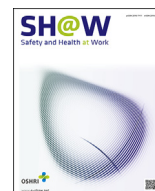




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Investigation of Working Conditions and Health Status in Platform Workers in the Republic of Korea



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ABSTRACT

Background: The present study aimed to analyze several aspects of the working conditions and health status of platform workers in the Republic of Korea, such as ergonomic and emotional hazards. We also compared the health status of the platform workers with that of the general population.

Methods: A total of 1,000 platform workers participated in this survey from August 7 to August 17, 2022. The participants included 400 designated drivers, 400 food-delivery drivers, and 200 housekeeping managers. A face-to-face survey with a structured questionnaire was conducted by researchers who had received specific instructions. The focus of the survey extended to the work environment, encompassing factors such as workplace violence, as well as physical, chemical, and ergonomic hazards. Health-related data for the previous year were also collected, covering a range of issues such as hearing problems, skin problems, musculoskeletal symptoms, headaches, injuries, mental health issues, and digestive problems. Subsequently, we compared the health symptom data of the responders with those of the general population in the Republic of Korea.

Results: Platform workers, including designated drivers, food-delivery drivers, and housekeeping managers, existed in the blind spot of social insurance, facing frequent exposure to physical and chemical hazards, ergonomic risk factors, and direct or indirect violence. The prevalence of health problems, including musculoskeletal symptoms, general fatigue, and depressive symptoms, in each occupational group was statistically higher than that in the general population after standardization for age and gender.

Conclusion: The results revealed unfavorable working environment and inferior occupational health of platform workers compared with those of the general population.

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1. Introduction

As digital technology develops, new types of platform-based labor have emerged. The coronavirus disease–2019 (COVID-19)

pandemic has facilitated the growth of digital platforms owing to the rapid increase in the non-face-to-face transition of economic activities and digitalization of the economy [1]. However, capturing the number of workers engaged in digital labor platforms is

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challenging, as most platforms do not disclose the number of active workers. In Europe, an estimated 9.7% of the adult population engages in platform work [2]. Remarkably, since 2010, the number of platforms has increased more than fivefold, with global investments in platforms reaching an estimated US \$119 billion. Consequently, the international community has witnessed a rapid expansion in the number of platform workers over the last decade [3].

Platform work offers “alternative work arrangements” including but not limited to temporary work, contingent work, part-time work, contract work, and freelance work [4] for pieces of jobs (gigs), which are mediated by digital platforms [5]. As gigs have evolved, the platform economy has shifted economic risk-taking and responsibilities from employers to workers without offering any meaningful opportunity for rewards in the form of pay increases or job stability [6]. Although self-employment offers some generally empowering aspects, including the freedom to choose where and when to work, the influence of the algorithmic management systems controlled by the platform introduces a new dynamic. This dynamic intensifies competition among workers bidding for jobs, consequently heightening the risks associated with low incomes. Hence, platform workers typically have little or no control over the amount of work available [7]. Owing to the nature of these contracts, there are vulnerabilities in platform work, including employment instability, poor job quality, and often low salaries [7].

Platform worker vulnerabilities can be classified into three categories: 1) occupational, 2) precarity, and 3) platform-based vulnerabilities [8]. Occupational vulnerability is associated with the nature of the occupation. Precarity encompasses aspects of job insecurity and exclusion from social insurance, similar to temporary employment. Platform-based vulnerabilities arise from the components of a platform or how they operate.

Diverse definitions of platform work vary across different countries and globally. Therefore, it is important to establish a clear definition for this category of work. In this study, we define platform work as encompassing four key aspects: 1) services or labor traded through algorithm-based digital platforms, 2) the process of finding jobs, including short-term projects and tasks, through digital platforms, 3) workers who receive payment through a digital platform, and 4) digital platforms open to anyone seeking a job.

