

Health Risks and the Burden of Diseases Attributed to Overwork

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1. Introduction

Overwork issues have of late come to the fore of social attention against the backdrop of increasing cases of disease, death and suicide that are attributed to long working hours and shiftwork. The norm of long hours, once a prime contributor to Korea's rapid industrialization and GDP growth, is now widely regarded as a source of disturbances to daily life. A growing body of research points out that overwork negatively affects the worker's physical and mental health. This study attempts to examine, through a broad literature review, the health risks of overwork and estimate the burden of diseases attributable to overwork in Korea.

2. Overwork: its definition and prevalence

"Overwork" has yet to gain a precise, academically pinned-down definition, but what it is can in the main be determined in terms of hours of work, work schedules, and work intensity. This is to say that how long, when, and in what pace one works determines whether or not one is engaged in overwork.

By long work hours both the ILO and the EU mean a weekly average of more than 48 working hours. In Korea, the Bill on Reduced Working Hours, passed by the National Assembly in 2018, cut the legal maximum number of weekly working hours from the previous 60 to 52. Under Korea's Industrial Accident Compensation Insurance Act, a disease is recognized as overwork-related and considered subject to compensation if the afflicted has worked more than 60 hours a week over a course of 12 weeks prior to its onset. A weekly average of more than 52 working hours is widely thought to be associated with increased health risks.

Work schedules often involve assigning workers to non-standard work hours that may render those workers less able than otherwise to go on with their daily social activities. The US National Institute for Occupational Health and Safety regards any form of work carried out in the hours outside "standard working hours," which it defines as between 7 a.m. and 6 p.m., as a shiftwork. Shiftwork is considered a fatigue factor, as it is practiced as a way to maximize an organization's operational hours. Shiftwork is also widely thought to disrupt circadian rhythms, affecting health in adverse ways.

Work intensity refers to the level of effort the work exacts of the worker. Work intensity is sometimes couched in the phrase "work intensification"—as distinguished from "work extensification" (an increase in the time spent working)—to denote the degree of time pressure an employee is under at having to accomplish a given amount of work in the time available.

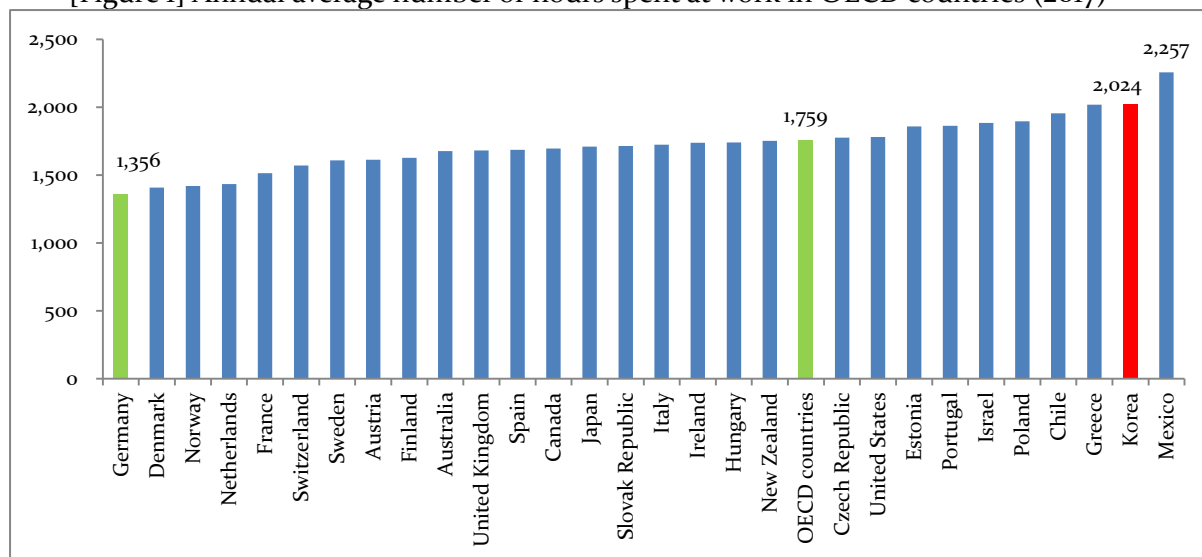
Some claim that the concept of overwork should take into account not only the quantitative aspect of time spent working, but also the relationships one has with people at work. Two recent resounding suicides—one of a newly-hired nurse at a top-tier hospital and the other of a web designer—have brought to people's attention not only compressed working hours, but also

workplace bullying. In the case of Japan, where overwork-related suicides as well as deaths are recognized as occupational accidents, not only such physical health risks as long and compressed working hours but also psycho-emotional risks like bullying are taken into account as among the factors that define overwork.

