

Association Between Abrupt Change to Teleworking and Physical Symptoms During the Coronavirus Disease 2019 (COVID-19) Emergency Declaration in Japan

Masato Tezuka, BSc, Tomohisa Nagata, MD, PhD, Kenta Saeki, BSc, Yamato Tsuboi, PhD, and Naoto Fukutani, PhD

Objective: We investigated the association between telework frequency and the presence of non-COVID-19–related physical symptoms during the COVID-19 emergency declaration among workers in Japan. **Methods:** Data were collected from 1648 workers via web-based self-reported questionnaires. Multivariate logistic regression models were used to investigate the association between telework frequency per week (0, 1–2, 3–4, and ≥ 5 days/week) and the presence of stiff shoulders, eyestrain, and low back pain. **Results:** Among 917 participants, telework frequency was significantly associated with stiff shoulders (≥ 5 days: adjusted odds ratio [aOR] 3.02, 95% confidence interval [CI] 1.37–7.06), eyestrain (≥ 5 days: aOR 5.31, 95% CI 2.09–13.44), and low back pain (≥ 5 days: aOR 5.57, 95% CI 2.22–14.00), compared with non-teleworkers. **Conclusions:** Workers who

From the Department of Public Health, Graduate School of Health Science, Kobe University, Kobe, Japan (Tezuka, Saeki, Dr Tsuboi); BackTech Inc., Kyoto, Japan (Tezuka, Saeki, Dr Tsuboi, Dr Fukutani); Department of Occupational Health Practice and Management, Institute of Industrial Ecological Sciences, University of Occupational and Environmental Health, Kitakyushu, Japan (Dr Nagata); Department of Physical Therapy, Human Health Sciences, Graduate School of Medicine, Kyoto University, Kyoto, Japan (Dr Fukutani).

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Ethical Considerations & Disclosures: The research protocol was approved by the Ethics Committee of Medical Research, University of Occupational and Environmental Health, Japan (R2-013). Consent to participate in this study was obtained from all participants in written.

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Data Sharing Statement: The datasets generated and/or analyzed during the current study are not publicly available, to protect the personal privacy of participants, but are available from the corresponding author on reasonable request.

Patient and Public Involvement: Patients or the public were not involved in the design, conduction, reporting, or dissemination plans of our research.

Clinical Significance: Higher teleworking frequency was associated with a higher prevalence of physical symptoms among workers in Japan during the COVID-19 emergency declaration. Our results suggest that workers who abruptly begin teleworking often suffer from significant health problems; thus, careful monitoring of health problems in workers who abruptly begin teleworking is crucial.

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Address correspondence to: Masato Tezuka, BSc, Department of Public Health, Graduate School of Health Sciences, Kobe University, 7-10-2, Tomogaoka, Suma, Kobe, Hyogo 654-0142, Japan (214k301k@stu.kobe-u.ac.jp).

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Learning Objectives

- Discuss previous reports on telework-related health problems that have emerged during the COVID-19 pandemic.
- Summarize the new findings on common types of physical symptoms developing after the COVID-19 emergency declaration among workers in Japan, and the associations of these symptoms with telework frequency.
- Discuss the study implications for managing telework-related symptoms in employees.

abruptly began telework experienced more physical symptoms than non-teleworkers during the emergency declaration.

Keywords: coronavirus disease 2019, COVID-19, eyestrain, low back pain, physical symptoms, stiff-shoulders, telework

In response to the coronavirus disease 2019 (COVID-19) pandemic, many employers in Japan abruptly switched to telework to reduce the risk of infection among workers.^{1–3} The first SARS-CoV-2 infection in Japan was reported on January 16, 2020, and cases quickly began increasing.⁴ Thus, to prevent the spread of COVID-19 and the collapse of medical services, the Japanese government officially declared the COVID-19 emergency declaration in seven prefectures on April 7, 2020, until May 31,⁵ and across the entire country on April 16, 2020, until May 16.⁵ This emergency declaration called for employers to adopt teleworking as much as possible.³

