these workers, 220 were excluded because the standard occupation classification data or the information on occupations or per-day average sleep duration was not available. 9,012 workers were finally chosen for the analysis.

Data on per-day average sleep duration, socio-demographic variables, and work-related variables was selectively used for this study. Respondents were asked about how long they sleep per day in order to get the data on their daily average sleep duration. They were required to simply respond at the unit of hours between 0 to 24 hours. In this way, the sleep duration was categorized into 0 to 24 hours, and short sleep was defined if the sleep duration is less than six hours. Socio-demographic variables analyzed are sex, age, marital status, educational level, perceived health status, comorbid diseases, and perceived stress; Work-related variables analyzed cover type of occupation (nine standard industrial classifications), mean working hours per week, and working condition (fixed daytime work and so on).

Statistical analysis was performed using SAS 9.2 (SAS Institute, Cary, NC). Statistical tests used p<0.05 significance level. In case that the sampling is made using complex sample design, weighted analysis was conducted to allow the approximation of Korean population. Chi-square analysis tests and applied multiple logistic regression analysis were presented to examine socio-demographic variables and occupation-related variables associated with short sleep duration.

3   Results

The overall prevalence of short sleep duration (<6hr) was 43.0% among workers. The results shows that Short sleep was more prevalent significantly in male, older age, the divorced or separated, with low educational attainment, people having more comorbid diseases, and with higher perceived stress. The prevalence of short sleep was higher among physical workers (46.9%), among long workers who work more than 51 hours per week on average (50.7%). There was no significant differences according working shift (daytime or not).

On multivariate logistic analysis regression, factors associated with significantly increased odds of short sleep were male (odd ratio=1.26[95% CI=1.12-1.41]), older age (>65 years) compared to young age (19~44 years) (1.34[1.03-1.76]), divorced or separate marital status compared to married group (1.54[1.24-1.90]). The findings presented high school graduates had significantly lower odds of short sleep (OR 0.87[0.76-0.99]) than college graduates, workers with more perceived stress revealed higher odds (odds ratio 1.43[1.28-1.61]) (Table 1). No significant associations with short sleep found for comorbid disease or subjective health status. It was found that employment status was associated with short sleep. Agricultural and fishery skilled workers and service-sector employees demonstrated a significant lower odds (odds risk 0.52[0.28-0.98]) and (odds risk 0.79[0.63-0.99] respectively). The association between short sleep and length of working hours was found with higher odds among those who working less than 21 hours or more than 40 hours per week than those who working 21-40 hours per week.

Table 1. Multiple logistic regression analysis for relating factors of short sleep

Variable(reference group)	Category	Short Sleep Odds ratio (95% CI)
Sex (Female)	Men	1.26(1.12-1.41)
Age group (19-44 years)	45-64	1.14(0.99-1.30)
	≥65	1.34(1.03-1.76)
Marital status (Married)	Never married	1.13(0.98-1.29)
	Divorced, separated	1.54(1.24-1.90)
Education (≥College)	Primary school	1.09(0.86-1.38)
	Middle school	0.99(0.79-1.23)
	High school	0.87(0.76-0.99)
Perceived health status (Good)	Poor	1.00(0.86-1.16)
Number of chronic illness (None)	1	1.03(0.90-1.17)
	2 or more	1.16(0.97-1.40)
Perceived stress (Little)	Much	1.43(1.28-1.61)
Occupation (Physical workers)	Manager	0.75(0.51-1.10)
	Professional	1.05(0.85-1.29)
	Office worker	0.90(0.73-1.10)
	Service	0.79(0.63-0.99)
	Sales	0.81(0.65-1.02)
	Agricultural etc	0.52(0.28-0.98)
	Technician	0.99(0.80-1.23))
	Mechanics	0.87(0.67-1.13)
Working time (21-40 h/wk)	≤20	1.21(1.01-1.45)
	41~50	1.33(1.10-1.62)
	≥51	1.74(1.42-2.14)
Working Shift (Fixed day duty)	Irregular	1.11(0.95-1.30)

CI=confidence interval; h/wk = hour/week

4   Discussion

This study revealed that 43.0% of Korean wage workers were short sleepers. The main study findings indicated that the associated factors with short sleep were gender, age, marital status, education level, perceived stress, occupation, and working hours. The overtime work among our study variables showed the highest odds of short sleep.

The prevalence of short sleep was higher among old people, and similar results were evident in other study [4]. This study results indicated sleep hours of those separated, divorced, and separated by death was shorter. This finding could be occurred due to they had to take greater economic and home-affair responsibility, or psychological instability following the loss of spouse [5]. Education level was also associated with short sleep. Primary school graduates showed workers with lower education attainment had higher short sleep prevalence. This might be explained that workers with lower education level were less sensitive to sleep hygiene practices and importance of sleep than those with higher education level [6]. College graduates could be more likely to have short sleep duration because of their professional work and greater responsibility imposed on them [7]. Perceived stress might contribute to

increasing depression and nervousness and had negative impact on sleep hours and continuity of sleep.

The prevalence of short sleep varied from 32.2% to 46.9% according to occupation. Four groups representing physical workers, mechanics, professional workers, and equipment and assembly mechanics demonstrated higher short sleep prevalence than other occupation group. It was found that agricultural and fishery skilled workers reported lower short sleep prevalence than physical workers after adjustment is made for socio-demographic variables. Agricultural and fishery skilled workers spent most of the time of a day on outdoor work. This might contribute to take good and deep sleep [2].

Overtime work inevitably accompanies the higher risk of short sleep. Longer the work time is, the higher the level of perceived stress is proportionally. Thus, workers tend to drink and smoke more to relieve the stress. This will deteriorate workers' health [9]. It is believed that more aggressive intervention might be needed to improve work conditions such as reduced work hours as a way to resolve short sleep.

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