Overwork, as such, is a term that concerns both the quantitative and qualitative dimensions of work. However, it is beyond the scope of this study to quantify the qualitative aspect of work. This study is confined to discussing long working hours and shiftwork in Korea and their contribution to disease and mortality burdens.

Koreans work 2,024 hours a year on average. That is 265 hours more than the OECD average of 1,759 hours and 314 hours more than in Japan, a country that popularized the word “*karoshi*”—death by overwork. As of 2015 in Korea, those who worked a weekly average of more than 48 hours accounted for 27.2 percent of the working population, compared to around 10 percent in some major advanced economies.¹

[Figure 1] Annual average number of hours spent at work in OECD countries (2017)



Source: OECD. (2018). OECD Stat. <http://stats.oecd.org>

By industry, the proportion of those working long hours (more than 52 hours a week) was highest in lodging and restaurant businesses and the transport sector. By occupation, service workers were the most likely to work long hours. Also, the larger the firm, the lower was the proportion of employees working long hours.²

A 2014 survey found that those on rotational shiftwork schedules accounted for 7.1 percent of all workers in Korea.³ Another study finds that the larger the firm, the higher the percentage of rotational shift workers it employs. This has to do with the fact that large-scale firms in Korea are more likely to be in the equipment and machinery industry, where what matters most is the capacity to operate on a round-the-clock basis.⁴

¹ ILO. (2018). ILOSTAT. <http://www.ilo.org/ilostat>

² Kim, Y. Korea Labour & Society Institute. (2017). KLSI Issue Paper No.2. pp. 9-10.

³ Korean Working Conditions Survey (IV), Occupational Safety and Health Research Institute (2014). pp. 9-10.

⁴ Kiu-Sik Bae et al. Long Working Hours and Reduction in Working Hours (I). Korea Labor Insitute (2011). p. 93.

3. Pathways through which overwork affects health

A 2012 report by the International Labor Organization binds together long working hours and night shift as “abnormal work schedule.” The ILO report links abnormal work schedules to circadian-clock disruption, sleep disturbance and disruption of family and social life, and, in turn, to acute effects on fatigue levels, mood, and performance. Such work stress factors as high work demands and heavy workload may add to those acute effects.⁵ An earlier study by Caruso et al. (2006) likewise argues that extended work hours leave workers with reduced time available—or reduced ability to use the time available—and, in turn, with longer exposure and increased vulnerability to workplace health risk factors, leading to reduced sleep, fatigue, stress, negative emotional states, discomfort, pain, neurological disorder, cognitive dysfunction and physiological disturbances.⁶

4. The health risks of long working hours and shiftwork

Many studies published from 1990 onward in Korea and elsewhere associate extended working hours and shiftwork with various health conditions including cardio-cerebrovascular disease, psychiatric disorder, sleep disturbance, metabolic disorder, cancer, changes in health-related behavior, maternal issues, and musculoskeletal disorder.

A relatively large number of studies have consistently demonstrated significant associations between long working hours and shiftwork on one hand and cardio-cerebrovascular diseases on the other. A meta-analysis of 25 cohort studies finds that people working an average of 55 hours or more per week are 1.13 times more likely to have coronary artery diseases like myocardial infarction, and 1.33 times more likely to have a stroke than those working between 35 and 40 hours a week. The risk of having a stroke has been found to increase in proportion to increases in working hours.⁷ Another meta-analysis of 21 studies finds that the risk of cardiovascular morbidity is 26 percent higher in people on shiftwork than in those working standard hours.⁸

The relation between overwork and mental health has been the focus of many studies, especially since 2000. In most of these studies, long working hours and shiftwork are found associated to a significant extent with higher prevalence of anxiety and depression. The risk of depression and anxiety is 1.3 to 1.7 times higher for those who spend 55 hours or more at work a week than for those working 35 to 40 hours a week.^{9,10} An analysis of data from the National Health and Nutrition Examination Survey finds that long work hours significantly increase the risk of suicidal ideation.¹¹ A more recent meta-analysis reveals the risk of depressive symptoms

5 ILO. (2012). Working time, health and safety: a research synthesis paper. Conditions of work and employment series No. 31. International Labor Office: Geneva. P. 6.

6 Caruso, C. C., Bushnell, T., Eggerth, D., Heitmann, A., Kojola, B., Newman, K., ... Vila, B. (2006). Long Working Hours, Safety, and Health: Toward a National Research Agenda. *Am J Ind Med.*, 49(11), p. 932.

7 Kivimaki, M., Jokela, M., Nyberg, S., Singh-Manoux, A., Fransson, E., Algreddsson, L., ... Virtanen, M. (2015). Long working hours and risk of coronary heart disease and stroke: a systematic review and meta-analysis of published and unpublished data for 603838 individuals. *Lancet*, 386, p. 1.