Telework has been effective in reducing the risk of COVID-19 infection during the pandemic⁶; however, teleworking has also been associated with certain health problems. A recent review indicated that health problems associated with telework can be divided into four categories: 1) musculoskeletal problems, 2) isolation and depression, 3) stress and overwork, and 4) other problems.⁷ It may be particularly important to focus on physical symptoms such as musculoskeletal problems because these symptoms are related to presenteeism, which may decrease work productivity.⁸ Prolonged periods of working at home on a computer can result in static, restricted postures and repetitive movements, which can lead to the development of musculoskeletal symptoms.⁹ Additionally, teleworkers tend to sit for a prolonged and continuous-time, without taking a break, because work and communication with colleagues online usually occur while seated.⁹

When implementing telework, a previous study reported the importance of providing adequate education to workers and supporting the maintenance of the work environment to prevent physical symptoms among workers.⁹ However, immediately after the government declared the emergency declaration in Japan, many workers were forced to convert to teleworking without adequate preparation owing to the risk of COVID-19 infection. Consequently, workers who abruptly started teleworking during the emergency declaration may have experienced more physical symptoms than those who did not start teleworking during the emergency

declaration.¹⁰ Additionally, workers with a higher telework frequency may have more physical symptoms. Given that many employers continued telework for a long period, it is important to assess physical symptoms among workers who abruptly began teleworking during the COVID-19 emergency declaration.¹¹

The purpose of this study was to investigate the association between telework frequency and the presence of physical symptoms during the COVID-19 emergency declaration in Japan.

METHODS

Procedure and Participants

This cross-sectional study collected data from June to September 2020, which is after the COVID-19 emergency declaration. The subjects of this survey are workers of the companies collected from the recruitment by BackTech Inc. Two non-ferrous metal companies agreed to participate in this study and we distributed web-based self-reported questionnaires via the intranet to 4759 workers; 1648 workers completed the questionnaires (response rate: 34.6%). The inclusion criteria were full-time workers, aged ≥20 years, and non-teleworker before the emergency declaration (to target workers who abruptly began teleworking during the declaration). The exclusion criterion was having missing data. Data from 917 participants were available for statistical analysis.

This study was approved by the institutional ethics committee (approval no. R2-013). Informed consent was obtained from all participants prior to completing the web-based questionnaire.

Outcomes

The primary outcome was the presence of physical symptoms not due to COVID-19 infection during the emergency declaration. The presence of physical symptoms was measured using the following question: “What physical symptoms concerned you during the emergency declaration?” Respondents selected from among 15 physical symptoms, chosen from the leading symptoms in the National Lifestyle Survey of Japan.¹² The 15 symptoms were: stiff shoulders, eyestrain, low back pain, fatigue, sluggishness, cough and expectoration, frequent urination, constipation, joint pain, headache, diarrhea, dizziness, hearing loss, numbness in the fingers and forearms, and tinnitus. If participants had no physical symptoms, they responded “no symptoms.” Afterward, we used the prevalence of the three leading physical symptoms (stiff shoulders, eye strain, and low back pain) as the outcome variables.

Exposure

Based on the responses from the self-reported questionnaires, telework frequency during the emergency declaration was measured in telework days per week (response options were 0, 1, 2, 3, 4, and ≥5 days/week). We divided telework frequency into the following categories: 0, 1 to 2, 3 to 4, and ≥5 days per week.

Other Variables

Data on the following demographic variables were obtained from the self-reported questionnaires: age, sex, height, weight, marital status (married, single, divorced, or widowed), occupational status (in a management position and not in a management position), occupation (general office clerks, engineering professionals, sales workers, science professionals, planning managers, human resource managers, customer services clerks, senior officials, personal care workers, and others), the presence of any of the 15 physical symptoms before the emergency declaration. Body mass index was calculated as weight in kilograms divided by height in meters squared.