Platform worker refers to an individual engaged in platform work. The criteria defining platform workers might depend on the context or research parameters. In our study, platform workers are considered individuals currently involved in platform work above mentioned at the time of survey, as in other studies. A previous report that delved into the size and characteristics of platform workers in the Republic of Korea conducted a survey [9]. The findings estimated that 2.6% of employed individuals aged 15–69, roughly 661,000 people, are currently engaged in the platform economy. Within this demographic, delivery and driving constitute 76% of the primary jobs, followed by professional services such as translation, instruction, and counseling (8.1%); simple tasks such as data entry (4.8%); housekeeping, cleaning, and child care (4.3%); and art activities (2.9%). For occupations involving professional services or data entry, which are likely conducted online or involve office work, there appears to be a lesser need to investigate the labor environment and health status of workers. Therefore, we focused on participants who worked three types of jobs: designated drivers [10], food-delivery drivers [11], and housekeeping managers [12], which accounted for a large portion of the platform labor market in the Republic of Korea and were expected to be vulnerable to physical and mental health challenges.

Because of the nature of platform work, the working conditions and health status of platform workers warrant investigation [5,13].

However, few studies have assessed the health status of platform workers [8], with the majority focusing predominantly on mental health [14–17]. Therefore, the present study aimed to analyze several aspects of the working conditions and health status of platform workers, in particular designated drivers, food-delivery drivers, and housekeeping managers, in the Republic of Korea. We also compared the health status of the platform workers with that of the general population.

2. Methods

2.1. Participants and data collection

With the cooperation of private survey institutions, we recruited designated drivers, food-delivery drivers, and housekeeping managers from among platform workers. The number of participants reflects the composition and geographical distribution of platform workers in the Republic of Korea using data from previous studies [9,18]. A total of 1,000 platform workers participated in this survey from August 7 to August 17, 2022. The participants included 400 designated drivers, 400 food-delivery drivers, and 200 housekeeping managers. For clarity, a designated driver refers to a person who drives to a destination on behalf of a customer, food delivery driver refers to a person who delivers dishes from various restaurants to specified locations as per customer requests, and housekeeping manager is someone who helps with housework or cares for an employer's child.

A face-to-face survey with a structured questionnaire was conducted by researchers who had received specific instructions. With the cooperation of the platform workers' associations or entities, researchers, distributed by region, visited related job information centers or places where workers in each occupation typically wait and rest. During the survey, no additional incentive was provided beyond transportation expenses. Notably, although the participation rate at the time of the survey was not fully calculated, it was found that there were many cases of discontinuation during the investigation, especially among the food delivery and designated drivers. However, the survey involving housekeeping managers was fully conducted unless they declined participation initially.

2.2. Measurement of general characteristics and occupational hazards

Various sociodemographic characteristics, including gender (men or women), age, location (Seoul metropolitan area, Chungcheong, Ho-nam, or Young-nam), education, smoking status (classified based on consuming 100 cigarettes in a lifetime), whether platform labor constitutes the main or side job of the individual, social insurance, night work, monthly income, and average working time (years, days/week, and hours/day), were collected. The standard for night work was defined as 1) performing eight hours of work including 12 PM to 5 AM, or 2) performing work for an average of 60 hours or more per month between 10 PM and 6 AM. We considered respondents as having social insurance if they were actively enrolled in all four types of social insurance: national pension, national health insurance, employment insurance, and compensation insurance of workers.

Data regarding the work environment, specifically occupational hazard exposure, encompassing workplace violence and physical, chemical, and ergonomic hazards were obtained. In addition, participants from all three occupations were asked questions related to customer satisfaction rating (CSAT), where customers rate the quality of their service on the application or platform. These included questions such as “Have you ever often received unfair

customer satisfaction rating (CSAT) even if it was not your fault?”, “Does the unfair CSAT often disrupt your work?” and “Do you often worry about your CSAT?”

For questions pertaining to violence, we referred to the 6th Korean Working Conditions Survey (KWCS, 2020), a nationally representative cross-sectional survey conducted periodically by the Occupational Safety and Health Research Institute (OSHRI) [19]. The participants were asked, “Have you ever experienced violence in the last year?” The components of this question encompassed verbal abuse, threats, physical violence, and insults. Additionally, participants were required to indicate the extent of their exposure. Exposure to each hazard was considered if participants were exposed for more than one-quarter of their work time. However, for the hazard of “standing,” exposure was assumed if participants stood for more than half of their working hours.

