Increased Health Risk in Office Workers in the COVID-19 Era

Comparison of One-Year Incidence of Health Problems Before and During the COVID-19 Pandemic

Machi Suka, MD, PhD, Takashi Shimazaki, PhD, Takashi Yamauchi, PhD, and Hiroyuki Yanagisawa, MD, PhD

Objective: To examine whether the incidence of health problems increases during the COVID-19 pandemic. **Methods:** Using the health examination data (April 2018-March 2021) of Japanese workers aged 15 to 64 years, the 1-year incidence of five health problems (overweight, hypertension, hypercholesterolemia, hyperglycemia, and liver damage) and four unhealthy habits (snacking, heavy drinking, physical inactivity, and sleep deprivation) were compared before and during the COVID-19 pandemic. **Results:** The 1-year incidence of overweight, hypertension, hyperglycemia, and liver damage increased by 15% to 65% during the COVID-19 pandemic. Increased weight gain, related to decrease physical activity during the COVID-19 pandemic, was significantly associated with increased incidence of health problems. **Conclusions:** The COVID-19 pandemic have deteriorated workers' health even without the COVID-19 infection. Lifestyle interventions should be promptly started particularly targeting workers with gained weight to avoid more serious consequences.

Keywords: COVID-19, follow-up study, lifestyle change, weight gain

Learning Objectives

- Discuss the possible impact of lifestyle changes related to COVID-19 on changes in health during the pandemic.
- Summarize the new findings on changes in common health problems and unhealthy habits during the COVID-19 pandemic.
- Discuss the implications for lifestyle interventions to mitigate the consequences of pandemic-related health and behavior changes.

The novel coronavirus, COVID-19, has raised serious concerns worldwide. Physical distancing has been highly recommended as a preventive measure for infection expansion.[1] Many countries have imposed a full or partial lockdown to minimize person-to-person contact.[2]

Although Japan has never enforced the COVID-19 lockdown, the Japanese government has repeatedly urged the public to avoid closed and crowded places, to refrain from face-to-face conversation, and to wear a face mask. Many companies introduced remote working by the request from the Japanese Government.[3,4] Consequently, people's lifestyle has dramatically changed since the first outbreak started in the Tokyo major metropolitan area in February 2020. Our previous survey of people living in the metropolitan area[5] revealed a clear shift to sedentary lifestyle with decreasing moderate activity and increasing screen time. About one out of five people reported that their health was declining during the COVID-19 pandemic.

Many studies have been conducted to assess the impact of COVID-19 pandemic on people's health.[5–7] However, most of them collected data through an online survey. Online survey becomes one of the most popular data collection sources, because it enables access to a variety of populations, easy to obtain a large number of responses, saves time and money, and provides immediate results.[8] On the other hand, online survey technique is not suited for direct observations or measurements. There is scarce evidence on the health impact of COVID-19 pandemic based upon objective measurement data.

All workplaces in Japan are legally mandated to provide their employees with annual health examinations. Although health examination providers had to suspend their services just after starting the first outbreak for 2 months (April and May 2020), health examinations have since been resumed. Using the health examination data (April 2018-March 2021) of Japanese workers aged 15 to 64 years, we examined whether the incidence of health problems (overweight, hypertension, hypercholesterolemia, hyperglycemia, and liver damage) increases during the COVID-19 pandemic. Moreover, we evaluated the effect of lifestyle habit changes (snacking, heavy drinking, physical inactivity, and sleep deprivation) owing to the COVID-19 pandemic on weight change, which may affect the incidence of health problems. The results of this study will demonstrate the secondary harms of the COVID-19 pandemic in office workers and underline the necessity for prompt intervention to avoid more serious consequences.

METHODS

Participants

Electronic data of the health examinations conducted in fiscal years 2018, 2019, and 2020 (from April 1, 2018 to March 31, 2021) were collected from the Tokyo Health Service Association (located in the city of Tokyo, Japan), where a total of 130,000 people working in 1400 companies undergo a health examination every year (http://www.yobouigaku-tokyo.or.jp). The study protocol was approved by the ethics committee of the Tokyo Health Service

From the From the Department of Public Health and Environmental Medicine, The Jikei University School of Medicine, Minato-ku, Tokyo, Japan (Dr Suka, Dr Shimazaki, and Dr Yamauchi); The Jikei University School of Medicine, Tokyo, Japan (Dr Yanagisawa).