Statistical Analysis

For descriptive data, categorical variables are presented as numbers and percentages. Continuous variables are described as the

median and interquartile range (IQR). Logistic regression models were used to investigate the association between telework frequency and the presence of stiff shoulders, eyestrain, and low back pain during the emergency declaration. We constructed both crude and adjusted models. The following variables were included as covariates in the adjusted model: age, sex, body mass index, marital status, occupational status, and the presence of physical symptoms

TABLE 1. Participant characteristics (n=917)

Age (years), median (IQR)	45 (34–52)
Men, n (%)	714 (77.9)
BMI (kg/m ²), median (IQR)	22.5 (20.6–25.0)
Marital status, n (%)	
Married	598 (65.2)
Single	298 (32.5)
Divorced or widowed	21 (2.3)
Management position, n (%)	372 (40.6)
Occupations, n (%)	
General office clerks	275 (30.0)
Engineering professionals	220 (24.0)
Sales workers	156 (17.0)
Science professionals	121 (13.2)
Planning managers	80 (8.7)
Human resource managers	41 (4.5)
Customer services clerks	7 (0.7)
Senior officials	3 (0.3)
Personal care workers	2 (0.3)
Others	12 (1.3)
Telework frequency during the emergency declaration, n (%)	
0 day	85 (9.3)
1–2 days	144 (15.7)
3–4 days	211 (23.0)
≥5 days	477 (52.0)
Physical symptoms during the emergency declaration, n (%)	
Stiff shoulder	333 (36.3)
Eyestrain	299 (32.6)
Low back pain	256 (27.9)
Fatigue	178 (19.4)
Sluggishness	146 (15.9)
Headache	68 (7.4)
Constipation	43 (4.7)
Diarrhea	42 (4.6)
Tinnitus	33 (3.6)
Joint pain	29 (3.2)
Dizziness	28 (3.1)
Frequent urination	26 (2.8)
Cough and expectoration	17 (1.9)
Numbness of fingers and forearms	17 (1.9)
Hearing loss	26 (1.6)
No symptoms	317 (34.6)
Physical symptoms before the emergency declaration, n (%)	
Stiff shoulders	272 (29.7)
Eyestrain	210 (22.9)
Low back pain	140 (15.3)
Fatigue	137 (14.9)
Sluggishness	92 (10.0)
Headache	46 (5.0)
Constipation	26 (2.8)
Diarrhea	36 (3.9)
Tinnitus	22 (2.4)
Joint pain	8 (0.9)
Dizziness	22 (2.4)
Frequent urination	21 (2.3)
Cough and expectoration	16 (1.7)
Numbness of fingers and forearms	8 (0.9)
Hearing loss	13 (1.4)
No symptoms	430 (46.9)

BMI, body mass index; IQR, interquartile range.

TABLE 2. Logistic regression models for stiff shoulders during the emergency declaration

Prevalence of stiff shoulders, <i>n</i> (%)	Crude model		Adjusted model	
	OR	95% CI	OR	95% CI
Telework frequency				
0 day	ref		ref	
1–2 days	2.22	1.19–4.34*	2.10	0.85–5.37
3–4 days	2.38	1.32–4.51*	3.02	1.29–7.43*
5 or more days	2.93	1.69–5.37*	3.02	1.37–7.06*

CI, confidence interval; OR, odds ratio.

Adjusted for age, sex, body mass index, marital status, occupational status, and stiff shoulders before the emergency declaration.

**P* < 0.05.

before the emergency declaration (stiff shoulders, eyestrain, and low back pain). Crude and adjusted odds ratios (ORs) and 95% confidence intervals (CIs) were calculated. *P* values < 0.05 were considered statistically significant. All statistical analyses were performed using R version 4.0.2 (The R Project for Statistical Computing, Vienna, Austria).

