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Factors affecting fatigue in care and health service workers revealed by big data - the 7th Korean working conditions survey (2023)

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Abstract: The purpose of this study was to identify factors affecting fatigue among caregivers and health service workers as reflected in big data. Data was analyzed using Statistics Korea [1]. This data set consists of 50,195 data points from Korea's public big data. The study subjects were 765 care and health service workers. The general characteristics of the subjects were analyzed by frequency analysis. Differences in fatigue according to general characteristics, occupational characteristics, and work-related health problems were analyzed using the $\chi 2$ test and Fisher's exact test. Logistic regression analysis was used to identify factors affecting fatigue. Factors influencing the subjects' fatigue were depression (5.442), marital status (4.662), anxiety (3.148), upper limb muscle pain (2.539), and lower limb muscle pain (2.228), in that order ($p = < .001$). In addition, back pain (1.026) and children (1.015) were also found to have an influence ($p = < .05$). To reduce fatigue among care and health service workers, workplaces need mental health management programs to reduce anxiety and depression and musculoskeletal disease prevention and management programs.

Keywords: *Big data, Care and health service, Fatigue, Workers.*

1. Introduction

According to the Korean Standard Occupational Classification, care and health service occupations are categorized by job type and target audience as follows: "Teacher assistants and childcare workers," "Nursing assistants and caregivers," "Elderly and disabled care workers," and "Other care and health service workers" [2]. Among these, care and health service workers oversee health, welfare, and education, and have been the fastest-growing field of employment in Korea over the past decade, with 722,000 workers as of 2024 [3].

Care sector employment is closely linked to the government's socialization policy. Korea's long-term care insurance program for the elderly, introduced in 2008, has seen its budget grow exponentially, from 500 billion won in 2008 to 9.4 trillion won in 2020. This currently accounts for 1.1% of Korea's GDP. The Ministry of Employment and Labor announced that care sector employment is expected to see the greatest growth in employment in its mid- to long-term labor supply and demand forecast through 2030, signaling a continued expansion of employment in the care sector [4].

The most striking demographic characteristic of care workers is their high proportion of women. Due to the increase in female employment in the care sector, which accounted for 15.7% of all female employment in 2011, that proportion increased to 20.5% in 2021. This expansion of the care sector has also led to an increase in female employment [5].

Care and health care workers, due to the nature of their work, are physically demanding, requiring them to stand continuously. The proportion of those who spend more than half their time standing was significantly higher among health care workers (63.1%) and education care workers (82.1%) compared to 48.2% of all wage earners. Experiences of psychological stress were also relatively high, with a high proportion of those exposed to emotionally unstable situations and engaging in emotional labor [5]. Care and health care workers suffer from musculoskeletal disorders due to their high-intensity work.

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Their work environment requires them to provide services to elderly people, children, and patients, and these individuals often experience fatigue due to their specific characteristics [6, 7]. In a previous study of these individuals, high levels of musculoskeletal symptoms were found to be associated with poorer subjective mental health[8]. Furthermore, caregivers' work stress and emotional labor exacerbated depression and anxiety [9] and were also factors contributing to fatigue [10]. This fatigue among caregivers and healthcare workers increased the perceived fatigue associated with caring for patients and was associated with functional impairments in daily life [7]. Therefore, the issue of fatigue among caregivers and healthcare workers can impact patient care, making it a societal issue. Their health and well-being appear to be directly linked to the quality of care services.

Accordingly, this study was conducted to identify factors affecting fatigue among care and health service workers as revealed through a work environment survey and to use this as basic data for developing a program to reduce their fatigue.

The purpose of this study was to identify factors affecting fatigue among caregivers and health service workers as reflected in big data.

The specific objectives are as follows.

- First, identify the general characteristics of the subjects.
- Second, identify differences in fatigue based on the subject's general characteristics, occupational characteristics, and work-related health issues.
- Third, identify factors influencing the subjects' fatigue.

2. Research Methods

2.1. Research Design

This study is a descriptive cross-sectional study using raw data [11] from the 7th Work Environment Survey in 2023, a public data set in Korea, to identify factors affecting fatigue among care and health service workers.

