

Original Article



Relationship between of working hours, weekend work, and shift work and work-family conflicts among Korean manufacturers

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ABSTRACT

Background: In the manufacturing industry, work-family conflict (WFC) is related to working hour characteristics. Earlier studies on the relationship between working hour characteristics and WFC in the manufacturing industry have been limited to some regions in Korea. No study has addressed the data on a national scale. Thus, this study investigated the impact of weekly working hours, weekend work, and shift work on WFC using national-scale data.

Methods: This study was based on the fifth Korean Working Conditions Survey of 5,432 manufacturers. WFC consists of 5 variables; WFC1 “kept worrying about work”; WFC2 “felt too tired after work”; WFC3 “work prevented time for family”; WFC4 “difficult to concentrate on work”; WFC5 “family responsibilities prevented time for work”. As WFC refers to the inter-role conflict between the need for paid work and family work, WFC has been measured in two directions, work to family conflict (WTFC: WFC1, 2, 3) and family to work conflict (FTWC: WFC4, 5). With these WFC variables, we conducted multiple logistic analyses to study how working hours, weekend work, and shift work impact WFC.

Results: Korean manufacturers’ prolonged working hours increased all aspects of WFCs. Odds ratios (ORs) of WFCs based on working hours (reference of under 40 hours) of 41–52, 53–60, over 61 were 1.247, 1.611, 2.279 (WFC1); 1.111, 2.561, 6.442 (WFC2); 1.219, 3.495, 8.327 (WFC3); 1.076, 2.019, 2.656 (WFC4); and 1.166, 1.592, 1.946 (WFC5), respectively. Shift-work in the WFC2 model showed a significantly higher OR of 1.390. Weekend work ‘only on Saturday’ had significant ORs with WFC2 (1.323) and WFC3 (1.552).

Conclusions: An increase in working hours leads to the spending of less time attending to problems between work and family, causing both WTFC and FTWC to increase. As weekends, evenings, and nighttime are considered to be family-friendly to people, working on weekends and shift-work were highly correlated to WTFC.

Keywords: Family to work conflict (FTWC); Manufacturers; Shift work; Weekend work; Working hours; Work to family conflict (WTFC)

Abbreviations

CI: confidence interval; FTWC: family-to-work conflict; KOSHA: Korea Occupational Safety & Health Agency; KRW: Korean Republic won; KWCS: Korean Working Conditions Survey; OR: odds ratio; WFC: work-family conflict; WLB: work-life balance; WTFC: work-to-family conflict.

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Competing interests

The authors declare that they have no competing interests.

Author Contributions

Conceptualization: Lee Y, Lee S; Data curation: Kim YJ, Kang D; Formal analysis: Lee Y, Lee S, Kim YJ; Funding acquisition: Kang D; Investigation: Kang D; Methodology: Kim YJ, Kang D; Project administration: Kang D; Resources: Lee Y, Lee S; Software: Lee Y, Lee S; Supervision: Kang D; Validation: Lee Y, Lee S, Kim SY; Visualization: Lee Y, Lee S; Writing - original draft: Lee Y, Lee S, Kim YJ; Writing - review & editing: Kim YJ, Kim Y.

BACKGROUND

After the 1950s, South Korea achieved rapid economic growth with long hours of labor. Since the 2000s, the perception of working welfare has spread in Korea, and Korean workers have put emphasis on work-life balance (WLB).¹ As WLB is a term for personal life, it is closely related to one's family. If WLB is not achieved, work-family conflict (WFC) may occur,² which refers to inter-role conflict in requirements for paid work and family work.³

Early research classified WFC into 3 dimensions namely time-based, strain-based, and behavior-based conflict.⁴ Time-based conflict happens when the amount of time with one particular role prevents a person from fulfilling expectations of the other role. Strain-based conflict appears when strain experienced in one role affects one's performance in the other role. Behavior-based conflict is caused when behavior patterns in one role are incompatible with the behavior requirements of the other role.⁴ Researchers subdivided WFC in two different directions: work-to-family conflict (WTFC) and family-to-work conflict (FTWC).³ WTFC refers to "a form of inter-role conflict in which the general demands of, time devoted to, and strain created by the job interfere with performing family-related responsibilities," and FTWC refers to "a form of inter-role conflict in which the general demands of, time devoted to, and strain created by the family interference with performing work-related responsibilities."⁵ WFC affects people in many ways, especially health. A recent study in Europe revealed that WFC was interrelated with general mental and physical health, health behavior, health services utilization, and sleep.⁶ When comparing physical and mental health, the effects of mental health on job satisfaction were much greater. Within the mental health parameters, burnout, lowered self-esteem, anxiety, and depression were the relevant characteristics.⁷