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Ethical considerations: The study protocol was approved by the ethics committee of the Tokyo Health Service Association (Tou-Yo-Rin No.002) and has been conducted in accordance with the Ethical Guidelines for Medical and Biological Research Involving Human Subjects by the Japanese Government. The Tokyo Health Service Association obtained written informed consent from health examinees to use their health examination data for research purposes under conditions of anonymity and confidentiality.

Suka, Shimazaki, Yamauchi, and Yanagisawa have no relationships/conditions/circumstances that present potential conflict of interest.

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Address correspondence to: Machi Suka, MD, PhD, Department of Public Health and Environmental Medicine, The Jikei University School of Medicine, 3–25–8 Nishi-Shimbashi, Minato-ku, Tokyo 105–8461, Japan (suka@jikei.ac.jp).

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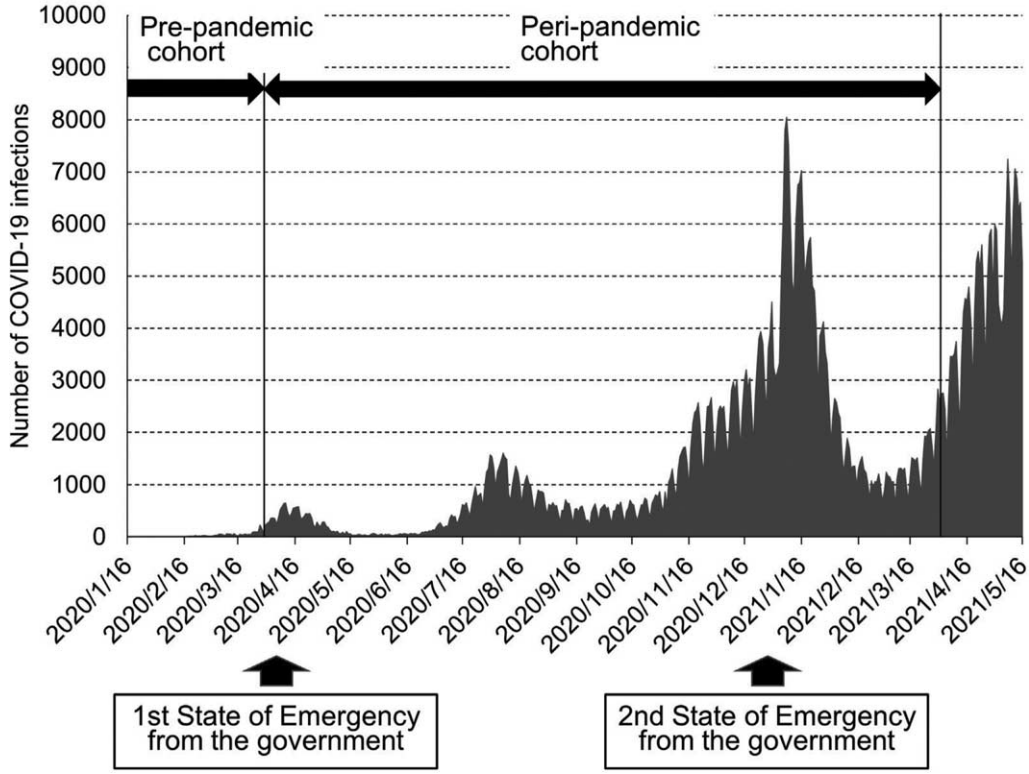

FIGURE 1. The number of COVID-19 infections in Japan.

Association (Tou-Yo-Rin No.002) and has been conducted in accordance with the Ethical Guidelines for Medical and Biological Research Involving Human Subjects by the Japanese Government.[9]

Participants in health examinations have each been given a unique identifier number as a means of managing their health examination data. Annual health examination data can be combined by a one-to-one merge based on the identifier number. Using the health examination data (April 2018-March 2021), the following two cohort datasets were constructed for the study. One was a prepandemic cohort: the health examinees of fiscal year 2018 (from April 1, 2018 to March 31, 2019) aged 15 to 64 years were followed up by merging with the health examination data of fiscal year 2019 (from April 1, 2019 to March 31, 2020). Of the 78,951 people with complete anthropometric, laboratory, and lifestyle data of the 2018 health examination, 57,190 people (72.4%) underwent the next health examination in 12 ± 2 months. Another was a peri-pandemic cohort: the health examinees of fiscal year 2019 (from April 1, 2019 to March 31, 2020) aged 15 to 64 years were followed up by merging with the health examination data of fiscal year 2020 (from April 1, 2020 to March 31, 2021). Of the 84,081 people with complete anthropometric, laboratory, and lifestyle data of the 2019 health examination, 36,190 people (43.0%) underwent the next health examination in 12 ± 2 months. Health examinations had to be suspended for 2 months (April and May 2020) by the request of the Japanese Government. Many people postponed receiving the 2020 health examination and thus were excluded from the study.

