The Relationship Between Frequency of Injuries and Workplace Environment in Korea: Focus on Shift Work and Workplace Environmental Factors

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A B S T R A C T

Background: The purpose of this study was to investigate the effect of shift work on occupational safety in various industrial sectors. The study analyzes the effects of shift work on the health of workers by considering factors such as the workplace environment and welfare.

Methods: Focusing on the 4th Korean Working Conditions Survey, this study used an ordinary least-square multiple regression analysis. The dependent variable was the annual frequency of injuries reported by workers. Independent variables were categorized as demographic, shift work, workplace environment, and welfare variables. The analysis was conducted on two levels: 1) Shift work and nonshift work groups were compared, and 2) Shift work was compared with fixed and rotating shifts.

Results: For the entire group, age, a low level of education, work hours, and daily and dispatch work negatively impacted the frequency of injuries. Shift work was negatively affected by workplace environment and welfare factors. In the shift group, the frequency of injuries was lower than that of regular workers, and the greater the autonomy in the choice of work hours, the lower the frequency of injuries. Furthermore, shift workers in Korea have longer work hours (49.25 h/week) than other workers (46.34 h/week).

Conclusion: Overall, welfare factors such as workplace satisfaction and work–life balance reduced the frequency of injuries. The effect of shift work was limited, but it was confirmed that shift worker autonomy could reduce the frequency of injuries.

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Q2 1. Introduction

Describing the 19th-century British work environment, Marx mentions shift work including night work. The rationalization for night work, which was regarded as a dimension of useless instinct, was to maximize productivity [1]. This “time squeeze” requires being awake constantly, changes modern people’s perception of time, and permanently creates tension in the modern society [2].

Nowadays, stores with bright lights can be found throughout cities at all hours. One element essential for 24-hour stores is a shift work system. The issues pertaining to shift work are closely related to problems in the work environment, such as long hours, disturbances of the daily cycle, and the problem of autonomy in the choice of work hours.

The purpose of this study is to investigate the effect of shift work on occupational safety in various occupations. The study analyzes the effects of shift work on the health of workers by considering factors such as workplace environment and welfare. There are two research objectives. First, we explore the effects of shift work and workplace environment in Korea. This study is exploratory rather than heuristic, so as to reflect the reality that shift work has spread to include workers in a wide range of occupations in Korea. Second,
this study seeks to exploit the advantages of research using a large-scale sample. Previous studies on shift work and the risk of worker injury in Korea were limited to small groups of shift workers. To accomplish the objectives of the study, the Korean Working Conditions Survey was used as a data set.

According to the International Labor Organization, shift work is a work-time organizational scheme in which an individual worker can do more work by handing over work to another worker in the workplace [1]. The European Council Directive defines shift work as a pattern in which workers work in the same workplace. Some work hours may be divided as shift work and are defined as such [2]. The International Agency for Research on Cancer (IARC) recommends classifying shift work as unstable and nonstandard work [3]. The definition of night work, considered the most problematic type of shift work, is as follows. The European Council Directive stipulates that night shifts involve night duties for at least 3 h during total work hours. Each member country has its own national law pertaining to nighttime standards [2].

Workers engaged in shift work, including night work, tend to stay awake longer before work begins than nonshift workers. Night workers are awake for about 20 h, and weekly workers are awake for 15 h. This is because nighttime sleepers are less likely to sleep in the daytime, and the effects of the bio-cycle reduce the time spent sleeping [6]. The absolute sleep time of shift workers, including night workers, is longer than that of nonshift workers; however, it is associated with health problems such as drowsiness and persistent fatigue during work [7]. The time spent reading and prescribing dispensations is 83% higher for night-duty nurses than those who work in the day [8]. Regarding occupational injuries, there are fewer cases for those working in fixed night shifts than for those working in other types of shift. However, for both groups, sleepiness and insomnia are not statistically significant [9]. Specifically, compared with fixed night-shift workers, rotating shift workers often complain about disturbances in relationships with their family or friends and physical problems such as sleepiness during the week [10].