As previously stated, WFC is emerging as an important issue in Korea. Accordingly, the Korean government has promulgated a few policies dealing with this problem. Family-friendly management and parental leave are examples of these policies. (Family-friendly management is a policy that provides certification to companies and public institutions that operate "family-friendly" systems). However, the adoption rate of these policies was found to be much higher than the implementation rate.⁸

Even with the same working hour characteristics, cultural, national, and industrial differences can cause variations in WFC characteristics between individuals or groups.⁹ There were some studies on the relationship between working hour characteristics and WFC which were limited to the manufacturing industry in some regions in Korea.^{10,12} But there were no studies based on national data. Thus, the aim of this study was to examine how characteristics of weekly working hours, weekend work, and shift work affected the manufacturers' WFC and to gain a better understanding of how each independent or confounding variable affects WTFC and FTWC using national-scale data.

METHODS

Study sample

This study is based on the fifth Korean Working Conditions Survey (KWCS) by the Korea Occupational Safety & Health Agency (KOSHA). The survey was conducted in 2017 from July to November and included 50,205 workers in 17 cities and provinces across South Korea.

Participants of the KWCS provided informed consent. Because the KWCS data were open with anonymity, this study was not applicable for the Institutional Review Board.

Survey variables

This study used only the manufacturer's data from the survey. In the survey, there were 6,120 manufacturers, 688 (11.2%) respondents who did not respond to the WFC questionnaires were removed and the study was conducted based on 5,432 manufacturers. The independent variables were weekly working hours, weekend work, and shift work. The WFC the dependent variable in this study comprised the five questionnaires including WFC1 which was "kept worrying about work when you were not working," WFC2 which was "felt too tired after work to do some of the household jobs which need to be done," WFC3 which was "found that your job prevented you from giving the time you wanted to your family," WFC4 which was "found it difficult to concentrate on your job because of your family responsibilities," and WFC5 which was "found that your family responsibilities prevented you from giving the time you should to do your job." We operationally interpreted WFC1, WFC2 and 3 as WTFWC, and WFC4 and 5 as FTWC. Working hours, a continuous variable in the fifth KWCS, was converted into a categorical variable divided into 40, 52, and 60 hours. Weekend work was divided into "No weekend work", "Only on Saturday", and "On all weekends". "Only on Sundays" was deleted because of its low frequency of 10 (0.2%). The dependent variables, the five WFCs, were based on a Likert scale; the positive 2 (always, most of the time) were set to "yes" values, the negative 2 (rarely, never) were set to "no" values, and "sometimes" was set to a missing value. Age was divided into four categories namely "Under 30s," "The 40s," "The 50s," "Over 60s." Education was divided into 4 categories namely "Middle school (or below)," "High school," "Junior college," "College (or higher)." According to the total number of households and the existence of a spouse, the household size was set as either "single-family," "2 with a spouse," "more than 3 with a spouse," "2 without a spouse," and "more than 3 without a spouse." The commuting time, a continuous variable, was converted into categorical data divided into "30 minutes" and "1 hour." Income, categorized in units of 1 million won, was divided into 3 categories namely "2 million won," "3 million won," and "4 million won," Employment status was divided into 4 categories namely "Self-employed (without an employee)," "Self-employed (with an employee)," "Employee," "Family (unpaid)," sex, age, and education as the basic characteristics of the subject, and household size reflecting the number of spouses, income, employment status, and commuting time were confounding variables based on the preceding studies.

Statistical analysis

A frequency analysis was conducted on the demographic and work-related characteristics and WFC variables in the study population. χ^2 analysis was used to identify the relationship between independent and dependent variables. To arrive at the adjusted result, we used multiple logistic analyses to adjust the confounding variables with backward elimination with an entrance p -value of 0.25 and the elimination p -value of 0.10. We used the unweighted data of KWCS for the analysis and estimated the odds ratio (OR) and 95% confidence interval (CI). To verify the reliability of the analysis, additional analysis was performed by applying the design weights presented in the dataset of the KWCS data utilization manual. Also, the design weights were determined by the sample design non-response rate and post-stratification. The weighted analysis is presented as an appendix (**Supplementary Tables 1-3, Supplementary Fig. 1**). All statistical analyses were performed using IBM SPSS Statistics for Windows, version 26.0 (IBM Corp., Armonk, NY, USA), and the statistical significance level was set at $p < 0.05$.

