korea necessitates examining the effects of long work hours by gender. A ‘*Job stress*’ model suggests that jobs create pressure which adversely effects physical and mental well-being for men and women differently (Sorensen & Verbrugge, 1987). In Korea, women’s economic participation rate increased from 30.8% in 1963 to 48.3% in 2004. (Kim & Kim, 2007). According to the data from ‘Economically Active Populations Survey’ in December 2017, women’s economic participation rate was 51.8% compared to 73.2% for those of men’s (Statistics Korea, 2018). Despite increased female participation in the labor force, women continue

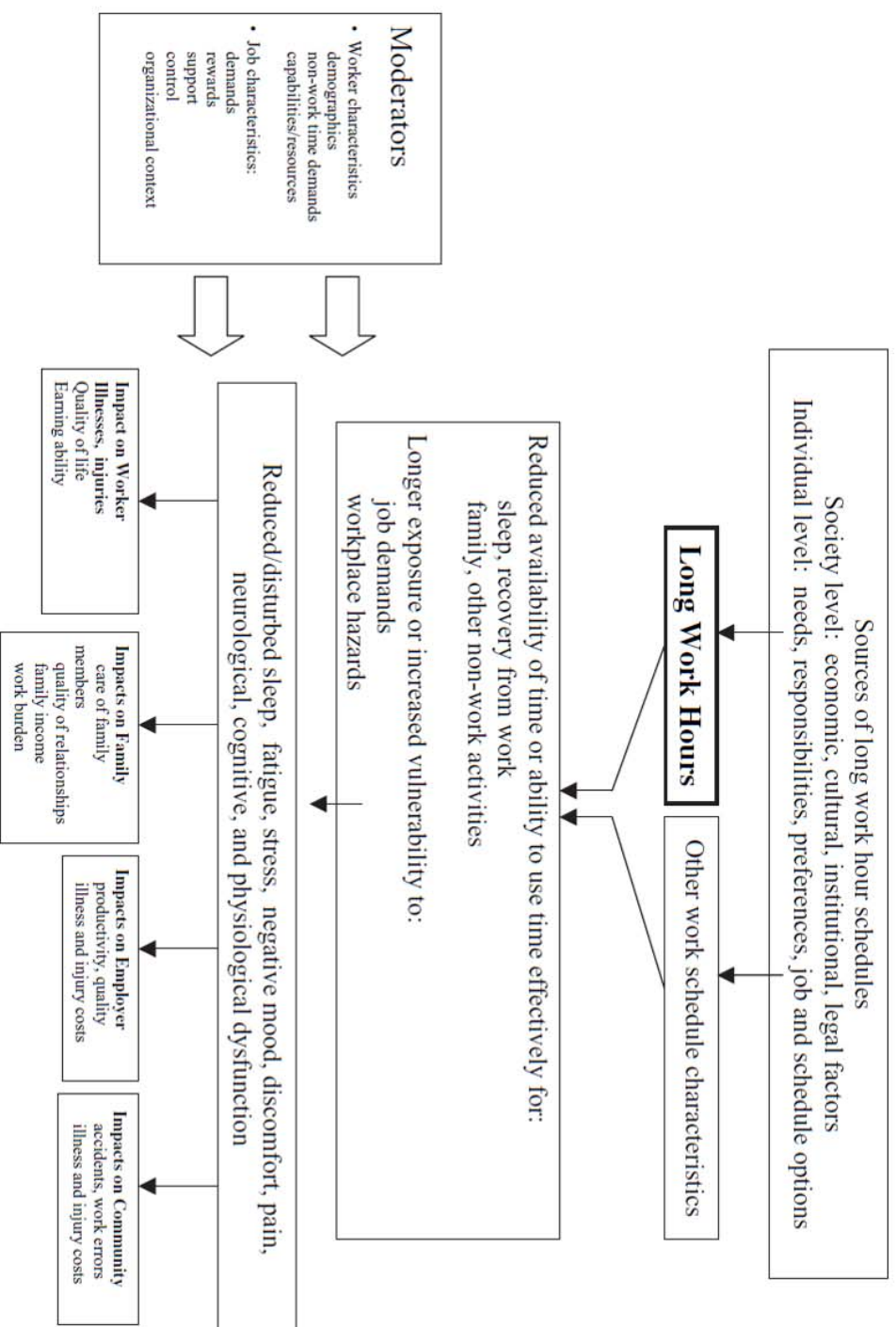
to fulfill household chores and childcare disproportionately (Sorensen et al., 1987). It is often mentioned that multiple responsibilities of wife, mother and worker will negatively affect women's health. According to Gove and Greerken (1997), having children in the family increases women's responsibility and results in a range of symptoms, both physical and psychological. Spurgeon et al. (1997) indicated that there is a gender difference in the adverse effects of long hours of work. The effect on women is believed to be greater than that on men since women generally have additional domestic stressors (Spurgeon et al., 1997), particularly in societies with very patriarchal cultures. Hall (1992) studied sex differences on combined impact of stress generated from 'house work' and 'paid work'. Women are more likely to have higher levels of psychosomatic symptoms than men due to the interactive effect between domestic work and paid work (Hall, 1992). Double exposure, simultaneous exposure to domestic activities and job strain, seems to be an important risk factor that causes greater health problems for women compared to men, who generally do not share equitably family housekeeping and child care responsibilities (Krantz & Ostergren, 2001).