2.2. Data Collection

The data for this study were extracted from raw data from the 7th Work Environment Survey, approved for use by the Korea Occupational Safety and Health Research Institute. The survey was developed based on the European Union (EU) Work Environment Survey. Korea conducted the first survey in 2006 and has conducted it every three years since, with the 7th survey completed in 2023 [11]. The raw data from the 7th Work Environment Survey is available for download and access by anyone after agreeing to the terms and conditions of the Personal Information Collection and Use Consent Form from the Korea Occupational Safety and Health Research Institute. This study was based on these raw data from the 7th Work Environment Survey. The raw data from the 7th Work Environment Survey is a large dataset, comprising 50,195 data points. This study used data from 1,145 of the 30,073 respondents who reported being wage earners and responded under the industry classification of "care and health service workers." After excluding 380 non-respondents and missing data, 765 data points were used for the final analysis (Figure 1).

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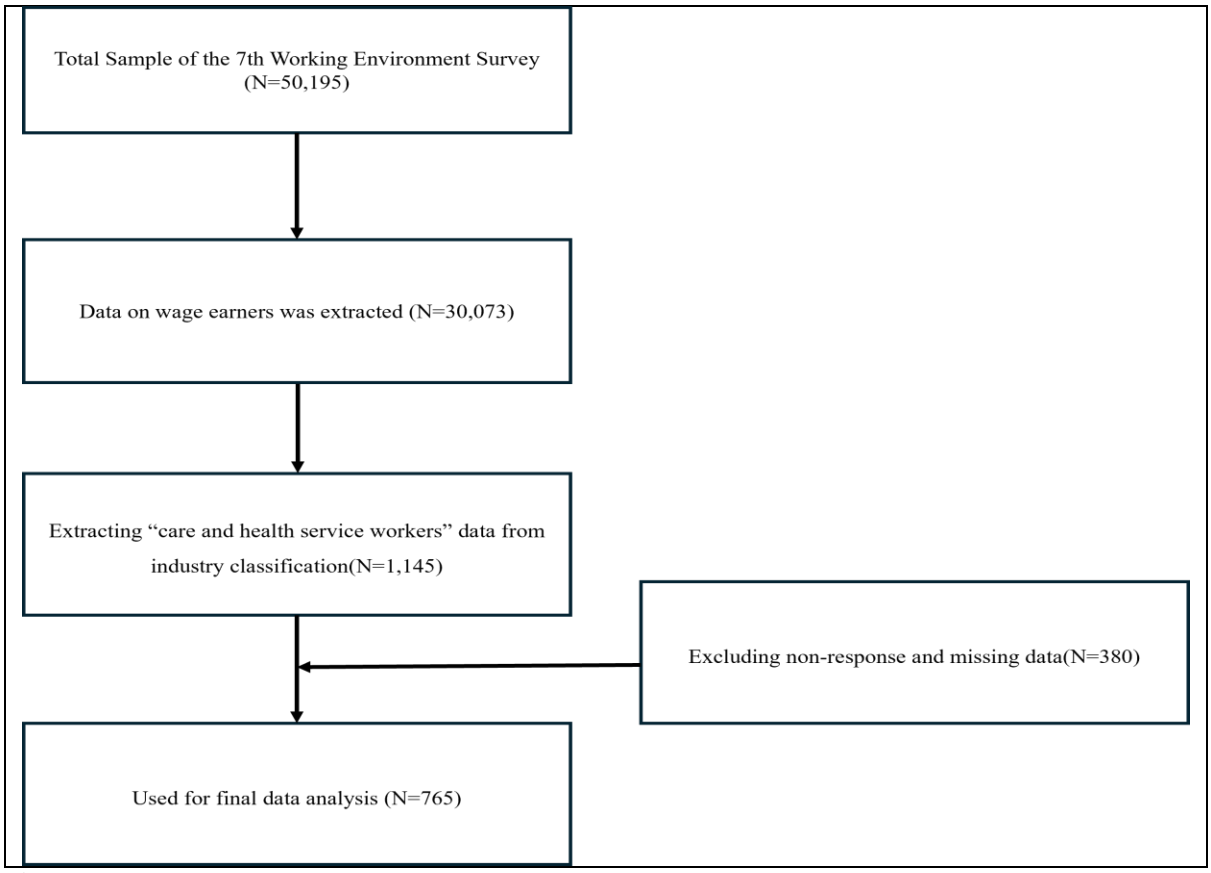

Figure 1.
Flowchart of analysis targets.