Ethics statement

As the KWCS data used was public data from a national survey, neither approval by the Institutional Review Board nor informed consent was necessary.

RESULTS

In the distribution of demographic and work-related characteristics (**Table 1**), 66.1% were male and 33.9% were female, and age, education, household size, income, employment status, commuting time are also treated. In terms of weekly working hours, under 40 hours showed the highest percentage (56.2%); the higher the working hours were, the smaller the percentage was (29.8%, 10.8%, and 3.3%, respectively). The shift group was 90.5% and the non-shift group was 9.5%. Regarding working on weekends, 61.2% responded they did not work on weekends at all; 31.9% responded they worked only on Saturdays, and 6.9% responded they worked on all weekends. The number of participants after weighting was 4,031,334 and **Supplementary Table 1** shows the distribution of the demographic and work-related characteristics.

Table 1. Distribution of demographic and work-related characteristics (n = 5,342)

| Variable | | No. | % |
|-------------------------|-------------------------------------|-------|------|
| Sex | Male | 3,590 | 66.1 |
| | Female | 1,842 | 33.9 |
| Age | Under 30s | 1,900 | 35.0 |
| | The 40s | 1,561 | 28.7 |
| | The 50s | 1,438 | 26.5 |
| | Over 60s | 533 | 9.8 |
| Education (graduation) | Middle school (or below) | 454 | 8.4 |
| | High school | 2,200 | 40.5 |
| | Junior college | 1,017 | 18.7 |
| | College (or higher) | 1,761 | 32.4 |
| Household size | Single-family | 633 | 11.7 |
| | 2 with a spouse | 1,089 | 20.0 |
| | More than 3 with a spouse | 3,260 | 60.0 |
| | 2 without a spouse | 235 | 4.3 |
| | More than 3 without a spouse | 215 | 4.0 |
| Income (KRW) | Less than 2 million | 1,251 | 23.0 |
| | 2 to less than 3 million | 1,665 | 30.7 |
| | 3 to less than 4 million | 1,388 | 25.6 |
| | More than 4 million | 1,128 | 20.8 |
| Employment status | Self-employed (without an employee) | 513 | 9.4 |
| | Self-employed (with an employee) | 239 | 4.4 |
| | Employee | 4,629 | 85.2 |
| | Family (unpaid) | 51 | 0.9 |
| Commuting time (minute) | Less than 30 | 1,266 | 23.3 |
| | 30 to less than 60 | 2,643 | 48.7 |
| | More than 60 | 1,523 | 28.0 |
| Weekly working hours | Under 40 hours | 3,052 | 56.2 |
| | 41 to 52 hours | 1,617 | 29.8 |
| | 53 to 60 hours | 585 | 10.8 |
| | Over 61 hours | 178 | 3.3 |
| Shift-work | No | 4,918 | 90.5 |
| | Yes | 514 | 9.5 |
| Weekend work | No weekend work | 3,326 | 61.2 |
| | Only on Saturday | 1,731 | 31.9 |
| | On all weekend | 375 | 6.9 |

KRW: Korean Republic won.

Table 2. Distribution of WFC variables (n = 5,342)

| WFC variable | | No. | % |
|--------------|------------------|-------|------|
| WFC1 | Always | 44 | 0.8 |
| | Most of the time | 461 | 8.5 |
| | Sometimes | 1,299 | 23.9 |
| | Rarely | 1,970 | 36.3 |
| | Never | 1,658 | 30.5 |
| WFC2 | Always | 50 | 0.9 |
| | Most of the time | 546 | 10.1 |
| | Sometimes | 1,813 | 33.4 |
| | Rarely | 2,006 | 36.9 |
| | Never | 1,017 | 18.7 |
| WFC3 | Always | 63 | 1.2 |
| | Most of the time | 628 | 11.6 |
| | Sometimes | 1,637 | 30.1 |
| | Rarely | 2,025 | 37.3 |
| | Never | 1,079 | 19.9 |
| WFC4 | Always | 31 | 0.6 |
| | Most of the time | 411 | 7.6 |
| | Sometimes | 1,116 | 20.5 |
| | Rarely | 2,344 | 43.2 |
| | Never | 1,530 | 28.2 |
| WFC5 | Always | 31 | 0.6 |
| | Most of the time | 436 | 8.0 |
| | Sometimes | 1,106 | 20.4 |
| | Rarely | 2,294 | 42.2 |
| | Never | 1,565 | 28.8 |

WFC: work-family conflict; WFC1: kept worrying about work when you were not working; WFC2: felt too tired after work to do some of the household jobs which need to be done; WFC3: found that your job prevented you from giving the time you wanted to your family; WFC4: found it difficult to concentrate on your job because of your family responsibilities; WFC5: found that your family responsibilities prevented you from giving the time you should to do your job.