8 Torquati, L., Mielke, G. I., Brown, W. J., & Kolbe-Alexander, T. (2018). Shift work and the risk of cardiovascular disease. A systematic review and meta-analysis including dose-response relationship. *Scan J Work Environ Health*, 44 (3), p. 229.

9 Kleppa, E., Sanne, B., & Tell, G. S. (2008). Working Overtime is Associated With Anxiety and Depression: The Hordaland Health Study. *J Occup Environ Med.* 50(6), P. 658.

10 Virtanen, M., Ferrie, J. E., Singh-Manoux, A., Shipley, M. J. Standeld, S. A., Marmot, <. G., ... Kivimake, M (2011). Long working hours and symptoms of anxiety and depression: a 5-year follow-up of the Whitehall II study. *Psychological Medicine*, 41, P. 2485.

11 Yoon, J., Jung, P. K., Roh, J., Seok, H., & Won, J. (2015). Relationship between long working hours and suicidal thoughts: nationwide data from the 4th and 5th Korean National Health and Nutrition Examination Survey. *Plos One*, 10(6), P. 1.

is 1.43 times higher in people on night shift than in those on standard work schedules.¹²

The effect that working long hours has on sleep has been the subject of a steadily increasing number of studies, most of which consistently find overwork associated with sleep disturbance, short sleep, disruptive sleep cycles and fatigue. One of these studies reports that those working more than 55 hours a week, compared to those working 35~40 hours a week, are 2.8 times, 7.9 times and twice more likely to suffer short sleep, difficulty falling asleep and early waking, respectively.¹³ Another study finds that working more than 11 hours a day has a negative effect on sleep quality.¹⁴ Also, rotating shifts—including night and early-morning shifts—have been found significantly associated with higher prevalence of reported sleep disturbance.

The association of working long hours with cancer incidence has not been sufficiently demonstrated, as since 1990 there have been only a small number of studies published bearing on this subject. Meanwhile, studies looking at the association between shiftwork and cancer incidence have been growing in number especially rapidly since the 2000s. The WHO-affiliated International Agency for Research on Cancer has suggested in 2007 that shiftwork could be potentially carcinogenic. However, although there is a considerable body of epidemiological studies where the association of shiftwork with breast cancer is quite consistently observed, findings are rather mixed across studies when it comes to the association between shiftwork and other cancer types. Also, the current state of research is such that, even after a considerable number of studies, there is a need for further studies to establish causal pathways from long working hours and shiftwork to various negative health outcomes including diabetes, hypertension, metabolic syndrome, adverse pregnancy and childbirth outcomes, and musculoskeletal disorders.

5. The population-attributable risk: the excess incidence of deaths and diseases attributed to overwork

This study draws on data from the 2016 National Health and Nutrition Examination Survey. The contribution of overwork to morbidity and mortality is quantified in terms of the population-attributable risk, which represents the proportion of cases in a given population that can be attributed to exposure to a certain risk factor, in this case overwork. The adverse health outcomes that this study addresses are limited to those whose associations with overwork have been relatively consistently demonstrated: cardio-cerebrovascular diseases; psychiatric disorders (affective disorder and stress disorder); and all-cause mortality. Overwork in this study means either working more than 60 hours a week or working outside the standard daytime work hours.

The population-attributable risk is calculated as follows: $PAR = Pe(RR-1)/[1+Pe(RR-1)]$, where Pe is the prevalence of exposure and RR is the relative risk for the effect of overwork on a given health outcome. The relative risks were obtained from a meta-analysis of studies published in Korea and elsewhere since 1990. The prevalence of exposure for overwork was calculated based on data from the 2016 National Health and Nutrition Examination Survey.

12 Lee, A., Myung, S. K., Cho, J. J., Jung, Y. J., Yoon, J. L., & Kim, M. Y. (2017). Night shift work and risk of depression: meta-analysis of observational studies. *J Korean Med Sci*, 32, P. 1091.

13 Virtanen, M., Ferrie, J. E., Gimeno, D., Vahtera, J., Elovainio, M., Singh-Manoux, A., ... Kivimaki, M. (2009). Long working hours and sleep disturbances: the Whitehall II prospective cohort study, *Sleep*, 32(6), 737-745.

14 Sekine, M., Chandola, T., Martikainen, P., Marmot, M., & Kagamimori, S. (2006). Work and family characteristics as determinants of socioeconomic and sex inequalities in sleep: The Japanese Civil Servants Study. *Sleep*, 2006 Feb, 29(2), 206-216.