Figure 1 shows the number of COVID-19 infections in Japan. The COVID-19 was first detected on January 16, 2020. The number of infected patients increased after the outbreak on a cruise ship in February 2020. The Japanese government declared a State of Emergency twice on April 7, 2020 and January 7, 2021, while three waves of infections occurred (the first wave in April 2020, the second wave in August 2020, and the third wave in January 2021). In contrast to the pre-pandemic cohort, the peri-pandemic cohort had experienced multiple waves of infections and self-restraint lifestyle for months on end.

Measures

Annual health examinations, including anthropometric measurements, laboratory tests, and a self-administered questionnaire, were performed in accordance with the Standard Health Examination Program by the Japanese Government.[10] The standard questionnaire which consists of 22 questions about past medical history, lifestyle, and willingness to change unhealthy habits[10] was submitted to the reception desk on the day of examination and was checked for completion by skilled staff on the spot.

Weight (in kilograms to the nearest 0.1 kg) and height (in centimeters to the nearest 0.1 cm) were measured with a participant lightly clothed and standing without shoes. Blood pressure was measured using an electronic sphygmomanometer with a participant sitting on a chair after at least 5 minutes of rest. Blood samples were assayed at a laboratory of the Tokyo Health Service Association, where both internal and external quality controls of the laboratory data are regularly in accordance with the guidelines of the expert committee for data standardization.

Incidence of Health Problems and Unhealthy Habits

This study focused on five health problems (overweight, hypertension, hypercholesterolemia, hyperglycemia, and liver damage) and four unhealthy habits (snacking, heavy drinking, physical inactivity, and sleep deprivation) which seem susceptible to the COVID-19 pandemic.[5] The health problems and unhealthy habits were defined according to the guidelines by the Japanese Government[10] and the expert committees.[11–13] Their incidence rates in the pre- and peri-pandemic cohorts, respectively, were calculated by using

a denominator of the number of people without the health problem or unhealthy habit at the baseline health examination.

Overweight

Overweight was defined as a body mass index (BMI) calculated by the weight in kilograms divided by the square of height in meters of $\geq$25.0.[10]

Hypertension

Hypertension was defined as a systolic blood pressure of $\geq$140 mmHg or a diastolic blood pressure of $\geq$90 mmHg.[10,11]

Hypercholesterolemia

Hypercholesterolemia was defined as a low-density lipoprotein cholesterol (LDL-C) measured by direct assay of $\geq$140 mg/dL (3.6 mmol/L).[10,12]

Hyperglycemia

Hyperglycemia was defined as a blood glucose of $\geq$110 mg/dL (5.6 mmol/L) or a hemoglobin A1c (HbA1c) of $\geq$6.0%.[13]

Liver Damage

Liver damage was defined as an aspartate aminotransferase (AST) of $\geq$51 U/L, an alanine aminotransferase (ALT) of $\geq$51 U/L, or γ glutamyl transferase (γGT) of $\geq$101 U/L.[10]

Snacking

The question was: ''Do you eat snacks after dinner more than 3 times a week? (Yes/No).'' Those who answered ''Yes'' were counted as ''snaking.''

Heavy Drinking

The questions were: ''How often do you drink alcohol? (everyday/sometimes/rarely)'' and ''How much do you drink alcohol per day? ($<$20/20 $\sim <$ 40/40 $\sim <$ 60/60 $\leq$ g of ethanol per day). Those who answered ''everyday'' and ''60 $\leq$ g of ethanol per day,'' respectively, were counted as ''heavy drinking.''

Physical Inactivity

The questions were: ''Are you in a habit of doing exercise to sweat lightly for over 30 minutes a time, 2 times weekly, for over a year? (Yes/No)'' and ''In your daily life do you walk or do any equivalent amount of physical activity more than one hour a day? (Yes/No).'' Those who answered ''No'' to both were counted as ''physical inactivity.''