As psychosocial hazards, occupational stress was evaluated using several questions derived partly from the 2020 KWCS and the Korean Occupational Stress Scale [20]. Each question utilized scales with ratings on a 1–5 scale (not at all, not much, often, mostly, always) or 1–4 (not at all, not much, yes, absolutely yes), with exposure to occupational stress defined as the most severe score on the 1–5 scale (mostly or always) and on the 1–4 scale (yes, absolutely yes).

When surveying designated drivers and food-delivery drivers, our inquiries extended to their engagement in risky behaviors while driving, including 1) using mobile apps to check orders and 2) manipulating navigation settings to change their routes. In addition, we asked housekeeping managers about their encounters with perceived injustices associated with housekeeping, responsibility for damaged items, and blame and misunderstanding for damaged items. We also asked all of three types of platform workers whether they were forced to perform off-duty tasks for customers.

2.3. Assessment of health status

We conducted a survey to assess various health conditions experienced in the preceding year, covering issues such as hearing problems, skin problems, musculoskeletal symptoms, headache, injury, mental health, and digestive problems. Presenteeism was determined by asking, “In the last 12 months, have you ever gone out to work even though you were sick?”

To evaluate depression, the Korean version of the Patient Health Questionnaire-9 (PHQ-9) was used [21]. Respondents with scores more than 5, which is the cutoff for mild depression, were considered to have depressive symptoms. Meanwhile, sleep disturbance was assessed using the Korean version of the Insomnia Severity Index [22]. Sleep disturbance was defined as an index of more than 14 out of 28, which is the standard for clinical insomnia.

We conducted a comparison of the responders' health symptoms, encompassing back pain, upper limb pain, lower limb pain, headache/eye fatigue, anxiety, fatigue, and depressive symptoms (calculated using the PHQ-9), with those of the general population in the Republic of Korea. For depressive symptoms, nationally representative data from the Republic of Korea National Health and Nutrition Examination Survey (KNHANES; a nationwide population-based cross-sectional complex sampling survey conducted by the Korean Ministry of Health and Welfare and the Republic of Korea Centers for Disease Control and Prevention [23]) in 2021 were used as the reference population. For the other symptoms, the KWCS from 2020 was referenced.

2.4. Statistical analysis

The study presented a summary of both general and occupational characteristics, along with hazard exposure during work, for participants engaged in three distinct platform jobs. Regarding the prevalence of health symptoms, indirect standardization was performed to assess whether the prevalence differed from that in the reference population when considering age and gender. The observed number of cases among platform workers was compared with the expected number based on the prevalence specific to age groups and gender statuses in the reference population. The 95% confidence intervals (95% CIs) of the age groups and gender-standardized prevalence ratios (SPRs) were calculated using Byar's approximation [23]. Individuals for whom platform work served as their main job were subjected to a separate analysis, as detailed in [Supplementary Tables 1–4](#). Statistical analysis was conducted using SAS version 9.4 with complex survey modules (SAS Institute, Cary, NC, USA).

2.5. Ethics statement

Written informed consent was obtained from all participants. This study was approved with ethical deliberation by the Institutional Review Board of St. Mary's Hospital, Catholic University of the Republic of Korea (approval number: KC22QISI0705).

3. Results

The general and occupational characteristics of the participants are presented in [Table 1](#). Among designated drivers, 98% were men, with the majority falling into the 50's age group (41.2 %). Among food delivery workers, 99.8% were men, and most were in their 30's (42.8%). Among housekeepers, 100% were women, 39.5% were in their 50's, and 39% were more than 60 years of age, indicating the highest concentration of seniors among the three occupational groups. Night work was prevalent among 71.5% of designated drivers, 12.5% of food-delivery drivers, and only 1 housekeeping manager. The average monthly income of the housekeepers was the lowest (151.03 Korean won [KRW], standard deviation [SD]: 48.67 Korean won (KRW)).

[Table 2](#) details the acquired occupational hazard exposure data by occupation. Designated drivers were frequently exposed to verbal violence, threats, physical violence, and personal insults. In addition, they exhibited the highest exposure to secondhand smoke, and 35.0% of the participants experienced situations that involved dealing with angry customers. Conversely, food delivery workers also reported more exposure to vibrations and fumes compared to the other occupations. Notably, the requirement to check orders on mobile apps while driving poses a potential risk of accidents. In contrast, housekeepers displayed the highest exposure to musculoskeletal risk among the three occupations.