2.3. Data Analysis Method

The data collected was analyzed using IBM SPSS/WIN 28.0 statistical software as follows. The statistical analysis methods are as follows: The general characteristics of the subjects were analyzed using frequency analysis. Differences in fatigue according to the subjects' general characteristics, occupational characteristics, and work-related health problems were analyzed using the $\chi 2$ test and Fisher's exact test. Finally, logistic regression was used to determine factors influencing fatigue.

3. Research Questionnaire

3.1. General and Occupational Characteristics

The research instrument used data from the 7th Work Environment Survey, consisting of six questions on general characteristics and three on occupational characteristics. The general characteristics questions included age, gender, education, marital status, children, and income. The occupational characteristics questions included three questions on years of service, company size, and whether night shifts were performed.

3.2. Health-Related Problems

Health-related issues were assessed using six items: fatigue, back pain, upper limb muscle pain, lower limb muscle pain, anxiety, and depression. For fatigue, the question "General fatigue" was answered with "yes" for "yes" and "no" for "no." For back pain, work-related back pain was answered with "yes" for "yes" and "no" for "no." Upper limb muscle pain was assessed as work-related, with pain

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in the upper extremities (shoulder, neck, arm, elbow, wrist, and hand) scored as "yes" and pain in the lower extremities (hip, leg, knee, and foot) scored as "no." Leg muscle pain was assessed as work-related, with pain in the lower extremities (hip, leg, knee, and foot) scored as "yes" and pain in the upper extremities scored as "no." Anxiety was assessed as work-related, with "yes" indicating "existence" and "no" indicating "absence." Depression was assessed as work-related, with "yes" indicating "existence" and "no" indicating "absence."

4. Results

4.1. General Characteristics of the Subjects

The average age of the subjects was 59.02 ± 10.25 years. The majority, 734 (95.9%), were female workers, and 604 (79.0%) had a high school diploma or lower. Additionally, 726 (94.9%) were married, and 698 (91.2%) had children. The majority, 564 (73.7%), earned between 2 million won and 4 million won per month (Table 1).

Table 1.
General characteristics of the subjects (N=765).

Variables	Categories	N (%) or M±SD
Age (years)		59.02±10.25
Gender	Male	31(4.1)
	Female	734(95.9)
Education	≤ High school graduate	604(79.0)
	College graduate	88(11.5)
	≥University graduate	73(9.5)
Marital status	Married	726(94.9)
	Single	39(5.1)
Children (person)	Have	698(91.2)
	Have no	67(8.8)
Income (10,000won/month)	< 200	188(24.6)
	200-400	564(73.7)
	> 400	13(1.7)

4.2. Fatigue According to the General and Occupational Characteristics and Health-Related Problems of the Subject

Based on general characteristics, the proportion of respondents who reported experiencing fatigue differed significantly between married and single individuals: 25.9% (188 respondents) were married, compared to 12.8% (5 respondents) who were single (p=.004). There was also a significant difference between those who reported having children (25.2% (183 respondents)) and those who did not (14.9% (10 respondents)) (p=.032). Based on occupational characteristics, there was a significant difference between those who reported experiencing fatigue, with 40.3% (29 respondents) reporting working night shifts and 23.7% (164 respondents) reporting no work (p=.004). Regarding health-related issues, the percentage of respondents who reported experiencing fatigue was 35.5% (117 respondents) for back pain and 17.5% (76 respondents) for no back pain, showing a significant difference (p<.001). Regarding muscle pain, the percentage of respondents who reported experiencing fatigue was 38.2% (139 respondents) for upper limb muscle pain and 13.5% (54 respondents) for no muscle pain, showing a difference (p<.001). Regarding lower limb muscle pain, the percentage of respondents who reported experiencing fatigue was 47.6% (89 respondents), while 25.2% (193 respondents) reported no fatigue, showing a difference (p<.001). In the proportion of those who responded that they had fatigue, there was a difference in anxiety between 68.8% (22 people) who responded 'yes' and 23.3% (171 people) who

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responded 'no' (p=<.001), and in depression between 74.2% (23 people) who responded 'yes' and 123.2% (170 people) who responded 'no' (p=<.001).