Sleep Deprivation

The question was: ''Do you sleep well and enough? (Yes/No).'' Those who answered ''No'' were counted as ''sleep deprivation.''

Statistical Analysis

All statistical analyses were performed using the SAS ver. 9.4 (SAS Institute, Cary, NC). For the 1-year weight change, age-specific means and standard deviations (SDs) were compared between the pre- and peri-pandemic cohorts using t test, and weighted (age-adjusted) means with 95% confidence intervals (CIs) were calculated using the age distribution of pre-pandemic cohort as the standard. For the 1-year incidence of health problems and unhealthy habits, standardized (age-adjusted) incidence ratios with 95% CIs were calculated by the indirect method using the age distribution of pre-pandemic cohort as the standard. Multiple logistic regression analysis was performed to evaluate the effect of weight change on incidence of health problems and the effect of lifestyle habit changes on weight gain, respectively. The one-year weight changes were classified into 7 strata ($+10<$, $+6<\sim+10$, $+2<\sim+6$, $-2<\sim<+2$, $-6\sim<-2$, $-10\sim<-6$, and <-10 kg) in the analysis. The 1-year health habit changes were categorized into ''quit (change from yes to no),'' ''develop (change from no to yes),'' ''continue (not change from yes),'' and ''no change (not change from no).'' Odds ratios with 95% CIs were calculated with adjustment for age and BMI at baseline. Significant levels were set at $P < 0.05$.

RESULTS

Table 1 shows the baseline characteristics of the pre- and peri-pandemic cohorts. The pre- and peri-pandemic cohorts had the almost same means and SDs for age and BMI at baseline in both sexes. The prevalence of health problems and unhealthy habits at baseline did not differ between the two cohorts.

Table 2 shows the 1-year incidence of health problems. The standardized incidence ratio (the peri-pandemic cohort versus the pre-pandemic cohort) was significantly greater than 1 for overweight, hypertension, hyperglycemia, and liver damage, while the value of significantly smaller than 1 was observed in hypercholesterolemia. The greatest value was observed in liver damage, followed by overweight in both sexes.

Table 3 shows the 1-year incidence of unhealthy habits. The standardized incidence ratio (the peri-pandemic cohort versus the pre-pandemic cohort) was significantly greater than 1 for physical inactivity and heavy drinking (in female workers), while the value of significantly smaller than 1 was observed in sleep deprivation and snacking (in female workers).

Male workers gained more weight than female workers both in the pre- and peri-pandemic cohorts. The weighted mean (95% CI) weight change in the peri-pandemic cohort of male workers was 0.73 (0.72–0.74) kg, compared with 0.40

TABLE 1. Baseline Characteristics of the Pre- and Peri-pandemic Cohorts

	Pre-Pandemic Cohort		Peri-Pandemic Cohort	
	N	Prevalence	N	Prevalence
Male				
N	32,792		20,253	
Age, mean (SD)	43.6	(11.2)	43.9	(11.1)
BMI, mean (SD)	23.7	(3.6)	23.8	(3.7)
Health problems				
Overweight	10,002	30.5%	6,341	31.3%
Hypertension	3,680	11.2%	2,452	12.1%
Hypercholesterolemia	8,745	26.7%	5,645	27.9%
Hyperglycemia	4,243	12.9%	2,736	13.5%
Liver damage	4,605	14.0%	2,919	14.4%
Unhealthy habits				
Snacking	22,562	68.8%	14,354	70.9%
Heavy drinking	4,095	12.5%	2,411	11.9%
Physical inactivity	14,349	43.8%	8,244	40.7%
Sleep deprivation	12,213	37.2%	8,007	39.5%
Female				
N	24,398		15,937	
Age, mean (SD)	41.0	(12.0)	41.2	(12.0)
BMI, mean (SD)	21.5	(3.5)	21.6	(3.6)
Health problems				
Overweight	3,362	13.8%	2,369	14.9%
Hypertension	1,019	4.2%	754	4.7%
Hyperglycemia	4,398	18.0%	3,257	20.4%
Hyperglycemia	1,777	7.3%	971	6.1%
Liver damage	590	2.4%	392	2.5%
Unhealthy habits				
Snacking	21,353	87.5%	13,919	87.3%
Heavy drinking	588	2.4%	356	2.2%
Physical inactivity	11,372	46.6%	6876	43.1%
Sleep deprivation	10,315	42.3%	6725	42.2%