A questionnaire on health status was administered, as shown in [Table 3](#). The proportions of the population with eye fatigue and digestive disorders were higher among designated drivers than among other occupations. The prevalence of musculoskeletal problems was also notably high among platform workers. Additionally, 25–33% of platform workers had experienced presenteeism during the last 12 months, and 17% of respondents of designated driver respondents and food-delivery drivers reported depressive symptoms. However, sleep disturbances were rarely observed, irrespective of occupation.

Table 1
General and occupational characteristics of the three types of platform workers

Variables	Designated drivers	Food-delivery drivers	Housekeeping managers
Gender			
Men	395 (98.8)	399 (99.8)	0 (0)
Women	5 (1.3)	1 (0.3)	200 (100)
Age (years)			
<20	0 (0)	6 (1.5)	0 (0)
20–30	6 (1.5)	76 (19.0)	0 (0)
30–40	82 (20.5)	171 (42.8)	7 (3.5)
40–50	101 (25.3)	82 (20.5)	36 (18.0)
50–60	165 (41.2)	53 (13.2)	79 (39.5)
≥60	46 (11.5)	12 (3.0)	78 (39.0)
Location			
Seoul metropolitan area	200 (50.0)	200 (50.0)	100 (50.0)
Chung-cheong	50 (12.5)	50 (12.5)	25 (12.5)
Ho-nam	50 (12.5)	50 (12.5)	25 (12.5)
Young-nam	100 (25.0)	100 (25.0)	50 (25.0)
Education			
High school or lower	237 (59.3)	263 (65.8)	164 (82.0)
Two-year college	120 (30.0)	114 (28.5)	33 (16.5)
University or higher	43 (10.7)	23 (5.7)	3 (1.5)
Smoking			
Smoker	300 (75.0)	329 (82.3)	6 (3.0)
Non-smoker	100 (25.0)	71 (17.8)	194 (97.0)
Main/Side job			
Main job	315 (78.8)	364 (91.0)	197 (98.5)
Side job	85 (21.2)	36 (9.0)	3 (1.5)
Social insurance	53 (13.3)	52 (13.0)	11 (5.5)
Night work	286 (71.5)	50 (12.5)	1 (0.5)
Working duration (years) (mean ± SD)	3.97 ± 2.9	3.08 ± 1.9	4.96 ± 3.6
Working day/week (mean ± SD)	5.53 ± 0.6	5.70 ± 0.8	4.90 ± 0.8
Working time/day (hours) (mean ± SD)	6.08 ± 1.8	7.38 ± 1.9	6.69 ± 1.9
Monthly income (mean ± SD), 10 thousand Korean won (KRW)*	209.01 ± 64.5	230.38 ± 75.5	151.03 ± 48.7
Total, N (%)	400 (100)	400 (100)	200 (100)

* 10 thousand Korean won (KRW) = approximately 7.7 dollars (March 29, 2023).

After standardization for age and gender, the prevalence of health problems, including musculoskeletal symptoms, general fatigue, and depressive symptoms, in each occupational group was statistically higher than that in the general population (Table 4). Notably, designated and food-delivery drivers showed a higher prevalence of depressive symptoms compared to the general population. Additionally, housekeeping managers demonstrated a greater incidence of musculoskeletal symptoms than observed in the general population.

4. Discussion

This study focused on designated drivers, food-delivery drivers, and housekeeping managers among platform workers who are in the blind spot of social insurance and are often exposed to unfair CSAT. Our findings show that platform workers are exposed to various types of occupational hazards, including violence and physical, chemical, ergonomic, emotional, and psychosocial hazards. As a result, platform workers are often vulnerable to musculoskeletal disorders, accidents, and psychological distress such as stress, depressive symptoms, and anxiety. Importantly, comparable results were noted in the analysis of individuals for whom platform work constituted their main job, as detailed in Supplementary Tables 1–4.

Platform workers contend with challenges such as low pay, job insecurity, social isolation, unsocial and irregular working hours, overwork, emotional labor, sleep deprivation, and exhaustion [5,7]. Among this study's findings, it was noted that, regardless of the job, the social insurance subscription rate was low for platform workers.