Table 2.
Fatigue According to the General and Occupational Characteristics and Health-Related Problems of the Subject (N=765).

Variables	Categories	Total (n=765) N (%)	Fatigue		χ^2	*p*
			Yes(n=193) N (%)	No(n=572) N (%)		
Gender	Male	31(4.1)	6(19.4)	25(80.6)	0.625	0.429
	Female	734(95.9)	187(25.5)	547(74.5)		
Education	≤High school	604(79.0)	154(25.5)	450(74.5)	0.124	0.940
	College	88 (11.5)	21(23.9)	67(76.1)		
	≥University	73(9.5)	18(24.7)	55(75.3)		
Marital status	Married	726(94.9)	188(25.9)	538(74.1)	8.382	0.004
	Single	39(5.1)	5(12.8)	34(97.2)		
Children (person)	Have	698(91.2)	183(26.2)	515(73.8)	4.577	0.032
	Have no	67(8.8)	10(14.9)	57(85.1)		
Income (10,000won/month)	<200	188(24.6)	43(22.9)	145(77.1)	0.897	0.639
	200-<400	563(73.7)	145(25.9)	418(74.1)		
	≥400	14(1.7)	5(31.0)	9(69.0)		
Average tenure(year)	<1	97(12.7)	25(25.8)	72(74.2)	3.326	0.344
	1 - <5	174(22.7)	42(24.1)	132(75.9)		
	5 - <10	350(45.8)	97(27.7)	253(72.3)		
	≥10	144(18.8)	29(20.1)	115(79.9)		
Company size(people)	<50	630(82.4)	151(24.0)	479(76.0)	2.901	0.089
	≥50	135(17.6)	42(31.8)	93(68.9)		
Night shift	Yes	72(9.4)	29(40.3)	43(59.7)	8.717	0.004
	No	693(90.6)	164(23.7)	529(76.3)		
Back pain	Yes	330(43.1)	117(35.5)	213(64.5)	32.001	<0.001
	No	435(56.9)	76(17.5)	359(82.5)		
Upper extreme muscle pain	Yes	364(47.6)	139(38.2)	225(61.8)	63.181	<0.001
	No	401(52.4)	54(13.5)	347(86.5)		
Lower limb muscle pain	Yes	187(24.4)	89(47.6)	98(52.4)	60.583	<0.001
	No	578(75.6)	193(25.2)	572(74.8)		
Anxiety	Yes	32(4.2)	22(68.8)	10(31.2)	20.088	<0.001
	No	733(95.8)	171(23.3)	562(76.7)		
Depression	Yes	31(4.1)	23(74.2)	8(25.8)	34.295	<0.001
	No	734(95.9)	170(23.2)	564(95.9)		

4.3. Factors on Fatigue of the Subjects

To examine the factors influencing the subjects' fatigue, a regression analysis was performed, and the regression model was found to be significant (χ^2= 126.702, <.001). The Cox & Snell coefficient of determination (R2), which indicates the model's explanatory power, was 35.3%, and the Nagelkerke coefficient of determination (R2), which indicates its explanatory power, was 42.5%. The factors with the greatest influence on the subjects' fatigue were depression (5.442), marital status (4.662), anxiety (3.148), upper limb muscle pain (2.539), and lower limb muscle pain (2.228), in that order (p = <.001)

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Back pain (1.026) and children (1.015) also appeared to have an influence (p = <.05). However, working night shifts did not appear to affect the subjects' fatigue (Table 3).

Table 3.
Factors on Fatigue of the Subjects (N=765).

Variables	Categories	OR	95% CI	*p*
Marital status (ref. single)	Married	4.662	1.020-2.285	<0.001
Children (person) (ref. have no)	Have	1.015	0.432-2.619	0.047
Night shift (ref. no)	Yes	0.463	0.266-0.806	0.060
Back pain (ref. no)	Yes	1.026	0.666-1.560	0.040
Upper extremity muscle pain (ref. no)	Yes	2.529	1.613-3.964	<0.001
Lower limb muscle pain (ref. no)	Yes	2.228	1.458-3.402	<0.001
Anxiety (ref. no)	Yes	3.148	1.242-4.976	<0.001
Depression (ref. no)	Yes	5.442	2.103-14.088	<0.001