TABLE 2. One-Year Incidence of Health Problems

	Pre-Pandemic Cohort		Peri-Pandemic Cohort		Standardized Incidence Ratio
	N	Incidence	N	Incidence	95% CI
Male					
Overweight	22,790	1,101	13,912	874	1.30
		4.8%		6.3%	1.21–1.38
Hypertension	29,112	1,868	17,801	1,395	1.21
		6.4%		7.8%	1.15–1.27
Hypercholesterolemia	24,047	3,186	14,608	1,678	0.86
		13.2%		11.5%	0.82–0.90
Hyperglycemia	28,549	1,345	17,517	967	1.17
		4.7%		5.5%	1.09–1.24
Liver damage	28,187	1,696	17,334	1,545	1.48
		6.0%		8.9%	1.41–1.55
Female					
Overweight	21,036	474	13,568	374	1.22
		2.3%		2.8%	1.09–1.34
Hypertension	23,379	557	15,183	434	1.19
		2.4%		2.9%	1.07–1.30
Hypercholesterolemia	20,000	1,859	12,680	926	0.78
		9.3%		7.3%	0.73–0.84
Hyperglycemia	22,621	694	14,966	532	1.15
		3.1%		3.6%	1.06–1.25
Liver damage	23,808	285	15,545	309	1.65
		1.2%		2.0%	1.47–1.84

(0.36–0.44) kg of the prepandemic cohort. The weighted mean (95% CI) weight change in the peri-pandemic cohort of female workers was 0.50 (0.49–0.51) kg, compared with 0.46 (0.42–0.51) kg of the pre-pandemic cohort. Age-specific mean weight change was shown in Supplementary Table 1, http://links.lww.com/JOM/B58.

Table 4 shows the effect of weight change on incidence of health problems in the peri-pandemic cohort. A significant dosedependent relationship between the weight change and the incidence of health problem was observed in all health problems; greater weight gain had greater odds ratios for the incidence of health problems.

Table 5 shows the effect of lifestyle habit changes on weight gain in the peri-pandemic cohort. Physical inactivity showed the strongest association with weight gain in both sexes. In addition, changes in snacking and heavy drinking were significantly associated with weight gain in male workers.

DISCUSSION

Using the health examination data (April 2018-March 2021) of Japanese workers aged 15 to 64 years, the 1-year incidence of five health problems and four unhealthy habits were compared before and during the COVID-19 pandemic. The incidence of overweight,

TABLE 3. One-Year Incidence of Unhealthy Habits

	Pre-Pandemic Cohort		Peri-Pandemic Cohort		Standardized Incidence Ratio
	N	Incidence	N	Incidence	95% CI
Male					
Snacking	10,230	3,135	5,899	1,735	0.96
		30.6%		29.4%	0.91–1.00
Heavy drinking	28,697	1,060	17,842	694	1.05
		3.7%		3.9%	0.97–1.13
Physical inactivity	18,443	2,888	12,009	2,430	1.29
		15.7%		20.2%	1.24–1.34
Sleep deprivation	20,579	3,105	12,246	1,310	0.71
		15.1%		10.7%	0.67–0.75
Female					
Snacking	3,045	1,421	2,018	837	0.89
		46.7%		41.5%	0.83–0.95
Heavy drinking	23,810	221	15,581	179	1.24
		0.9%		1.1%	1.06–1.42
Physical inactivity	13,026	2,375	9,061	2,013	1.22
	18.2%				
	22.2%	1.16–1.27			
Sleep deprivation	14,083	2,555	9,212	1,151	0.69
		18.1%		12.5%	0.65–0.73

TABLE 4. Effect of Weight Change on Incidence of Health Problems in the Peri-Pandemic Cohort