The prevalence of exposure to overwork (*Pe*) and the relative risk of morbidity and mortality due to overwork

This study found that of Koreans aged 20–69, those working more than 60 hours a week accounted for 14 percent for men and 5.1 percent for women and those on shiftwork schedules accounted for 14.5 percent for men and 11.6 percent for women. Our meta-analysis found that working long hours was associated with a 47.7-percent increase in cardiovascular events, a 28.8-percent increase in risk for mental disorders and a 9.7-percent increase in the odds of death. Shift workers, compared to regular-hour workers, were 22.4 percent, 28.3 percent, and 9.9 percent more likely to have cardiovascular disease, mental disorder, and all-cause death, respectively.

The population-attributable risk of morbidity and mortality due to long hours work

Among men, the population-attributable risk of cardio-cerebrovascular diseases was highest at 16.1 percent in those in their 40s. For women, the population-attributable risk of overwork for cardio-cerebrovascular disease increased with age, with those in their 60s having the highest value at 16.8 percent. In men, the population-attributable risk of overwork for mental disorder was highest for those in their 40s, in whom 14.5 percent of all psychiatric cases were assumed attributable to overwork. The population-attributable risk for death varied across the age groups, from 0.2 to 2.1 percent for men and from 0.5 to 3.4 percent for women.

[Table 1] Population-attributable risks of cardio-cerebrovascular disease, metal disorder, and death due to long hours work (2016)

	Cardio-cerebrovascular disease		Mental disorder		Death	
	Men	Women	Men	Women	Men	Women
20~29	0.021	0.029	0.019	0.001	0.002	0.005
30~39	0.096	0.081	0.086	0.002	0.012	0.015
40~49	0.161	0.055	0.145	0.002	0.021	0.010
50~59	0.128	0.124	0.115	0.004	0.016	0.024
60~69	0.132	0.168	0.119	0.005	0.017	0.034

Population-attributable risk of morbidity and mortality due to shiftwork

The proportion of cardio-cerebrovascular cases attributable to shiftwork was higher in women than in men and highest in those in their 30s for both men and women. For this age group, 1.4 percent of all cardio-cerebrovascular cases in men were attributed to shiftwork. For women of the same age group, the figure was 5.1 percent. In the case of mental disorder, the population-attributable risk was highest in those in their 30s for both men (3.9 percent) and women (5.7 percent). The proportion of deaths attributable to shiftwork was higher in women (1.9~4.0 percent) than in men (less than 0.5 percent for all the age groups).

[Table 2] Population-attributable risks of cardio-cerebrovascular disease, mental disorder, and death due to shiftwork (2016)

	Cardio-cerebrovascular disease		Mental disorder		Death	
	Men	Women	Men	Women	Men	Women
20~29	0.009	0.050	0.026	0.056	0.002	0.039
30~39	0.014	0.051	0.039	0.057	0.003	0.040
40~49	0.007	0.025	0.019	0.028	0.002	0.019
50~59	0.009	0.030	0.024	0.034	0.002	0.023
60~69	0.006	0.034	0.017	0.038	0.001	0.026

6. Concluding remarks

Adult workers spend most of their waking hours at work. Work environment and work conditions are an important health and safety concern, as they constitute the circumstances to which workers are exposed on a daily basis. Work is a major social determinant of health, and it is in this connection that the WHO's Commission on Social Determinants of Health has set as one of its primary goals the promotion of work conditions, with a view to improving health and health equity.

Associated to a significantly extent with cardio-cerebrovascular events and mental health issues, overwork is found to add considerably to the incidence of morbidity in Korea. Cardio-cerebrovascular disease, the second leading cause of death in Korea, is estimated to have affected some 344 thousand people in the population aged 20-69, of whom 23 thousand cases are assumed attributed to long working hours and another 5 thousand cases to shiftwork. An estimated 21 thousand mental disorder cases were attributed to long hours work and another 41 thousand cases to shiftwork.

The use of shiftwork schedules should be restricted to such fields as equipment manufacturing and vital public services. Also, regulations on long working hours should be more stringently enforced. A wider implementation of flexible work hours, while considered as an attractive option for Korea, should be put to further consideration as it may mean for some workers increased work hours and increased health risks. It is crucial that the government controls overwork in a responsible way. Also, protecting the health of workers requires more proactive medical interventions. Stringent onsite safety management should be made required of workplaces where long hours working is necessary. Also, there is a need for a precise legal basis on which to punish, control and manage workplaces that have experienced an incident of overwork-related death. Special health examinations and follow-up medical care should be adequately provided, especially for nightshift workers. In addition, government authorities should ensure that existing guidelines concerning health protection for those in non-standard work arrangements (including the guidelines on "health management for long-hours workers and shift workers" and those on "risk assessment and follow-up management for cardio-cerebrovascular diseases at work"), the compliance with which is currently left to the discretion of the employer, are strictly adhered to.