Conceptual framework of long work hour study

Caruso et al. (2006) suggested a conceptual framework for the study of long work hours. In her framework, long work hours are associated with workers' illness and injuries through intervening variables. Possible interventions were reduced sleep or ability to use time for family. Her framework contains two types of moderating factors. The first type of moderator is workers' characteristics such as 1) age, 2) gender, 3) health status, 4) coping styles, 5) sleep needs, 6) support from family, 7) financial status (Caruso

et al., 2006). These kinds of considerations, individual, social, and economic characteristics, may influence the health effects of overtime work. Beside these moderators, Caruso (2006) also recommended examining ‘job characteristics’ in research on long work hours. Job characteristics, such as job demand, occupational exposures and financial rewards, may also influence the impact of long work hours on health.

Figure 3. Framework for study of undesirable impact of long work



Source: Caruso et al., 2006.

HYPOTHESES

Based on this previously discussed research, several hypotheses can help explain the differences in health associated with length of work hours. Growing numbers of scholars have argued that long work hours cause ill health (Van der Hulst, 2003; Sparks et al., 1997; Caruso et al., 1997). Sparks et al. (1997) indicated that working long hours can cause detrimental health. In the particular case of ‘self-rated health’, some studies demonstrated that extended work hours are associated with negative general health. (Van der Hulst, 2003). Maruyama (1995) argued long work hours are associated with unhealthy life style choices such as smoking and insufficient exercise. Then, these behaviors can lead to ill health. Based on these empirical studies, I propose that there is adverse association between overtime work hours and health, and proffer the following hypotheses,

H1: Workers who work overtime (48-59) are less likely to be healthy than those who work normal work hours (35-47).

H2: Workers who work excessive overtime (60+) are less likely to be healthy than those who work normal work hours (35-47).

H3: The adverse effect of long work hours on health is stronger for those who work excessive overtime (60+) than those who work overtime (48-59).

As mentioned above, besides of overtime hours of work, women generally have additional domestic work at home (Spurgeon et al., 1997). According to the data from Time Use Survey in 2004, Korean women among dual-income family spent approximately 2.5 hours for house work whereas Korean men spent 0.2 hours. (Kim et al.,

2007). Gove (1997) concluded that the multiple responsibilities of wife, mother and worker will negatively affect their health (Gove et al., 1977). Spurgeon et al. (1997) cited that there is gender difference in adverse effects of long hours of work. The effect on women is greater than on men since women have additional domestic stressors (Spurgeon et al., 1997). Thus, I expect the ill health effect is stronger for women than for men. I propose here that women are more likely to be influenced by the negative effect of long work hours, according to the following hypotheses,

H4: Female workers are less likely to be healthy than male workers at the same or equivalent levels of working hours.

METHODOLOGY

Data

I analyzed data from the Korean Working Conditions Survey (KWCS). The KWCS was conducted at four times points: 2006, 2010, 2011, and 2014 by Korean Occupational Safety and Health Agency (KOSHA). This paper will use the 2014 survey. KWCS benchmarked the Working Conditions Survey of the EU (EWCS) and the Labor Force Survey of England. It aimed to identify working conditions such as work type, employment form, categories of occupation and business, exposure to hazards and stability of employment from nationwide workers (KOSHA, 2014).

The population targeted for this survey was paid workers (those working for salary or wages) aged 15 (minimum legal work age) and older, at the time of survey, living in any household of Korea. The survey population is defined through the Population & Housing Census in 2010, and it reflects characteristics of 50,000 economically active workers. 'Economically active' was defined those who worked more than 1 hour during previous week at the time of survey. The unemployed, housewives, retired, and students were excluded. Fieldwork was conducted from June to August with about 500 people conducting the survey (KOSHA, 2014). Interviewers visited each household for the survey and both PAPI (pen-and-paper interviewing) and CAPI (computer-assisted personal interviewing) were utilized (KOSHA, 2014). The full response rate, the number of respondents gave complete answers denominated by number of survey subjects, was 0.316 (KOSHA, 2014).

In the sampling design, multi-stage random sampling method was used. From the 2010 Population and housing census, 17 cities were stratified depending on the characteristic of each enumeration districts. Then, sampling enumeration districts were extracted by using the simple systematic sampling method. Within those sampling units, the households located at every k th point from reference point were selected. If the households having more than one employee, the final respondents were selected by the method applying the late birthday (KOSHA, 2014). Because of the sampling design, case weights were provided and the weighted results are reported.

Measurement

Dependent variable

Subjective Health Status. Subjective health was measured by a question that asks, “How is your health in general?” The answers were 1) Very good, 2) Good, 3) Fair, 4) Bad, 5) Very bad. Self-assessments of health have been used universally as indicators of health across the study of sociology, epidemiology and gerontology (Shadbolt, 1997). Despite the subjective nature of self-reported health, scholars utilize it as a reliable indicator of overall health (Schnittker & Bacak, 2014, Okosun et al. 2001). Some scholars argued that subjective health is strongly associated with objective health. For example, objective health status such as obesity has negative impact on subjective health (Okosun et al. 2001). I will use reversed-coding, which is 1) Very bad, 2) Bad, 3) Fair, 4) Good, 5) Very good. In this way, interpretation of the results is clear that higher values are associated with the better subjective health status.

Independent variables

Work Hours. Number of hours worked per week was measured by a question that asked, “How many hours do you usually work per week in your main paid job?” The work hours will be grouped into four categories for the comparison of workers’ health. The categorized groups are 1) Part time (1-34), 2) Full Time (35-47), 3) Overtime (48-59), and 4) Excessive Overtime (60+). The reference group will be ‘Normal Work hours’ group which ranges from 35 through 47 hours per week. Numerous scholars have compared health outcomes between workhour groups. However, there is no universal agreement on definition of part-time, full-time and overtime since the definition of legal work hours are different by countries. Moreover, the concept of overtime also varies depending on various cultures and work environments. In this study, I used the ILO’s definition to categorize work hours per week. The ILO defines ‘*Part time* (1-34)’ that work less than 35 hours per week. ‘*Overtime* (48-59)’ is defined any work beyond 48 hours up to 59 hours per week. ‘*Excessive overtime* (60+)’ is work more than 60 hours per week. There is no specific definition of ‘*Normal Work hours*’ given. However, we can assume that work hours between ‘*Part time*’ (less than 35 hrs/week) and ‘*Overtime*’ (more than 48 hrs/week) is the ‘*Normal Work hours*’. Thus, this research will define ‘*Normal Work Hours*’ that weekly hours range from 35 to 47.