Among the respondents, 723 of 884 people who did not have at least one of the four major insurances indicated that they did not have all four insurances (327 designated drivers, 212 food-delivery drivers, and 184 housekeeping managers). In particular, 60% of the participants did not have employment insurance, and 70% were not covered by workers' compensation insurance. This situation arises because platform workers are assigned work through platforms and receive income allocated by the platform. With no legal employer in this arrangement, platform workers have traditionally been classified as self-employed workers. Thus, there is no obligation to subscribe to social insurance [24].

Although the average working hours per day or average working days per week did not seem to be long for platform workers, 53.1% of them worked more than 6 days a week. The breakdown by occupation showed designated driving at 56.0%, food delivery at 69.7%, and housework management at 14.0%. While statistics on the prevalence of six-day workweeks among general workers are unavailable, data from the 6th KWCS (2020) indicates that 43% (35% of wage workers) work on Saturdays and 20% (16% of wage workers) work on Sundays. Even considering that only some of them work more than six days a week, it is anticipated that platform workers have more working days than general workers.

As one of the new aspects of platform labor, platform-based rating and reputation systems have enabled effective means of control; hence, workers with the best CSAT and the most experience receive more work due to client preferences and the platform's algorithmic ranking of workers within the search results [25]. However, more than 9% of the designated drivers and 11% of food deliverers were worried about their CSAT, and 7% had received

Table 2
Occupational hazard according to the three types of platform workers

Hazard exposures	Designated drivers	Food delivery drivers	Housekeeping managers
Unfair customer satisfaction rating (CSAT) even without fault	30 (7.5)	28 (7.0)	0 (0.0)
Disruption in work due to unfair CSAT	29 (7.3)	22 (5.5)	0 (0.0)
Worry about their CSAT	63 (15.7)	75 (17.0)	2 (1.0)
Violence exposure over the last year			
Verbal abuse	306 (76.5)	216 (54.0)	30 (15.0)
Threats	82 (20.5)	60 (15.0)	3 (1.5)
Physical violence	47 (11.8)	14 (3.5)	1 (0.5)
Insult	264 (66.0)	220 (55.0)	63 (31.5)
Physical and chemical hazards			
Vibrations	121 (30.3)	209 (52.3)	8 (4.0)
Noise	79 (19.8)	184 (46.0)	1 (0.5)
High temperatures	87 (21.8)	197 (49.3)	14 (7.0)
Low temperatures	136 (34.0)	199 (49.8)	13 (6.5)
Fumes, dust	84 (21.0)	208 (52.0)	2 (1.0)
Organic solvents	35 (8.8)	58 (14.5)	0 (0.0)
Chemicals	21 (5.3)	25 (6.3)	29 (14.5)
Secondhand smoke	256 (64.0)	180 (45.0)	1 (0.5)
Infection sources	49 (12.3)	30 (7.5)	5 (2.5)
Ergonomic hazard			
Tiring and painful positions	177 (44.3)	231 (57.8)	103 (51.5)
Moving heavy items	25 (6.3)	75 (18.8)	63 (31.5)
Standing positions	32 (8.0)	113 (28.3)	4 (2.0)
Repetitive hand or arm movements	286 (71.5)	302 (75.5)	166 (83.0)
Emotional hazards			
Dealing with people other than colleagues	294 (73.5)	289 (72.3)	104 (52.0)
Dealing with angry customers	140 (35.0)	128 (32.0)	33 (16.5)
Encountering emotionally disturbing situations	90 (22.5)	115 (28.8)	21 (10.5)
Psychosocial hazards			
Not enough time to get the job done	118 (29.5)	138 (34.5)	27 (13.5)
Experience stress in your work	133 (33.3)	133 (33.3)	31 (15.5)
Hide their emotions during work	210 (52.5)	129 (32.3)	56 (28.0)
Not able to apply own ideas in your work	190 (47.5)	189 (47.3)	65 (32.5)
Pressed for time	181 (45.3)	297 (74.3)	56 (28.0)
Insufficient rest	249 (62.3)	273 (68.3)	98 (49.0)
Future uncertainty	315 (78.8)	284 (70.8)	84 (42.0)
Risky behaviors while driving			
Dealing with mobile apps to check orders	208 (52.0)	333 (83.3)	
Controlling navigation settings to change routes	181 (45.3)	244 (61.0)	
Injustice experiences related to housekeeping			
Responsibility for damaged items			84 (42.0)
Blamed for damaged items unfairly			22 (11.0)
Force to perform off-duty tasks	22 (5.5)	56 (14.0)	51 (25.5)
Total, N (%)	400 (100)	400 (100)	200 (100)