RESULTS

Participant Characteristics

Among the 917 participants, the median age was 45 years (IQR: 34–52 years) and 77.9% were men. Eighty-five participants (9.3%) reported 0 days of telework during the emergency declaration, 144 (15.7%) reported 1 to 2 days, 211 (23.0%) reported 3 to 4 days, and 477 (52.0%) reported ≥ 5 days. The prevalence of the three leading physical symptoms during the emergency declaration was as follows: stiff shoulders (36.3% of participants), eyestrain (32.6%), and low back pain (27.9%) (see Table 1).

Association of Telework Frequency with Physical Symptoms during the Emergency Declaration

In the adjusted model, only 3 to 4 days and ≥ 5 days of teleworking per week had significant associations with the presence of stiff shoulders during the emergency declaration (3–4 days: OR = 3.02, 95% CI = 1.29–7.43; ≥ 5 days: OR = 3.02, 95% CI = 1.37–7.06) (see Table 2). Any frequency of teleworking was significantly associated with eyestrain during the emergency declaration in the adjusted model (1–2 days: OR = 3.62, 95% CI = 1.31–10.00; 3–4 days: OR = 3.88, 95% CI = 1.46–10.30; ≥ 5 days: OR = 5.31, 95% CI = 2.09–13.44) (see Table 3). The adjusted model also showed telework frequency was significantly associated with low back pain during the emergency declaration (1–2 days: OR = 3.83, 95% CI = 1.41–10.36; 3–4 days: OR = 6.09,

95% CI = 2.33–15.94; ≥ 5 days: OR = 5.57, 95% CI = 2.22–14.00) (see Table 4).

DISCUSSION

In this study, even after adjustment, higher telework frequency was significantly associated with a higher prevalence of stiff shoulders, eyestrain, and low back pain among workers in Japan during the COVID-19 emergency declaration. To the best of our knowledge, no studies have investigated the association between telework frequency and the presence of physical symptoms due to telework implemented without adequate preparation because of the COVID-19 pandemic.

A previous study found that, although the reported prevalence of low back pain was higher in teleworkers than non-teleworkers during the COVID-19 lockdown, the prevalence of neck pain showed no significant difference between teleworkers and non-teleworkers.¹³ These findings partially support our study results; however, covariates were not controlled in that study. In our study, we used multivariate analysis and adjusted for covariates, such as the presence of physical symptoms before the COVID-19 emergency declaration.

The association between telework frequency and stiff shoulders, eyestrain, and low back pain could be attributed to the following factors: 1) increased sitting time, 2) decreased physical activity, and 3) poor work environment at home. A previous study reported that in adults, physical activity has decreased and sitting time has increased during the COVID-19 pandemic.¹⁴ In general, sedentary behaviors can cause adverse effects on physical health.¹⁵ Indeed, increased sitting time has been associated with a higher risk for musculoskeletal pain, eyestrain, and fatigue.^{16–19} Therefore, increased sitting time may be a risk factor for stiff shoulders, eyestrain, and low back pain among teleworkers. A previous study reported that a prolonged sitting position may cause a continuous static load on the neck

TABLE 3. Logistic regression models for eyestrain during the emergency declaration

Prevalence of eyestrain, <i>n</i> (%)	Crude model		Adjusted model	
	OR	95% CI	OR	95% CI
Telework frequency				
0 day	ref		ref	
1–2 days	3.72	1.71–8.08*	3.62	1.31–10.00*
3–4 days	4.19	1.98–8.86*	3.88	1.46–10.30*
5 or more days	4.94	2.41–10.10*	5.31	2.09–13.44*

CI, confidence interval; OR, odds ratio.

Adjusted for age, sex, body mass index, marital status, occupational status, and eyestrain before the emergency declaration.

**P* < 0.05.

TABLE 4. Logistic regression models for low back pain during the emergency declaration

Prevalence of low back pain, n (%)	Crude model		Adjusted model	
	OR	95% CI	OR	95% CI
Telework frequency				
0 day	ref		ref	
1–2 days	2.58	1.28–5.25*	3.83	1.41–10.36*
3–4 days	2.25	1.14–4.45*	6.09	2.33–15.94*
5 or more days	2.63	1.39–4.99*	5.57	2.22–14.00*

CI, confidence interval; OR, odds ratio.