Gender. Respondents’ sex was originally coded 1=male and 2=female. I recoded this into 0=male, 1=female.

Workers' Characteristics variables (Control variables).

Workers' characteristics variables used in the analysis are 'age' and 'education'. *Age* is a continuous variable in this analysis. As for *education*, it is ordinal and is measured in levels by answers to the question "What is the level of highest education or training that you have successfully completed?". There are seven choices, including 1) no education or lower than primary education 2) Elementary schools, 3) Middle school, 4) High school, 5) College (2-year course), 6) University (4-year course), 7) Graduate or above. The reference group for education will be 'No education' group.

Job Characteristics Variables (Control variables).

Job characteristics variables used in the analysis are 'Types of occupation', and 'Region'. *Type of occupation* were measured by question asking "Of the following, which one would be suitable for your work?" Respondents were asked to choose occupation type between eleven categories 1) Administrator, 2) Professional, 3) Engineer and Semi-professional, 4) Office worker, 5) Service worker, 6) Sales worker, 7) Agriculture, forestry and fishery industry skilled worker, 8) Technical skilled worker and related skilled worker, 9) Equipment-machinery operator and assembly worker, 10) Simple labor worker, 11) Soldier. This measure is recoded into four broad occupation groups by occupational skill level such as 'High-skilled non-manual', 'Low-skilled non-manual', 'Skilled manual', and 'Unskilled manual'. As for *region*, respondents were asked to choose one of the seventeen regions. These regions consist of Seoul, six metropolitan regions and ten regional provinces. These will be dichotomized into Seoul

and other regions (Seoul=1, Other regions=0) to examine the health difference between capital city of South Korea and other cities.

Household Characteristics Variables (Control variables).

Household characteristics variables used in the analysis are ‘Number of household members’, ‘Housework Frequency’. *Number of household members* is a discrete, ratio variable. It is measured by answers to the question “Including yourself, can you please tell me how many people live in this household?” As for *Housework Frequency*, it was measured by question asking “In general, how often are you involved in any of the following activities outside work? Cooking and housework” Respondents were asked to choose housework frequency between six categories 1) Everyday for 1 hour or more, 2) Everyday or every second day for less than 1 hour, 3) Once or twice a week, 4) Once or twice a month, 5) Once or twice a year, 6) Never.

Ordinal Logistic Regression Analysis

To test the hypotheses in this study, ordinal logistic regression models were estimated to test the relations between an ordinal dependent variable and some independent variables. Ordinal logistic regression is used when the dependent variable is measured on an ordinal scale (Agresti & Finlay, 2009; Kutner, Nachtsheim, Neter, & Li, 2005). Categorical variables can be analyzed by nominal logistic regression. However, it is more effective strategy using ordinal logistic regression if the categories are ordered (Agresti et al., 2009; Kutner et al., 2005). In this study, ordinal logistic regression will be used since our dependent variable, self-rated health, answered with ranked scale rated on

a 5-point scale (very bad, bad, fair, good, very good). For the interpretation, coefficients were exponentiated to form an estimated odds ratio for cumulative probabilities.

RESULTS

Descriptive statistics

Univariate analyses were conducted, which reported descriptive statistics such as frequency, percentage, mean and standard deviation, medians for each variable.

As indicated in Table 2, Subjective health status ranged from “very bad (1)” to “very good (5)”. Those who reported very bad and bad health were 0.4% and 4.7% respectively. One fourth of respondents reported fair health. Those who rated good and very good health were 62.1% and 7.7% respectively.

Work hours were measured through number of weekly work hours. The mean for work hours per week was 45.9 hours and the standard deviation was 14.7. Work hours were categorized into four groups for comparison between groups. One eighth respondents worked part time (less than 35 hours per week). Those who worked normal work hours (between 35 hours and 47 hours per week) were 43%. The proportion of overtime (between 48 hours and 59 hours per week) and excessive overtime (more than 60 hours per week) workers were 22.7% and 21.8% respectively. When we add proportion of overtime and excessive overtime groups together, 44.5% of sample workers worked more than 48 hours per week. This result indicated proportion of workers that work more than 48 hours are even larger than those with normal work hours (43.0%), but was a 5% reduction from the 2010 estimates by Park.

The sample was 50.3% male and 49.7% female. Age ranged from 15 to 97: the mean age was 45.6 years and the standard deviation was 13.5. Table 2 indicates that 2.3% of respondents had ‘no education’, Workers completed elementary school, middle school

and high school were 5.7%, 8.3% and 39.0% respectively. One eighth (12.5%) received some college or associate's degree, and 30.1% of respondents completed their bachelor's degree. Workers with graduate or higher level of education was 2.0%. Most respondents have 'low-skilled non-manual' occupation (52.9%) followed by 'skilled manual (20.3)', 'skilled non-manual (14.3%)' and 'unskilled manual (12.4%)' occupation. The region variable was dichotomized by whether respondents live in Seoul or not. One fifth of the sampled workers lived in Seoul and 79.9% lived in other areas. The number of household member ranged from 1 to 10. The mean number of household member was 2.9 and the standard deviation was 1.2. More than two fifths of respondents did housework everyday more than 1 hours while 22.3% never did housework at home.