In respect to the distribution of responses to the WFC questionnaire (**Table 2**), negative response (rarely, never) rates were much higher than the positive response (always, most of the time) rates in WFC1-5. The response “sometimes” was 23.9%, 33.4%, 30.1%, 20.5%, and 20.4% respectively in WFC1-5 and these values were set to missing values. **Supplementary Table 2** shows the distribution of WFC variables after weighting.

From χ^2 analysis (**Fig. 1**), sex was statistically significant with WFC2, 3, 4, and 5. In the significant cases, the percentage of people who answered “yes” was higher in the female group. Each percentage of the females who said “yes” to WFC2, 3, 4, and 5 was 19.4%, 20.0%, 12.5%, and 12.7%. Age was statistically significant with WFC1, 2, and 4. The 50s showed the highest percentage with WFC1, 2, and 4. Employment status was statistically significant with all WFC variables. In these cases, the percentage of people who answered “Yes” was highest among the self-employed groups, and relatively low among the employee group and the unpaid family worker group. Commuting time was statistically significant with WFC1, 3, 4, and 5. The number of working hours was statistically significant with all WFC variables. Common in these cases, the more the weekly working hours were, the higher the percentage of people who answered “yes.” The shift work was statistically significant with WFC2. In this case, the percentage of people who answered “yes” was higher in the shift group (20.6%) than in the non-shift group (16.1%). The weekend work was statistically significant with all WFC variables. In most of these cases, the percentage of people who answered “yes” was the smallest in the no weekends workgroup. **Supplementary Fig. 1** shows the prevalence of WFC according to the demographic and work-related characteristics after weighting.