unfair CSAT that could disrupt their productivity. In particular, food-delivery drivers or designated drivers may drive at excessive speeds due to client preferences, increasing the risk of accidents.

Moreover, platform workers experience significant psychosocial stress, dealing with challenges such as managing angry customers, exposure to violence, unfair scoring, time pressures, and uncertainty about the future. These factors might contribute to a higher prevalence of depressive symptoms compared to that in the general population. These findings are consistent with those reported in previous articles [6]. The high prevalence of depressive symptoms in platform workers compared with that in the general population was also reported in the previous studies on platform workers [14,15], largely attributed to high job strain and low job security [26]. Platform workers are not stably employed, lack continuous management due to being outside of social insurance, and are compelled to work quickly and substantially for their income [13]. Consequently, the gig economy induces job strain and insecurity, elevating the risk of occupational stress and depression [27].

Most of the designated drivers and food-delivery drivers in this study were men, aligning with findings from a prior study [10,28]. Notably, due to the characteristics of the designated drivers, a significant number were night workers. As late-night openings in restaurants became more prevalent, some food-delivery drivers were also categorized as night workers. Distinctly, more than half of

these participants engaged in risky behaviors related to platform apps while driving. This trend is noteworthy as platform workers, similar to self-employed individuals, have the potential to earn more based on the number of calls they accept; consequently, the increased workload may contribute to issues such as presenteeism [29] and dangerous driving behaviors [30].

Given that designated drivers frequently deal with drinkers, they are often subjected to violence from angry consumers, and emotional labor. Similarly, food delivery workers frequently face emotional customers due to factors such as late delivery times or spoiled food. Furthermore, both designated drivers and food-delivery drivers are exposed to occupational hazards such as vibrations, noises, fumes/dust, and secondhand smoke, stemming from the nature of their work environment [13]. The ergonomic hazards they confront, including constantly tiring and painful positions and repetitive movements, can cause cumulative traumatic injuries, which explains the high prevalence of back, upper limb, and lower limb pain compared with the general population [31]. Moreover, exposure to physical hazards and job strain may lead to symptoms such as headaches and eye fatigue [32].

All the housekeeping managers who participated in this study were women. Notably, their monthly income was lower than that of other jobs, and approximately 11% of the participants had experienced unfair blame for damaged items. These characteristics seem

Table 3
Health status of the three types of platform workers

Health status	Designated drivers	Food delivery drivers	Housekeeping managers
Health problems over the last year			
Hearing problems	5 (1.3)	9 (2.3)	0 (0.0)
Skin problems	4 (1.0)	17 (4.3)	5 (2.5)
Back pain	147 (36.8)	120 (30.0)	88 (44.0)
Upper limb pain	170 (42.5)	165 (41.3)	128 (64.0)
Lower limb pain	106 (26.5)	117 (29.3)	69 (34.5)
Headache, eye fatigue	177 (44.3)	114 (28.5)	37 (18.5)
Injuries	18 (4.5)	92 (23.0)	1 (0.5)
Depression	30 (7.5)	20 (5.0)	16 (8.0)
Anxiety	47 (11.8)	30 (7.5)	7 (3.5)
Fatigue	179 (44.8)	187 (46.8)	101 (50.5)
Digestive problems	91 (22.8)	59 (14.8)	31 (15.5)
Presenteeism over the last year	103 (25.8)	109 (27.3)	66 (33.0)
Depressive symptoms*	67 (16.8)	69 (17.3)	15 (7.5)
Sleep disturbance†	13 (3.2)	4 (1.0)	1 (0.5)
Total, N (%)	400 (100)	400 (100)	200 (100)

* Depressive symptoms: PHQ-9 > 5.