Table2. Descriptive Statistics

	N	Mean (std.)/ Medians if ordinal	Frequency	Valid Percent
Subjective Health Status	49,220	4		
Very Bad (1)			194	0.4
Bad (2)			2,331	4.7
Fair (3)			12,335	25.1
Good (4)			30,571	62.1
Very Good (5)			3,789	7.7
Work Hour / Week	49,576	45.9(14.7)		
PartTime(<34)			6,174	12.5
Normal(35-47)			21,329	43.0
Overtime(48-59)			11,264	22.7
Excessive Overtime(>60)			10,809	21.8
Gender	50,038			
Male			25,165	50.3
Female			24,873	49.7
Age	50,038	45.6(13.5)		
Education	49,589			
No Education			1,124	2.3
Elementary School			2,834	5.7
Middle School			4,128	8.3
High School			19,352	39.0
College(2-year course)			6,221	12.5
University(4-year course)			14,926	30.1
Graduate and Above			1,003	2.0
Type of Occupation	50,009			
Unskilled			6,226	12.4
Skilled Manual			10,159	20.3
Low-skilled Non-Manual			26,475	52.9
Skilled Non-Manual			7,149	14.3
Region	50,038			
Others			39,979	79.9
Seoul			10,059	20.1
members	50,038	2.9(1.2)		
Housework	50,038			
Never			11,141	22.3
Once a year			1,824	3.6
Once a month			4,007	8.0
Once a week			6,076	12.1
Everyday less than 1hr			5,666	11.3
Everyday More than 1hr			20,998	42.0

Source: Korean Working Conditions Survey in 2014

Nested Models

The following section analyzes the influence of long work hours on health controlling for several characteristics: gender, age, education, occupation type, region, number of household members, and housework frequency. Ordinal logistic regression was used to assess the role of long work hours to workers' health. The independent variables were entered in sets according the types of characteristics (i.e. work hours, gender, workers' characteristics, job characteristics, household characteristics).

As depicted in the Table 3 below, there were five set of models designed to predict the outcome values in a hierarchical order. Although not all the independent variables were significant in predicting the dependent variable, the comparison of the constant-only model with the full model chi-square is highly significant($p < 0.001$), indicating that as a set, the predictors are reliable in predicting subjective health.

The first model explained a modest amount of the variance (pseudo r-square: 3.2%) in subjective health can be explained by 'work hour' variable alone, and the chi-squared statistics with $df=3$ in Model 1 indicates that work hour significantly added to the fit of Model 1 than did the constant model. Both 'Overtime' and 'Excessive Overtime' were found to be statistically significant predictors across all other models ($p < 0.001$), and Excessive Overtime group shows stronger negative effect than Overtime group when predicting workers health.

In Model 2, gender variable was included. The coefficients of 'Overtime' and 'Excessive Overtime' were not changed much, nor was pseudo r-square (3.5%).

In Model 3, workers' demographic characteristics were included. The effect of work hour factor in subjective health was reduced considerably, from $\beta = -0.38$ to $\beta = -0.22$ for overtime, from -0.65 to -0.30 for excessive overtime. Model 3 (chi-square=9145.74, $df=11$) shows that the addition of workers' characteristics (age and education) significantly better fit than the constant only model ($p < 0.001$). The set of workers' characteristics with work hour is a strong predictor of workers health since psuedo r-square changed from 0.032 to 0.199. This suggests that a large proportion of the variance in subjective health can be explained by work hour, gender, age and education. Females were less likely than males to rate better health generally, as indicated by the negative coefficients ($\beta = -0.23$, $p < 0.001$). As workers' age increased by one year, respondents' who report better health decreased by 4% when controlling for work hour, gender and education. Education was found to be statistically significant for all the models ($p < 0.001$), As the respondents completed higher education, the positive relation to self-rated health strengthened which means more educated workers report better health than less educated respondents.

In Model 4 (chi-square=9366.98, $df=15$), we added job characteristics to our Model 3. Psuedo r-square changed from 0.119 to 0.203. The chi-square shows, the addition of job characteristics (occupation type, region) along with workers' demographics (gender, age and education) significantly better fit than the constant only model ($p < 0.001$). When we compare health status by four types of occupation group, Low-Skilled Non-Manual ($\beta = 0.28$, $p < 0.001$) rated better health followed by High-

Skilled Non-Manual ($\beta = 0.18$, $p < 0.001$), Unskilled Manual (reference), and Skilled Manual ($\beta = -0.13$, $p < 0.001$).

In the Model 5 (chi-square=9397.96, $df=21$), household characteristics are added to the previous Model 4. Pseudo r-square did not change much this time with the value of 0.205. The number of household members and several dummy variables representing housework frequency were not statistically significant either. However, the 'housework everyday more than 1 hour' group was less likely report better health when we compare workers in 'never does housework' group. For example, respondents who do household work every day more than 1 hour are 20% less likely (odds ratio=0.80, $p < 0.001$) report better health than those who never do housework. Even though the number of household members was not significant in the model, I decided to keep this variable to see how the effects differ by gender.

Table 3. Ordinal Logistic Regression Analysis for the Relationship of Independent variables to Subjective Health.