Work-family conflicts and prolonged, weekend, and shift work

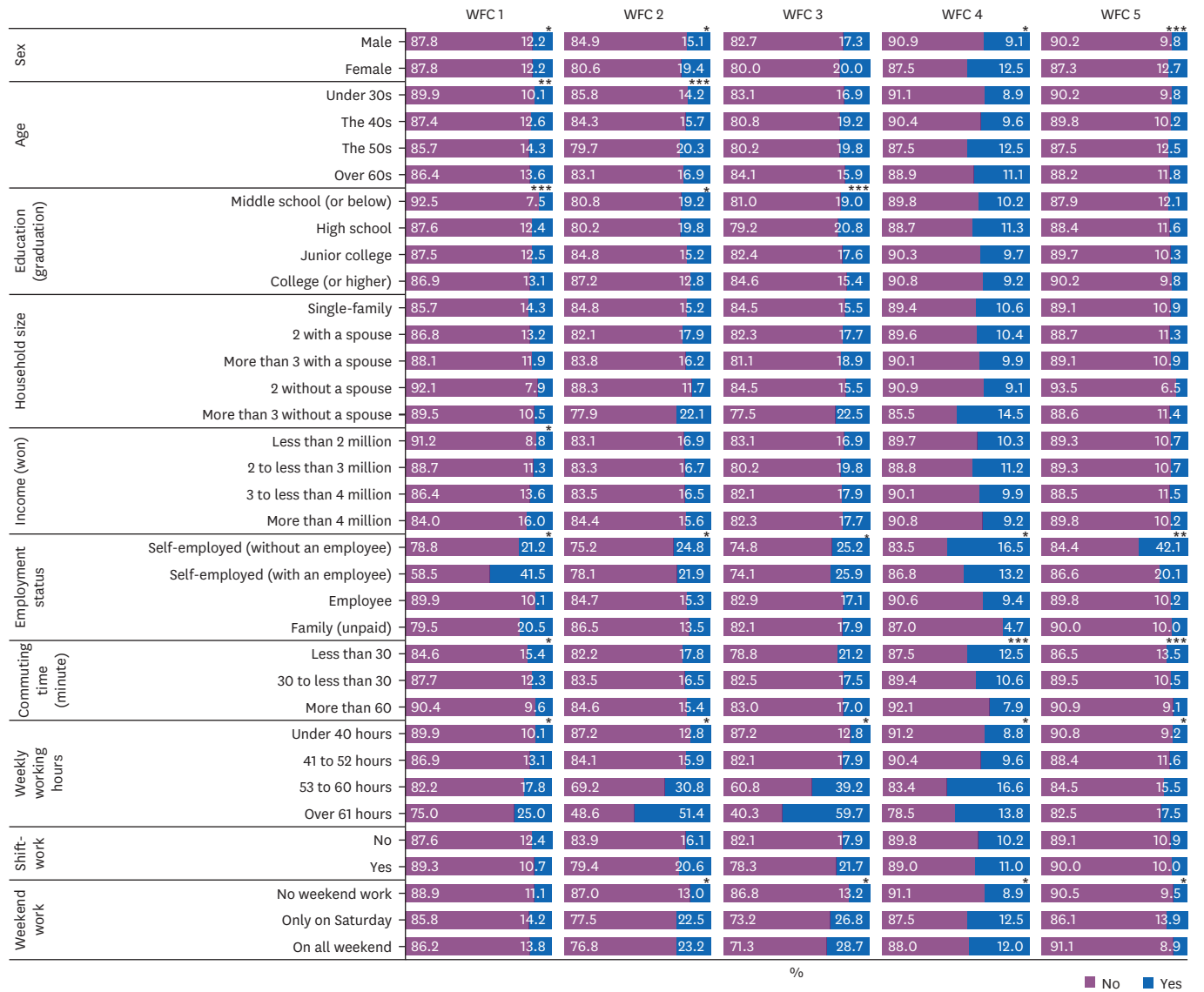


Fig. 1. Prevalence of work-family conflicts according to demographic and work-related characteristics. WFC1: kept worrying about work when you were not working; WFC2: felt too tired after work to do some of the household jobs which need to be done; WFC3: found that your job prevented you from giving the time you wanted to your family; WFC4: found it difficult to concentrate on your job because of your family responsibilities; WFC5: found that your family responsibilities prevented you from giving the time you should to do your job. * $p < 0.001$, ** $p < 0.010$, *** $p < 0.005$.

According to multiple logistic analysis (Table 3), working hours remained in all 5 models, and WFCs tended to increase in longer hours. Shift remained only in the WFC2 model. Weekend work was excluded from the model of WFC1 and WFC4. Weekend work in “only on Saturday” had significant ORs with WFC2 (1.32) and WFC3 (1.55). Weekend work in “on all weekends” had significant OR with only WFC3 (1.48). Supplementary Table 3 shows the results of the multiple logistic regression analysis after weighting. When weights were applied, all five WFC models showed an overall increase in the size of the effect (OR) and a tendency to increase in significance. However, in some cases, there was a difference from the existing trend in Table 3 as can be seen in Supplementary Table 3.

Work-family conflicts and prolonged, weekend, and shift work

Table 3. Results of multiple logistic regression analysis between WFC variables and demographic and work-related characteristics