5. Discussion

This study analyzed factors affecting fatigue among care and health service workers. The study found that 95.9% of the participants were women. The care service sector encompasses a wide range of areas, including elderly care, disability care, and childcare, and is often perceived as a field primarily filled by women. Furthermore, the actual proportion of female workers is also found to be higher [5]. The average age was 59.02±10.25, indicating advanced age. These results suggest that the social welfare service sector, among the care sectors, is characterized by a high average age of workers, indicating an aging population. Furthermore, the care service sector is characterized by low wages and high labor intensity due to emotional labor, which discourages young workers from applying. This trend is accelerating due to the aging population [5, 12]. When considering fatigue based on general characteristics, married workers and those with children reported more fatigue. This is supported by a previous study Choi [13], showing that the burden of work and home life was the greatest factor in burnout among elderly caregivers. Therefore, compared to single workers, married workers and workers with children appear to report more fatigue. Furthermore, workers who work night shifts reported more fatigue. This is explained by a study of shift workers, which found that across all occupations, shift workers experienced worse sleep quality and sleep disturbances, and that these sleep disturbances were linked to depression and fatigue [14]. Additionally, the risk of fatigue increased when shift workers were female, worked more night shifts, worked more Sundays, worked more than 10 hours a day, and woke up feeling exhausted or extremely tired [15].

Psychological factors that influence fatigue include depression and anxiety. Caregivers experience long hours of care work, unstable work environments, workplace violence, and emotional dissonance as major factors that increase depression and anxiety [9, 16]. Emotional dissonance in service workers refers to the experience of emotional damage resulting from the suppression and control of emotional expression at work. Therefore, if workers are exposed to depression due to stress in the work environment, proactive problem-solving, such as individual counseling and treatment, is necessary.

The subjects' upper and lower extremity muscle pain and back pain were found to affect fatigue. Muscle pain, including back pain, in caregivers is closely related to fatigue, and this muscle pain, due to the nature of care work, was found to exacerbate fatigue [17]. Care work involves a lot of physical activity, and elderly care often involves moving heavy objects and standing for long periods of time, placing significant strain on muscles [18]. Repetitive movements, incorrect postures, and long working hours in the work environment of caregivers cause back pain and further aggravate chronic fatigue and stress [7, 17].

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Care workers' musculoskeletal symptoms themselves had a negative impact on their mental health, and some of them also experienced a negative impact on their mental health through sleep problems [8].

Therefore, safety training, safety equipment use, and stretching training are necessary for caregivers and service workers, and institutional measures are needed to ensure sufficient rest during work. Furthermore, legal revisions are necessary to improve the poor working conditions of workers [19]. Fatigue is a key health-related factor that predicts work-life balance, with higher levels of fatigue associated with lower work-life balance [20]. This means that the more fatigue workers experience, the more likely they are to encounter worse health problems and a greater imbalance between work and life.

Fatigue is typically considered a common physical symptom experienced by middle-aged women. Consequently, the specific nature of the work often isn't considered. Therefore, moving beyond the perspective of taking fatigue for granted requires proactive approaches to fatigue intervention. Furthermore, it's crucial to recognize and prioritize fatigue before it becomes chronic or develops into a disease, and to explore interventions to reduce it. This approach is crucial not only for the individual health of caregivers but also for the quality of care, ultimately impacting the national picture.

6. Conclusion

This study analyzed factors affecting fatigue in care and service workers using raw data from the Korean Work Environment Survey. The results showed that the most significant factors affecting fatigue were depression, marital status, anxiety, upper limb muscle pain, and lower limb muscle pain, in that order. Back pain and children were also found to have an impact. Therefore, improving the working environment, including appropriate workload distribution and providing break times, is necessary to prevent worker fatigue. Furthermore, musculoskeletal disease prevention and management programs that provide education, counseling, and support for musculoskeletal disorders are needed. To manage the mental health of care workers, emotional support programs are necessary, including regular counseling and dialogue with colleagues and managers. Caregivers should also maintain a positive mindset, manage their personal time between work and home, and strive to find emotional stability. Fatigue among caregivers and service providers can also impact the quality of care provided to recipients. Future research is recommended to analyze the relationship between worker fatigue and the quality of care provided to recipients.

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Transparency:

The author confirms that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

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