Variable	Model 1			Model 2			Model 3			Model 4			Model 5		
	B	SE	Exp(B) Sig.	B	SE	Exp(B) Sig.	B	SE	Exp(B) Sig.	B	SE	Exp(B) Sig.	B	SE	Exp(B) Sig.
Working hours per week (reference=\$-47)															
Part Time(<34)	-0.04	0.03	0.39 ***	-0.90	0.03	0.41 ***	-0.14	0.03	0.87 ***	-0.14	0.03	0.87 ***	-0.13	0.03	0.88 ***
Over Time(48-59)	-0.37	0.02	0.69 ***	-0.38	0.02	0.68 ***	-0.22	0.03	0.80 ***	-0.21	0.03	0.81 ***	-0.21	0.03	0.81 ***
Excessive Overtime(>60)	-0.64	0.02	0.53 ***	-0.65	0.02	0.52 ***	-0.30	0.03	0.74 ***	-0.34	0.03	0.71 ***	-0.35	0.03	0.71 ***
Gender (reference=male)															
Female				-0.24	0.02	0.79 ***	-0.23	0.02	0.79 ***	-0.32	0.02	0.72 ***	-0.21	0.03	0.81 ***
Age															
Education (reference= no education)															
Elementary School							-0.05	0.00	0.96 ***	-0.04	0.00	0.96 ***	-0.04	0.00	0.96 ***
Middle School				0.53	0.07	1.69 ***	0.48	0.07	1.62 ***	0.47	0.07	1.61 ***	0.47	0.07	1.61 ***
High School				0.90	0.07	2.45 ***	0.81	0.07	2.26 ***	0.81	0.07	2.25 ***	0.81	0.07	2.25 ***
Community College				1.26	0.07	3.52 ***	1.11	0.07	3.03 ***	1.11	0.07	3.04 ***	1.11	0.07	3.04 ***
University				1.47	0.07	4.35 ***	1.27	0.08	3.58 ***	1.28	0.08	3.58 ***	1.28	0.08	3.58 ***
Graduate and above				1.74	0.07	5.71 ***	1.50	0.07	4.48 ***	1.49	0.07	4.44 ***	1.49	0.07	4.44 ***
Occupation Type (reference=unskilled manual)															
Skilled Manual															
Low Skilled Non Manual							-0.13	0.03	0.88 ***	-0.14	0.03	0.87 ***	-0.14	0.03	0.87 ***
High Skilled Non Manual				0.28	0.03	1.32 ***	0.28	0.03	1.32 ***	0.28	0.03	1.32 ***	0.28	0.03	1.32 ***
Region (reference = other than Seoul)															
Seoul															
Number of Household members															
Housework Frequency (reference=never)															
Once a year				-0.08	0.02	0.92 **	-0.08	0.02	0.92 **	-0.08	0.02	0.92 **	-0.08	0.02	0.92 **
Once a month				0.00	0.01	1.00	0.00	0.01	1.00	0.00	0.01	1.00	0.00	0.01	1.00
Once a week				-0.05	0.05	0.95	-0.05	0.05	0.95	-0.05	0.05	0.95	-0.05	0.05	0.95
Everyday less than 1hr				-0.01	0.04	0.99	-0.07	0.03	0.93 *	-0.07	0.03	0.93 *	-0.07	0.03	0.93 *
Everyday More than 1hr				-0.05	0.04	0.95	-0.05	0.04	0.95	-0.05	0.04	0.95	-0.05	0.04	0.95
				-0.22	0.03	0.80 ***	-0.22	0.03	0.80 ***	-0.22	0.03	0.80 ***	-0.22	0.03	0.80 ***
N	48771			48771			48360			48338			48121		
Pseudo R-square	0.032			0.035			0.199			0.203			0.205		
Chi-square(df)	1356(3) ***			1519(4) ***			9146(11) ***			9367(15) ***			9398(21) ***		

Note: *p<0.05, **p<0.01, ***p<0.001

Source: Korean Working Conditions Survey in 2014

Tests of Hypotheses

Table 4. shows results from the ordinal regression models of long working hour effects on subjective health. To get a better sense of whether these effects would differ by gender, models were estimated separately for male and female. According to the results, all three models, total and gender separate models, are statistically significant for predicting the effect of long work hours on subjective health as indicated by each model's chi-square and pseudo r-square.

Hypothesis 1: Workers who work overtime (48-59) are less likely to be healthy than those who work normal work hours (35-47).

Approximately 20.5% of variance in subjective health can be explained by the variance in work hours and control variables in the full model. After controlling for workers characteristics, job characteristics and household characteristic, working overtime show significant adverse effect on self-rated health compared to working normal hours (odds ratio=0.76, $p<0.001$). For example, workers who work overtime (48-59 hours/week) are associated with 24% decrease in the likelihood of reporting better health when compared to those who work normal hour (35-47 hours/week).

Hypothesis 2: Workers who work excessive overtime (60+) are less likely to be healthy than those who work normal work hours (35-47).

After controlling for workers characteristics, job characteristics and household characteristic, working excessive overtime also show significant adverse effect on self-rated health compared to working normal hours (odds ratio=0.69, $p<0.001$). For example, workers who work excessive overtime (60+ hours/week) is associated with 31% decrease

in the likelihood of reporting better health when compared to those who work normal work hour (35-47 hours/week).

Hypothesis 3: The adverse effect of long work hours on health is stronger for those who work excessive overtime (60+) than those who work overtime (48-59).

The first two hypotheses tested whether overtime or excessive overtime have a negative effect on workers' health or not. In hypothesis 3, we compare magnitude of effects between overtime and excessive overtime by comparing effect sizes. For the comparison, absolute value of coefficients of estimate was compared. Magnitude of coefficient in excessive overtime ($|\beta| = 0.38, p < 0.001$) was greater than those in overtime ($|\beta| = 0.27, p < 0.001$). Since both coefficients have negative sign, the adverse effect on health is stronger for excessive overtime work (60+) than overtime work (48-59).

Beside from comparing coefficients for two groups, we changed the reference from 'Normal Work Hours' to 'Overtime' and ran statistical tests again to determine if these are different from one another. Compared to overtime, excessive overtime was less likely to be healthy and the difference was statistically significant ($\beta = -0.11$ with $p < 0.01$, Male: $\beta = -0.12$ with $p < 0.01$ and Female: $\beta = -0.16$ with $p < 0.001$).