| Variable | | WFC1 | | WFC2 | | WFC3 | | WFC4 | | WFC5 | |
|-------------------------|-------------------------------------|-------|-------------|-------|--------------|-------|--------------|-------|-------------|-------|-------------|
| | | OR | 95% CI | OR | 95% CI | OR | 95% CI | OR | 95% CI | OR | 95% CI |
| Sex | Male | Ref | | Ref | | Ref | | Ref | | Ref | |
| | Female | 1.379 | 1.089–1.748 | 1.363 | 1.128–1.648 | 1.245 | 1.039–1.492 | 1.410 | 1.150–1.730 | 1.548 | 1.222–1.960 |
| Age | Under 30s | | | Ref | | Ref | | | | | |
| | The 40s | | | 1.081 | 0.855–1.368 | 1.121 | 0.904–1.392 | | | | |
| | The 50s | | | 1.304 | 1.034–1.644 | 1.014 | 0.809–1.271 | | | | |
| | Over 60s | | | 0.870 | 0.622–1.218 | 0.568 | 0.407–0.793 | | | | |
| Education (graduation) | middle school (or below) | Ref | | | | | | | | | |
| | High school | 1.761 | 1.130–2.744 | | | | | | | | |
| | Junior college | 1.928 | 1.187–3.132 | | | | | | | | |
| | College (or higher) | 2.178 | 1.358–3.493 | | | | | | | | |
| Household size | single family | | | | | | | | | | |
| | 2 with a spouse | | | | | | | | | | |
| | More than 3 with a spouse | | | | | | | | | | |
| | 2 without a spouse | | | | | | | | | | |
| Income (KRW) | Less than 2 million | Ref | | | | | | | | Ref | |
| | 2 to less than 3 million | 1.300 | 0.963–1.755 | | | | | | | 1.192 | 0.900–1.579 |
| | 3 to less than 4 million | 1.768 | 1.266–2.470 | | | | | | | 1.539 | 1.123–2.110 |
| | More than 4 million | 1.821 | 1.268–2.616 | | | | | | | 1.427 | 1.016–2.004 |
| Employment status | Self-employed (without an employee) | Ref | | | | | | | | | |
| | Self-employed (with an employee) | 2.403 | 1.521–3.796 | | | | | | | | |
| | Employee | 0.517 | 0.375–0.713 | | | | | | | | |
| | Family(unpaid) | 1.114 | 0.477–2.604 | | | | | | | | |
| Commuting time (minute) | Less than 30 | Ref | | | | | | Ref | | Ref | |
| | 30 to less than 60 | 0.833 | 0.653–1.063 | | | | | 0.908 | 0.714–1.153 | 0.785 | 0.620–0.994 |
| | More than 60 | 0.650 | 0.486–0.869 | | | | | 0.693 | 0.521–0.922 | 0.691 | 0.526–0.908 |
| Weekly working hours | Under 40 hours | Ref | | Ref | | Ref | | Ref | | Ref | |
| | 41 to 52 hours | 1.247 | 0.997–1.559 | 1.111 | 0.873–1.414 | 1.219 | 0.969–1.534 | 1.076 | 0.852–1.360 | 1.166 | 0.905–1.504 |
| | 53 to 60 hours | 1.611 | 1.179–2.203 | 2.561 | 1.872–3.503 | 3.495 | 2.600–4.697 | 2.019 | 1.513–2.696 | 1.592 | 1.126–2.252 |
| | Over 61 hours | 2.279 | 1.447–3.589 | 6.442 | 4.092–10.143 | 8.327 | 5.435–12.759 | 2.656 | 1.715–4.113 | 1.946 | 1.172–3.241 |
| Shift-work | No | | | Ref | | | | | | | |
| | Yes | | | 1.390 | 1.019–1.896 | | | | | | |
| Weekend work | No work on all weekends | | | Ref | | Ref | | | | Ref | |
| | Work only on Saturdays | | | 1.323 | 1.038–1.686 | 1.552 | 1.234–1.950 | | | 1.254 | 0.970–1.621 |
| | Work on all weekend | | | 1.006 | 0.681–1.484 | 1.480 | 1.048–2.090 | | | 0.730 | 0.466–1.141 |

Statistically significant values are shown in bold type ($p < 0.05$).

WFC: work-family conflict; WFC1: kept worrying about work when you were not working; WFC2: felt too tired after work to do some of the household jobs which need to be done; WFC3: found that your job prevented you from giving the time you wanted to your family; WFC4: found it difficult to concentrate on your job because of your family responsibilities; WFC5: found that your family responsibilities prevented you from giving the time you should to do your job; OR: odds ratio; CI: confidence interval; KRW: Korean Republic won.

First was the case wherein the size of the effect (OR) increases and significance changes substantially. In the WFC1 model, the variable of income (won) “2 to less than 3 million” had an OR of 1.358, and weekly working hours “41 to 52 hours” had an OR of 1.315. In the WFC2 model the variable age “Over 60s” had an OR of 0.964, in WFC3 the variable age “The 50s” had an OR of 1.099, and in WFC5, weekly working hours “41 to 52 hours” had an OR of 1.189. The second was the case wherein the size of the effect (OR) decreases and the significance changes substantially. In the WFC1 model, weekly working hours “41 to 52 hours” had an OR of 1.060, in WFC3, age “The 40s,” OR was 1.083 and weekly working hours, “41 to 52 hours” an OR of 1.192 and in WFC5 income (won) of “2 to less than 3 million” had an OR of 1.182. Third, the direction of the effect (OR) reverses (increase to decrease) and the significance changes substantially. In the WFC1 model, the employment status of “Family (unpaid)” had an OR of 0.854. Except for the results belonging to the above 3 types, it was found that the rest showed a trend similar to that before the application of the weights.

In addition, considering the characteristics of the WFC variables, weekend work was significant in WTFC variables (WFC2, 3), and commuting time (inverse proportion) had effects especially in FTWC variables (WFC4, 5). Sex and working hours are significantly related to all 5 WFC variables.

DISCUSSION

The purpose of this study was to find out how working hours, weekend work, and shift work among manufacturers affect WFC. Overall, the findings show that the more working hours, weekend work, and shift work, the more WFC occurs.