Adjusted for age, sex, body mass index, marital status, occupational status, and low back pain before the emergency declaration.

* $P < 0.05$.

muscles, which is a risk factor for stiff shoulders.²⁰ Further, previous studies have reported that increased work time using a visual display terminal (VDT) was significantly associated with eyestrain.^{21–23} Because many teleworkers use computers, it is likely that as sitting time increases, VDT work time also increases. Moreover, VDT work time may be increased in teleworkers because meetings often take place online. Regarding low back pain, previous studies have reported that intervertebral disc pressure is 1.4 times greater in a sitting position than a standing position,²⁴ and that sitting for more than 7 hours per day significantly increases the risk of low back pain.²⁵ Prolonged sitting may flex the spine and consequently place additional stress on the intervertebral discs.²⁶ Furthermore, a decreased physical activity in leisure and commuting times, including walking and cycling, may have a negative impact on the physical symptoms among teleworkers. A previous study reported that the leisure physical activity of the workers decreased after the COVID-19 epidemic.²⁷ Teleworkers may have spent less time performing any leisure physical activity than non-teleworkers.²⁸ According to previous studies, less leisure physical activity was a risk factor for stiff shoulders and low back pain.^{29,30} Finally, in addition to physical activity and sedentary behavior, a poor work environment at home may also negatively affect physical symptoms among teleworkers. Among those who started telework during the COVID-19 pandemic, a poor working environment at home has been associated with a high level of discomfort in, for example, the head, eyes, and muscles.³¹

To prevent the development of physical symptoms among teleworkers, it is important to reduce sitting time and increase leisure physical activity. It is likely that teleworkers experience increased sitting time because they communicate with colleagues online while seated and often work in a seated position with the computer at arm's length. A previous study reported that light-intensity walking breaks may counteract the increased fatigue that arises from remaining in a continuously sedentary position.¹⁸ We encourage teleworkers to stand regularly with a computer or phone reminder every 2 hours.^{32,33} Therefore, teleworkers must have a good awareness of the importance of taking frequent breaks and reducing sitting time. Teleworkers should replace their commuting time with the performance of physical activities, such as walking, to ensure that they would have sufficient time for physical activity. The World Health Organization recommends that adults should perform at least 150 to 300 min of moderate-intensity aerobic physical activity or at least 75 to 150 min of vigorous-intensity aerobic physical activity throughout a week.³⁴ Finally, workers who are forced to begin teleworking abruptly may be unable to maintain their normal work environment and, therefore, may have difficulty in adapting to telework. Thus, it is also important for companies to educate the work environment teleworkers and supply them with office chairs with armrests, external monitors, keyboards, and computer mice.^{7,11,31}

Limitations

This study had several limitations. First, because this was a cross-sectional study, causal relationships between telework frequency and physical symptoms during the emergency declaration remain unclear. However, we used multivariate analysis and adjusted for covariates such as the presence of physical symptoms before the emergency declaration. Thus, we were able to investigate the association between telework frequency and the presence of physical symptoms during the emergency declaration, by considering the presence of physical symptoms before the emergency declaration. However, there may be potential recall bias. Although the emergency declaration in Japan was declared from April 14 to May 25, 2020, participants completed the web-based questionnaires from June to September 2020. Finally, this sample might include selection bias due to the low response rate (34.6%) and the high percentage of men in the sample (77.9%). Because the web-based self-report questionnaires were distributed via the intranet, many workers may have been unaware this survey was being conducted.

CONCLUSION

Our study showed that higher telework frequency was independently associated with a higher prevalence of physical symptoms during the COVID-19 emergency declaration in Japan. This finding suggests that greater attention is needed for the health of workers who must abruptly begin teleworking without adequate preparation.

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