Thus, based on this analysis, the current study strongly supports the hypothesis that workers who work excessive overtime are less likely to be healthy than those who work overtime.

Hypothesis 4: Female workers are less likely to be healthy than male workers at the same or equivalent levels of working hours.

Based on the literature review, we expected adverse effect of long work hours on health is stronger for women than men since women have additional household work as mothers and wives (Gove et al., 1977, Hall, 1992, Kranz et al., 2001, Spurgeon et al., 1997). However, contrary to our expectations, the result from analysis indicates negative effect of overtime and excessive overtime is stronger for men than women when we compared gender effect on workers' health at the equivalent levels of working hours. To compare the effect size, logistic regression was conducted separately for male and female. And then, coefficient of estimate was compared. For those who work overtime, males are 24% less likely (odds ratio=0.76, $p<0.001$) report better health than reference group whereas females are 13% less likely (odds ratio=0.87, $p<0.001$) rate better health than reference group. This would suggest that the adverse effect of overtime work on health is stronger for men than women.

In the same way, effect sizes in excessive overtime were compared by gender. For workers who work excessive overtime, males are 32% less likely (odds ratio=0.68, $p<0.001$) rate better health than those worked normal work hours whereas females are 26% (odds ratio=0.74, $p<0.001$) less likely report better health than those worked normal work hours. The results show that the adverse effect of excessive overtime work on health is stronger for men than women.

Interactions between work hours and gender were tested. We found interaction effects in Part Time and Over Time groups with p-value less than 0.05. However, considering large sample size of fifty thousand, we concluded p-values more than 0.001 were not statistically significant. Therefore, interaction effects were not found in this case.

The analysis shows the opposite result of our expectation based on the research literature. The effects of long working hours on health for women compared to men warrant greater attention in future studies, both of Korean workers and among workers elsewhere.

Estimating Health with Several Characteristics.

Age. Respondents with one additional year in age are 4% less likely to report better health after controlling for work hours, gender, education, occupation type, region, number of household members and housework frequency (odds ratio=0.96, $p<0.001$).

Education. There are seven level of education respondents completed ranging from no education through graduate level. Higher level of educational attainment positively associated with better health. Compared to our reference group (no education), respondents with higher level of education are more likely to report better health and it is statistically significant all over the levels with alpha level of 0.001. Coefficients are gradually increase with the higher level of education which indicate that the more educated workers are more likely to rate better health (odds ratio for Elementary School: 1.61, odds ratio for Middle School: 2.26, odds ratio for High School: 3.05, odds ratio for College: 3.59, odds ratio for University: 4.45, odds ratio for Graduate: 4.49) after controlling for other variables in this study.

Occupation Type. Occupation types were categorized into four groups. Amongst these four occupation types, low-skilled non-manual workers shows better health (odds ratio=1.32) followed by high-skilled non-manual (odds ratio=1.19), unskilled manual

(reference) and skilled manual (odds ratio=0.87). Overall, non-manual workers rate their health better than manual workers.

Region. Workers in Seoul are less likely to report better health than those in other areas. However, its effects differ by gender. For example, female workers in Seoul are 17% less likely to report better health than those live in other regions (odds ratio=0.83, $p < 0.001$). For male workers, health status is not statistically different whether respondents live in Seoul or not. This result indicates that there is significant negative association between region and health for female but there is not for male.

Number of household members. Coefficients for number of household members are in opposite direction by gender ($\beta = -0.04$ for male, $\beta = 0.04$ for female). The result indicates that there is significant negative association between household member number and health for male. However, contrary to that, there is positive association between number of household members and health for female. For example, as the number of household members increases, the male workers are 4% less likely to report better health (odds ratio=0.96, $p < 0.001$) while female workers are 4% more likely to report better health (odds ratio=1.04, $p < 0.01$).

Housework Frequency. There are six categories indicating housework frequency from never to everyday more than 1 hours. Compared to our reference group (Never), workers doing housework everyday more than 1 hour are significantly different. Respondents in this category are 20% less likely to rate better health than those never did housework. (odds ratio=0.80, $p < 0.001$). And this results similarly shown in both gender (odds ratio for male=0.81 with $p < 0.001$, odds ratio for female=0.79 with $p < 0.001$).

Table 4. Ordinal Logistic Regression Analysis for the Relationship of Independent variables to Subjective Health by Sex.