In the case of working hours, a commonality between WFC1–5 is that more weekly working hours lead to an increase in WFCs (with both 2 directions). The contribution of working hours to both WTFC and FTWC increases may be explained by the fact that increased working hours cause time-based WFCs. The increase in working hours leads to a reduction in the absolute amount of time to be spent controlling or solving variables that may occur between work and home, which is the same as the decrease in the total amount of resources required to address the problems that arise, resulting in the simultaneous WTFC and FTWC. In addition, specifically, WFC was more severe in a group where weekly working hours exceeded 52 hours. This relationship of WFC linked to increasing work hours in this occupation was similar to the results of some preceding studies.^{13,14} However, it was inconsistent with the results of previous studies in some other occupations. This is because, in the study on the effect of the quality of working hours of nurses on the WFC using the 5th Korean Working Conditions Survey, which is the same raw data of this study, WFC did not increase significantly as the weekly working hours increased. Setting aside nurses, where more working hours did not lead to an increase in WFC despite using the same WFC variable, the fact that in all other scenarios more working hours led to a significant increase in WFC suggests the importance of resolving long working hours in the manufacturing industry.

With the dependent variable of WFC2, 3, and 5, weekend work remained in the final model. The WFC2, 3, and 5 tended to have bigger effects in the option “only on Saturday” than “no weekend work.” But, WFC tended to have less effect in the option “on all weekends” than “only on Saturday.” This was an unexpected phenomenon, so we further analyzed the relationship between weekend work and working hours considering that it would be important to know if the data contained any subjects that would work all weekend but rested on weekdays. In our data, only 24% of those who work on all weekends work 7 days a week. When looking at the percentage of those who work over 6 days a week, it was higher in cases where they worked only on Saturdays than those who worked all weekend. This could be the reason why working all weekend tends to result in fewer WFC than working only on Saturday. We tried to reanalyze the weekend variable into 5 groups (“No weekend work,” “Only on Saturday and work ≤ 5 days a week,” “Only on Saturday and work 6 days a week,” “All weekend and work ≤ 6 days a week,” and “Work 7 days a week”). However, the frequency of particular groups was too small to be analyzed and there were no significant results. Yet, the tendency of greater WFC when working on weekends than the no weekend workgroup was the same as in previous studies.^{14,16} In addition, weekend work was more significant in WFC2, 3, and considering that they are WTFC variables, interpretation is necessary. Assuming that they work the same time, it can be assumed that the reason for the higher WTFC occurred when working on the weekend than when not working on the weekend is because of the meaning

of the time of the weekend. It is said that it has a relative standard that can be changed according to the culture, values, and systems to which the worker belongs rather than being caused by.⁹ That is, the family-friendly meaning of the weekend will affect the judgment of workers facing the WFC. It can be interpreted that the WTFC has emerged as the family-friendly meaning of the weekend has made workers judge that what they are doing now takes away the time and resources needed to use it with their family.

Shift work was chosen as the final covariate only in the WFC2 with escalation when shift work was performed. This was consistent with previous studies.^{17,18} Shift work was particularly related to WFC2, which was the WTFC variable. Considering the WFC2 variable's own characteristics, this result is presumed to be due to excessive fatigue caused by shift work in the evening and night.¹⁹

The fact that manufacturing has a significant relationship with WFC is underlined by the fact that the manufacturing industry ranks first in overtime hours and second in holiday hours in Korea. It presents the problems of long working hours and holiday work, which have not been resolved due to salary problems. This has led to a search for measures to reduce working hours in the long term. This is echoed in a study about the manufacturing industry in Busan, which postulates that manufacturing is a very important industry in creating women's jobs.¹¹

Women had a greater degree of WFC in common with the WFC1-5. In the cross-analysis result (Fig. 1), it can be observed that more people conflict with the WTFC variables (WFC1, 2) compared to the FTWC variables (WFC4, 5). The effect of work on housework was greater than the negative effect of housework on work. In addition, the sex difference was significant in the 4 variables excluding WFC1 from the 5 variables considered. In a previous study,¹⁰ in the case of FTWC, females had more conflicts than males, and in the case of WTFC, female conflicts were insignificant or males had more conflicts, whereas, in this study, it was observed that females had more conflicts in both WTFC and FTWC. The previous study interpreted this trend of higher WTFC among males as being due to long working hours, which have been customary in Korean society, and present an obstacle to the male's family life and participation in caring work. We, therefore, analyzed the sex difference in working hours to find out whether this occurs with manufacturers as well, but it did not appear significant. From this, it appears that in females there is not only a greater effect of housework on the job (FTWC) but also an effect of work on the housework (WTFC). Perhaps this could be due to the traditional sex role stereotype based on patriarchal Confucianism that still persists within the manufacturing industry. Age was chosen as the final covariate in the cases with the WFC2 and 3, which are WTFC. Manufacturers who were in their 50s had more conflict of WFC2 and manufacturers who were over 60 had less conflict of WFC3. Expecting that these results would be related to "the number of children living together," we conducted additional analysis between the number of children in the household and WFC's. However, there was no significant relationship between the number of children in the household and the WFC1-5. Even though some studies showed a significant relationship between the growing number of children and WFC,²⁰ some studies suggest that the number of children and WFC were not related, but WFC was related to having young children.²¹ Gaspar⁹ found that having children in the home was a factor conditioning conflict in Spain, but no in Cantillon et al.²² show that the presence of children affects women and men employed in different ways. The low WFC in people in their 60s in our study could be caused by a decrease in the number of young children in the household. The high WFC in people in their 50s considering the characteristics of the WFC2 would be related to work overload.