	Male		Female	
	Odds Ratio*	**95% CI**	**Odds Ratio***	**95% CI**
Hypertension	(N = 17,801)		(N= 15,183)	
+ 10 < kg	2.52	1.71–3.70	2.80	1.54–5.09
+6 <∼+10	1.63	1.30–2.05	0.99	0.62–1.60
+2 <∼+6	1.36	1.19–1.55	1.20	0.95–1.51
−2 <∼<+2	1.00	Reference	1.00	Reference
−6∼<−2	0.73	0.61–0.88	0.84	0.62–1.13
−10∼<−6	0.74	0.51–1.06	0.66	0.34–1.27
<−10	0.28	0.12–0.63	0.87	0.37–2.02
p for trend	<0.001		0.001	
Hypercholesterolemia	(N= 14,608)		(N= 12,680)	
+ 10 < kg	2.76	1.99–3.84	3.15	2.12–4.68
+6<∼+10	2.05	1.69–2.47	1.52	1.15–2.00
+2<∼+6	1.43	1.27–1.62	1.40	1.19–1.64
−2<∼<+2	1.00	Reference	1.00	Reference
−6∼<−2	0.75	0.63–0.89	0.77	0.62–0.96
−10∼<−6	0.41	0.26–0.64	0.98	0.66–1.47
<−10	0.60	0.33–1.10	1.17	0.64–2.16
p for trend	<0.001		<0.001	
Hyperglycemia	(N= 17,517)		(N= 14,966)	
+ 10< kg	3.02	1.99–4.60	1.83	1.04–3.21
+6<∼+10	1.87	1.45–2.40	1.10	0.76–1.60
+2<∼+6	1.54	1.32–1.80	1.03	0.84–1.27
−2<∼<+2	1.00	Reference	1.00	Reference
−6∼<−2	0.80	0.64–1.00	0.67	0.51–0.89
−10∼<−6	0.59	0.35–0.98	0.54	0.29–0.99
<−10	0.33	0.12–0.90	0.35	0.11–1.11
p for trend	<0.001		<0.001	
Liver damage	(N= 17,334)		(N= 15,545)	
+ 10< kg	5.16	3.79–7.04	3.54	1.90–6.60
+6<∼+10	3.81	3.18–4.56	2.37	1.57–3.59
+2<∼+6	2.21	1.95–2.51	1.76	1.35–2.30
−2<∼<+2	1.00	Reference	1.00	Reference
−6∼<−2	0.56	0.45–0.70	0.72	0.48–1.09
−10∼<−6	0.18	0.09–0.37	0.88	0.42–1.82
<−10	0.13	0.04–0.41	0.71	0.22–2.26
p for trend	<0.001		<0.001	

*Adjusted for age and BMI at baseline.

hypertension, hyperglycemia, and liver damage increased significantly during the COVID-19 pandemic in both sexes. Increased weight gain, related to decrease physical activity during the COVID-19 pandemic, was significantly associated with increased incidence of health problems. These results are in line with our previous findings from an online survey.[5] The COVID-19 pandemic has a substantial negative impact on workers' health even without the COVID-19 infection. Lifestyle interventions should be promptly started particularly targeting workers with gained weight to avoid more serious consequences.

The 1-year incidence of overweight, hypertension, hyperglycemia, and liver damage increased by 15% to 65% during the COVID-19 pandemic. The increased incidence of health problems was significantly associated with greater weight gain. These results indicate that the COVID-19 pandemic has already started to pose a hazardous risk to workers' health in relation to lifestyle change and weight gain. Contrary to our expectation, the incidence of hypercholesterolemia decreased during the COVID-19 pandemic. Plasma LDL-C level is influenced by dietary intake of fatty acids and cholesterol.[12,14] Frequent eating out can cause excessive dietary fat intake.[15,16] Most Japanese people refrain from eating out and drinking parties during the COVID-19 pandemic by the request from the Japanese Government. The decreased incidence of hypercholesterolemia may be caused by change in people's eating-out behavior during the COVID-19 pandemic.

A number of studies have revealed that physical activity decreased and sedentary behavior increased among all age groups during the COVID-19 lockdown.[6,7,17] The results of this study revealed that many workers became physically inactive and gained weight even though a lockdown has never been imposed in Japan. Many companies introduced remote working with the COVID-19 pandemic as a trigger.[3,4] The rapid shift toward remote work increases sedentary time.[18–21] Since remote work and virtual meetings will persist after the COVID-19 pandemic, weight management programs become more important than ever.