Variable	Total				Male				Female			
	β	SE	Exp(B)	Sig.	β	SE	Exp(B)	Sig.	β	SE	Exp(B)	Sig.
Working hours per week (ref.=35-47)												
Part Time(<34)	-0.21	0.05	0.81 ***		-0.28	0.05	0.76 ***		-0.05	0.04	0.95	
Over Time(48-59)	-0.27	0.03	0.76 ***		-0.28	0.03	0.76 ***		-0.14	0.04	0.87 ***	
Excessive Overtime(>60)	-0.38	0.04	0.69 ***		-0.39	0.04	0.68 ***		-0.30	0.04	0.74 ***	
Gender (reference=male)												
Female	-0.26	0.03	0.77 ***									
Age												
	-0.04	0.00	0.96 ***		-0.04	0.00	0.96 ***		-0.04	0.00	0.96 ***	
Education (reference= no education)												
Elementary School	0.48	0.07	1.61 ***		0.38	0.13	1.47 **		0.46	0.08	1.58 ***	
Middle School	0.82	0.07	2.26 ***		0.70	0.13	2.01 ***		0.77	0.09	2.17 ***	
High School	1.12	0.07	3.05 ***		0.89	0.13	2.43 ***		1.18	0.09	3.26 ***	
Community College	1.28	0.08	3.59 ***		1.02	0.13	2.78 ***		1.38	0.10	3.96 ***	
University	1.49	0.07	4.45 ***		1.22	0.13	3.39 ***		1.63	0.10	5.11 ***	
Graduate and above	1.50	0.10	4.49 ***		1.38	0.16	3.96 ***		1.35	0.16	3.87 ***	
Occupation Type (ref.=unskilled manual)												
Skilled Manual	-0.14	0.03	0.87 ***		-0.02	0.04	0.98		-0.26	0.05	0.77 ***	
Low Skilled Non Manual	0.27	0.03	1.32 ***		0.38	0.05	1.46 ***		0.17	0.05	1.19 ***	
High Skilled Non Manual	0.17	0.04	1.18 ***		0.26	0.06	1.30 ***		0.07	0.07	1.07	
Region (reference = other than Seoul)												
Seoul	-0.08	0.02	0.92 ***		0.01	0.03	1.01		-0.18	0.03	0.83 ***	
Number of Household members												
	0.00	0.01	1.00		-0.04	0.01	0.96 ***		0.04	0.01	1.04 **	
Housework Frequency (ref.=never)												
Once a year	-0.05	0.05	0.95		-0.05	0.06	0.95		-0.05	0.15	0.95	
Once a month	-0.01	0.04	0.99		-0.02	0.04	0.98		0.11	0.11	1.12	
Once a week	-0.07	0.03	0.93 *		-0.09	0.04	0.92 *		0.04	0.08	1.04	
Everyday less than 1hr	-0.05	0.04	0.95		-0.04	0.05	0.96		-0.05	0.07	0.95	
Everyday More than 1hr	-0.22	0.03	0.80 ***		-0.21	0.05	0.81 ***		-0.23	0.06	0.79 ***	
Interactions (female=1)												
Part Time*Gender	0.13	0.06	1.14 *									
OverTime*Gender	0.12	0.05	1.12 *									
Excessive OverTime*Gender	0.05	0.05	1.05									
<hr/>												
N	48121				24164				23958			
Pseudo R-square	.205				.167				.236			
Chi-square(df)	9406(24) ***				3744(20) ***				5521(20) ***			

Note: 1) *p<0.05, **p<0.01, ***p<0.001

2) When we changed the reference group to 'Overtime', β for 'Excessive overtime' was -0.11 with p<0.01 (Male: β =-0.12 with p<0.01, Female: β =-0.16 with p<0.001)

Source: Korean Working Conditions Survey in 2014.

DISCUSSION

The proportion of the labor force that worked more than 48 hours per week in Korea in 2014 was 44.5%. This result suggests an approximately 5% decrease in the proportion of overtime workers than findings from previous works (Lee et al., 2007; Park et al., 2012). Separate sources indicate that 49.5% of employees work more than 48 hours a week (Lee et al., 2007), and the analysis of the KWCS in 2010 (Park et al., 2012). This study revealed that still majority of Koreans (44.5%) work more than 48 hours per week.

The findings of this study with South Korean workers' representative data demonstrate that overtime and excessive overtime have adverse effect on workers' health even after controlling for gender, age, education, occupation type, region, number of household members, housework frequency. Excessive overtime work has an even stronger negative effect than overtime work. These findings support the literature reviewed which, in general, states that longer working hours have a negative association with health. Previous research suggests that long working hours can result in health problems (Van der Hulst, 2003; Sparks et al., 1997; Caruso et al., 2006). Although much literature has been published on effect of long working hours, those studies have been conducted in Western Europe. There is no specific evidence to support long work hour effect on the Korean workforce generally. And there are not many studies on long working hours and its relationship to health in Korea even though Koreans are one of the hardest working people in the world. This study using South Korean workers' population-based data provides evidence supporting previous research conducted in other countries' long working hours effect studies.

Another objective of this study is to investigate the differences in adverse effect of overtime work by gender. This study shows the magnitude of adverse effect is larger for men than those for female. This finding is not consistent with literature reviewed in this study. Previous studies have reported that additional roles as mothers and wives at home more likely cause health problems for working women (Gove et al., 1977; Hall, 1992; Kranz et al., 2001; Spurgeon et al., 1997). However, the results of the analysis did not support the hypothesis that the adverse effect of long work hours on health is greater for women than men. The reason cannot be identified in this study, so this remains a topic for future research.

Besides the negative effect on health, we found there exists a gender difference on health by region and by the number of household members. Female workers in Seoul are less likely to report better health compared to those in other regions. For males, there is no difference on health between workers in Seoul and those in other regions.

Meanwhile, the subjective health in association with the number of household members has different effects by gender. The number of household members has a negative association for males whereas it has a positive association for females. Previous studies reported that there is a negative association between number of children and women's health. (Gove et al., 1997; Krantz et al., 2001). Though association between number of children and health was not directly examined due to data constraints, this study found the relationship between the number of household members and health is different by gender, and that men rather than women experience worse health with a higher number of household members.

Higher levels of educational attainment were positively associated with better health, as expected. This study found that more educated workers are more likely to rate better health after controlling for other variables.

Limitations of the study

First, the relationship between overtime work and health is quite complex and can be influenced by a broad range of intervening variables (Caruso et al., 2006). In this study, I only examined some of workers' characteristics though there are still other variables that affect health. For example, household compositions such as marital status and number of children might influence women's quantity of household chores which eventually impact on women's health negatively (Gove et al,1977, Krantz et al., 2001, Hall, 1992, Spurgeon et al., 1997). Due to data limitations, household compositions (e.g. number of children) were not tested as thoroughly as possible. Instead, number of household members and housework frequency were included in the analysis. To estimate the more precise effect on females' health, specific household compositions such as marital status, number of children, grandparents, extended family need to be controlled for in future studies.