Research on the health effects of shift work, including night shifts, generally focuses on identifying problems in shift workers' quality of sleep. Sleep is closely related to the physiological phenomena of the body. If our bodies are infected with an illness and exposed to excessive fatigue, the immune system induces us to fall asleep quickly [11,12]. This is because the immune system is activated while the body is in a sleep state and triggers antibodies such as leukocytes and lymph, promoting an immune response against various infections. Therefore, sleeping is a behavior that can actively resist an illness that is already present and plays a role in developing preventive immunity, which can eliminate disease-causing pathogens. Regarding quality of life, sleep disorders including insomnia are closely related to workers' health [13,14]. In 2010, the IARC pointed out the possibility that shift work could be a limited risk factor for cancer. A study on the carcinogenicity of shift work by the IARC in 2007 determined that this type of work is probably carcinogenic [3].

The working time capability theory explains long-term work, an issue pertaining to shift work, and the reduction of workers' use of time. According to this theory, shifts are a type of work in which the user organizes the worker's working time in such a way to maximize the production capacity of production facilities [15]. The theory of working time capability addresses the concept of workers' time sovereignty to explain why shift work causes long work hours and inadequate rest. Time sovereignty is directly related to workers' ability to balance the workplace and home or to choose work cycles that fit their biorhythms. When time sovereignty is secured, the worker may more aggressively look for the side effects of shift work [16].

2. Materials and methods

2.1. Data source

The data used in this study came from the 4th Korean Working Conditions Survey conducted by the Korea Occupational Safety and Health Research Institute in 2014. The total sample consisted of 50,007 people, of which 3,536 responded that they had engaged in shift work. The sample for this survey was the economically active nationwide population aged 15 y or older.

2.2. Measurement

The dependent variable used in the analysis was the frequency of injuries. The frequency was calculated by summing the frequency of responses to the questionnaire's (kQ69) "1-year health problem" question. This question asked whether they had experienced a physical health problem continuously for 1 y (K to N) such as an accident; physical health problem (A to J), or a psychological health problem such as anxiety or insomnia (yes or no). The researchers constructed the variables by adding the items that the respondents had experienced for 1 y. The frequency of injuries experienced by workers in the workplace is also a proxy for measuring the health of workers.

The independent variables were classified into four types as follows: 1) Sociodemographic variables were gender, age, education, income, and status of the worker. Gender was a nominal variable that was converted into a dummy variable (male = 1, female = 0). Age and income were continuous, discrete variables. Income was based on monthly income, and a natural logarithm was used for the analysis because income did not follow a normal distribution. Education was categorized as "higher than elementary school," "middle school," "high school," and "college education" and was replaced by an ordinal variable (elementary school = 1, college = 4). Finally, the status of the worker was categorized as a regular, temporary, or daily worker and was converted into a dummy variable (the reference variable was a regular worker).

2) Shift work was indicated by respondents answering "Yes" to the question on whether they worked shifts. The type of shift work was measured using a questionnaire with options for fixed and rotating shifts included in the subquestions. The type of shift work was used as a nominal variable, and all were replaced with dummy variables. In the analysis of the entire group, the reference variable was the nonshift work group, and in the analysis of the shift work group, the reference variable was the fixed shift group.

3) The group of work environment variables consisted of workplace safety and wage payment methods. Here, work hours and night work were discrete continuous variables. Work hours were measured as the total work hours per week, and night work as the number of workdays during which a worker worked for a full night during the month. Time sovereignty refers to autonomy in determining the work schedule. Time sovereignty was measured on a 4-point Likert scale (1 = the company decides the whole schedule, 5 = worker decides the whole schedule). Employment type, which refers to the payment of wages, was a nominal variable categorized as direct employment, dispatch work, or outsourcing. This variable was converted into a dummy variable (the reference variable was direct employment). Safety information vulnerability was measured on a 4-point Likert scale (1 = well informed, 5 = not informed); it refers to the availability of safety-related information in the workplace. The need for protective gear was a nominal variable and was used as a dummy variable (0 = not needed, 1 = needed).

4) The welfare factor was the level of subjective recognition of the level of welfare provided by the workplace. Here, workplace...
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