Hence, by conducting additional analysis between age and the variable “exhausted at the end of the job,” people who were over 50 had work overload. Hence the high WFC2 in people in their 50s might be caused by high work overload. With a higher educational background, the WFC1 tended to be more severe. In the model of WFC1 and 5, higher income was related to WFCs, which could be interpreted by higher responsibilities and interests of the work among higher-income groups.²³ WFC1 was severe in self-employed with an employee than without an employee, and WFC1 in employee was less than those of other positions. Because the self-employed with an employee was likely to have a larger scale of business than the self-employed without an employee, they might have a larger amount of work and responsibility. Previous research showed that workers at higher positions had higher levels of WFC than workers at lower positions.²⁴ WFC1, 4, and 5 tended to be high with less commuting time. This phenomenon can be explained in two ways. First, noting that WFC4 and 5 were variables that family affects work (FTWC), the fact that the shorter the commuting time the deeper the WFC4 and 5 could be interpreted that the closer the work environment and the family distance the greater the impact of the family on the work. Second, the distribution of sex might be an indirect cause of this phenomenon. In further analysis of our data, women had shorter commuting times than men. Schwanen et al.²⁵ explain that women’s short commuting time stems from their high responsibilities toward their families. In the relationship between the household size and WFC, household size was not chosen as a final covariate in any case. Also, in further analysis between household size and WFCs, all WFC variables were not statistically significant. As noted earlier, the existence of young children was related to WFC.²¹ However, household size (the variable we used) did not reflect the number of young children.

This study has several limitations. The first is that subjective responses of working hours, weekend work, and shift work might not be accurate with the actual workers’ working conditions. The second is the gap between the definition of WFC in previous studies and the WFC variables used in this study. The WFC variables used in this study were based on European Working Condition Survey. Unlike previous studies, work overload was not included as a confounding variable in our study because WFC2 included work overload. The third is that this study was a cross-sectional study, which did not show a causal relationship between variables. Despite these limitations, this study is meaningful in that it dealt with the effects of many work-time characteristics including work hours, weekend work, and shift work on manufacturer’s WFC using a representative data set of the national scale. In contrast to most studies using only one variable to represent WFC, this study used five variables for WFC with two directions, (WTFC and FTWC) which allowed closer observation of how each independent or confounding variable affects WFC.

CONCLUSIONS

An increase in working hours leads to less time available to resolve problems between work and family, causing both WTFC and FTWC to increase. As weekends, evenings, and nighttime are considered to be family-friendly to people, working on weekends and shift-work were highly correlated to WTFC. Considering the characteristics of the manufacturing industry with long working hours and holiday work, this study urges the reduction of working hours in the long-term in the manufacturing industry. Also, workers in their 50s were positively correlated with WTFC, and the lesser commuting time, the higher WFC (especially FTWC) were observed. The result of this study provided a detailed bi-directional (WTFC, FTWC) approach. For the results of this study to be more meaningful, prospective research in several industries of general workers is further needed.

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SUPPLEMENTARY MATERIALS

Supplementary Table 1

Distribution of demographic and work-related characteristics: weighted frequency (n = 4,031,334)

[Click here to view](#)

Supplementary Table 2

Distribution of WFC variables: weighted frequency (n = 4,031,334)

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Supplementary Table 3

Results of multiple logistic regression analysis between WFC variables and demographic and work-related characteristics: weighted frequency (n = 4,031,334)

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Supplementary Fig. 1

Prevalence of WFCs according to demographic and work-related characteristics. All numbers were weighted reflecting the sample design of the Korean Working Conditions Survey.

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