Beside household composition, ill health habits are critical factors of workhour effect on health studies. Many scholars have been argued that long work hours have been associated with bad lifestyle habits. Then these poor habits such as inadequate exercise, heavy smoking, insufficient diet can lead to ill health (Maruyama et al., 1995, Sparks et al., 1997; Van der Hulst, 2003). Due to the limitations of the working condition surveys,

poor health habits as intervening factors were not examined in this study. (Note: Long work hours can, likewise, prevent good health habits.)

Second, health status is a self-reported measure, and it was not possible to independently verify health information. Subjective health measure is a broadly used form in the absence of measured health since it is easy to administer in the survey research. Though some scholars utilize it as a valid and reliable indicator of general health, there is not a universal agreement on self-assessed health's validity (Okosun et al. 2001, Schnittker et al., 2014, Shadbolt, 1997). Shadbolt found that relationships between self-rated health and other health measures differed significantly by age. In addition, the measures represent many aspects of health status, it is hard to identify the specific nature of differences (Shadbolt, 1997).

Lastly, this study did not highlight the association between part time work and health since we only focused on overtime. The analysis indicated that part time workers were significantly report poorer health compared to normal workers. Long work hours may cause ill health as shown in the results, however, it is also possible that poor health reduced workers' motivation to work longer hours. To get a better sense of long work hour effects, it would be better to set cut point of working hours (e.g. work less than 10 hours per week).

CONCLUSIONS

Korean workers are known as one of the hardest working people in the world. Still, from the analysis from the KWCS in 2014, nearly half of Koreans (44.5%) work more than 48 hours a week. This study also revealed that long work hours have an adverse effect on health in Korean society. Working overtime has negative effect on workers' health. Working excessive overtime has even stronger negative effect on self-rated health than working overtime. Surprisingly, contrary to our expectation, the adverse effects of overtime and excessive overtime work on health is stronger for men than for women.

Considering the culture of long working hours compared to other countries, South Korean workers should consider reductions working hours, noting that long hours not only erode people's quality of life but also cause health problems. In the past, the culture of long work hours contributed to the nation's booming economy in the 1960s and 1970s (Kim & Park, 2002). However, it is time to think quality of work rather than quantity of work. It is necessary for companies to voluntarily set their own plans to reduce working hours. Labor and management should work together to shorten long work hours through mutual and voluntary concessions. In the long run, reduced work hours will bring us many changes such as healthier workers, safer workplaces, improved productivity, and optimal work-family balances at home.

APPENDICES

Appendix A

Variables used in the analysis

Dependent Variable		
Subjective Health Status (SHS)	<p>SHS was measured by question that ask “How is your health in general?”</p> <p>The responses of “Very good, Good, Fair, Bad, Very bad” were then coded as follows</p> <p>1 = Very good 2 = Good 3 = Fair 4 = Bad 5 = Very bad</p>	<p>Responses recoded</p> <p>1 = Very bad 2 = Bad 3 = Fair 4 = Good 5 = Very good</p>
Independent Variable		
Work Hour	<p>Work Hour was measured by question that ask “How many hours do you usually work per week in your main paid job?”</p> <p>Work Hour was coded into a continuous variable</p> <p>Note: Work Hour excluding lunch break and time spent travelling to and from work. If 30 minutes or more round up to next hour.</p>	<p>Responses recoded</p> <p>1 = 1 -34 hours/week (Part-Time) 2 = 35-47 hours/week (Full-Time) 3 = 48-59 hours/week (Over-Time) 4 = 60+ hours/ week (Excessive Overtime)</p>
Control Variables		
Workers’ Characteristics		
Gender	<p>1 = male 2 = female</p>	<p>Recoded into 0 = male 1 = female</p>
Age	<p>Age was coded into a continuous variable</p>	
Education	<p>Education was measured by question that ask “What is the level of highest education or training that you have successfully completed?”</p>	

	<p>The responses of “No education or lower than primary education, Primary education, Lower secondary education, Upper secondary education, Community College, University-undergraduate, Graduate or above” were then coded as follows</p> <p>1 = No education or lower than primary education 2 = Primary education 3 = Lower secondary education 4 = Upper secondary education 5 = Community college 6 = University-undergraduate 7 = Graduate or above</p>	
Job Characteristics		
Type of Occupation	<p>TO was measured by question that ask “Of the following, which one would be suitable for your work?”</p> <p>1 = Administrator 2 = Professional 3 = Engineer and Semi-professional 4 = Office worker 5 = Service worker 6 = Sales worker 7 = Agriculture, forestry and fishery industry skilled worker 8 = Technical skilled worker and related skill worker 9 = Equipment-machinery operator and assembly worker 10 = Simple labor worker 11 = Soldier</p>	<p>Recoded into</p> <p>1=Unskilled manual(10) 2=Skilled manual (7,8,9,11) 3=Low-skilled non-manual (4,5,6) 4= High-skilled non-manual (1,2,3)</p>
Region	<ol style="list-style-type: none"> 1. Seoul 2. Busan 3. Daegu 4. Incheon 5. Gwangju 6. Daejeon 7. Ulsan 8. Sejong 9. Gyeonggi 10. Gangwon 	<p>Recoded into</p> <p>0 = Others (2~16) 1 = Seoul (1)</p>

	11. Chungbuk 12. Chungnam 13. Junbuk 14. Junnam 15. Gyeongbuk 16. Gyeongnam 17. Jeju	
Household Characteristics		
Number of household members	Number of household members was coded into a continuous variable.	
Housework Frequency	Housework Frequency was measured by question that ask “In general, how often are you involved in any of the following activities outside work? Cooking and housework” The responses were coded as follows 1 = Everyday for 1 hour or more 2 = Everyday or every second day for less than 1 hour 3 = Once or twice a week 4 = Once or twice a month 5 = Once or twice a year 6 = Never	

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