† Sleep disturbance: ISI > 14.

to reflect the gender and low social positions of housekeeping managers. Although many studies have reported on hotel housekeeping managers [12,33], platform-based housekeeping managers, as examined in this study, were required to visit not only hotels but also any location requested by customers through the platform, which is a different concept from previous studies. Housekeeping managers in platform-based occupations are likely to engage in much more atypical labor as their workplace varies, exposing them to various types of violence due to the absence of employers to ensure their safety. Additionally, the housekeeping managers in the current study encountered violence, including insults, and were forced to do off-duty tasks. Moreover, these participants were mainly exposed to ergonomic hazards such as tiring and painful positions, moving heavy items, standing positions, and repetitive movements, as opposed to physical and chemical hazards, excluding chemicals used for cleaning. This pattern is consistent with the findings reported in hotel housekeeping managers [34,35]. Owing to these hazards, we observed a higher prevalence of back pain, upper limb pain, and lower limb pain in these individuals compared with the general population.

To our knowledge, this study is the first to evaluate the working conditions and health status of platform workers in the Republic of Korea. To survey representative groups, we investigated a nationwide sample and compared their health status with those of the general population. However, this study had some limitations. First, we could not evaluate the working conditions and health status of all platform workers because only three jobs were surveyed. However, we recruited a sample with a composition similar to that of a real population. Second, selection bias may have been present due to the use of self-reported surveys; however, we addressed this

by conducting a comparison with the general population that responded to the same survey. Third, this was a cross-sectional study, and the causality between health status and the platform system was not clear. Therefore, future prospective cohort studies on platform workers are needed to investigate how platform work influences worker health. Furthermore, research efforts should extend to examining health status and its impact on platform workers according to the various jobs that comprise platform work.

This study investigated the working conditions and occupational hazards experienced by platform workers, revealing a notably unfavorable working environment and poorer occupational health compared to the general population. This emphasizes the necessity of directing more attention toward improving poor working conditions. Ultimately, platform companies should consider establishing protective measures for workers who are making a living through their platforms. Additionally, the government should establish comprehensive social insurance through semi-compulsory or compulsory subscription models, rather than a voluntary subscription approach. In the case of the Republic of Korea, persons who provide their labor to others, including platform workers, are considered as workers subject to the Industrial Accident Compensation Insurance Act, after revision of the Act in 2022. In addition, employment insurance also became applicable to quick service drivers (including food-delivery drivers) and designated drivers since January 2022. However, the employment insurance subscription rate is still low, and even if insurance subscription increases, it is common for people to not receive actual benefits, such as not receiving unemployment or leave benefits due to administrative procedural requirements [36]. Therefore, several institutional improvements are still needed.

Table 4
Standardized prevalence ratio (95% CI) of the reported symptoms by the three types of platform workers*

Symptoms	Designated drivers	Food delivery drivers	Housekeeping managers
Back pain	0.68 (0.57–0.80)	1.40 (1.16–1.67)	1.26 (1.00–1.56)
Upper limb pain	1.35 (1.15–1.57)	1.67 (1.42–1.94)	2.78 (2.30–3.33)
Lower limb pain	1.71 (1.40–2.06)	2.42 (2.00–2.91)	5.26 (4.04–6.73)
Headache, eye fatigue	2.23 (1.91–2.59)	1.54 (1.27–1.85)	0.86 (0.58–1.22)
Anxiety	1.84 (1.34–2.46)	1.29 (0.86–1.86)	0.67 (0.27–1.39)
Fatigue	1.69 (1.45–1.96)	2.12 (1.82–2.45)	1.68 (1.35–2.05)
Depressive symptoms	4.19 (3.24–5.33)	3.10 (2.40–3.94)	1.85 (1.01–3.10)

Bold fonts indicate statistically significant results.

* Depressive symptoms (PHQ-9>5) were compared to the results of the Republic of Korea National Health and Nutrition Examination Survey. Other symptoms were compared with the results of the 6th Korean Working Conditions Survey (2020).

Conflicts of interest

The authors declare that they have no competing interests.

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Appendix A. Supplementary data

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