In the analysis of the effect of weight change on incidence of health problems (Table 4), greater weight gain had greater odds ratios for the incidence of hypertension, hyperlipidemia, hyperglycemia, and liver damage. The odds ratios greater than 1 were observed in those who had gained more than 2 kg. Our previous cohort study of male Japanese workers revealed that the risk of development of cardiovascular risk factors increased by 57%, 78%, and 124% for those who gained 2 kg, 3 kg, and 4 kg per year, respectively.[22] Weight gain of 2 kg seems to be a reasonable

TABLE 5. Effect of Lifestyle Habit Changes on Weight Gain in the Peri-Pandemic Cohort

	Male		Female	
	Odds Ratio*	95% CI	Odds Ratio*	95% CI
Snacking				
Develop	1.16	1.05–1.29	1.10	0.93–1.30
Quit	0.87	0.79–0.96	0.74	0.64–0.85
Continue	1.09	1.02–1.17	1.11	0.99–1.24
Heavy drinking				
Develop	1.22	1.06–1.41	1.12	0.85–1.47
Quit	0.84	0.73–0.96	1.04	0.76–1.42
Continue	0.96	0.87–1.06	1.21	0.94–1.54
Physical inactivity				
Develop	1.31	1.20–1.42	1.33	1.21–1.45
Quit	0.86	0.78–0.94	0.89	0.81–0.98
Continue	1.08	1.02–1.14	1.04	0.97–1.11
Sleep deprivation				
Develop	0.97	0.87–1.08	1.06	0.95–1.19
Quit	1.14	1.05–1.23	1.11	1.02–1.21
Continue	1.06	0.99–1.13	1.03	0.97–1.11

*Adjusted for age and BMI at baseline.

criterion for identifying people at increased risk of health problems. In the Standard Health Examination Program by the Japanese Government,[10] high-risk people are encouraged to reduce at least 2 kg in weight and 2 cm in waist circumference.

Male workers had greater weight gain than female workers. Besides physical inactivity, increases in snacking and heavy drinking were significantly associated with weight gain in male workers. According to these results, health professionals should give priority consideration to multifactorial lifestyle interventions targeting male workers. People have become more interested in managing their own health since they had to live daily under threat of COVID-19 infection.[5] Now is the best time to appeal them to improve their lifestyle.

The shift toward remote work can have both positive and negative impacts on workers' well-being.[19,20,23] Many workers may feel less stressful, more efficient, and have better quality of work during when working from home.[20] On the other hand, physical inactivity, weight gain, musculoskeletal pain, eye symptoms, and mental health problems may increase associated with remote working[19,20,21,23]. Major health issues are less likely to be the same in the remote work era. Moreover, it will be difficult to deliver onsite (face-to-face) interventions just like before. A variety of web-based lifestyle intervention programs have been proposed and applied to employees.[24–28] Further studies are needed to establish health promotion programs suitable for both in-office and remote workers.

This study provides evidence for the impact of COVID-19 pandemic on workers' health. Decreased physical activity and increased weight gain during the COVID-19 pandemic are important issues in most countries including Japan.[6,,17] The results of this study can provide valuable information for planning health promotion programs in the COVID-19 era. On the contrary, it has potential limitations. First, the study participants were selected from those who underwent the annual health examinations at the Tokyo Health Service Association. Moreover, those who did not undergo the annual health examinations at the interval of 12 ± 2 months were excluded from the study. The majority of participants were office workers in the Tokyo area who seem not representative of the entire Japanese working population. The selection bias may have some influence on the results. Second, lifestyle information was self-administered, so that the accuracy of responses would depend on participants' understanding of the questions and their motivation to answer questions accurately. Although the questionnaire used in the annual health examination was prescribed by the Japanese Government, it is impossible to eliminate the information bias completely.

Third, the influence of changes in work style (in-office, blended, and remote work) during the COVID-19 pandemic was not examined in this study, because information on work style was not collected in the annual health examinations. Further studies are needed to determine the impact of work style on workers' health.

CONCLUSION

The 1-year incidence of five health problems (overweight, hypertension, hypercholesterolemia, hyperglycemia, and liver damage) and four unhealthy habits (snacking, heavy drinking, physical inactivity, and sleep deprivation) were examined using the health examination data (April 2018–March 2020) of Japanese workers aged 15 to 64 years. The one-year incidence of overweight, hypertension, hyperglycemia, and liver damage increased by 15% to 65% during the COVID-19 pandemic. Increased weight gain, related to decrease physical activity during the COVID-19 pandemic, was significantly associated with increased incidence of health problems. Lifestyle interventions should be promptly started particularly targeting workers with gained weight to avoid more serious consequences. Further studies are needed to establish health promotion programs suitable for both in-office and remote workers.

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