

ORIGINAL ARTICLE

Pain, unhealthy days and poor perceived health among Japanese workers

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Abstract

Objectives: The current research aimed to study the relationship between health-related quality of life (poor perceived health/unhealthy days) and workers' pain.

Methods: This cross-sectional study was conducted among 1360 Japanese workers of a Japanese company in Kyushu. Health-related quality of life was measured by HRQOL-4 tool developed by Centers for Disease Control and Prevention of the USA. Pain was assessed by numeric rating scale with 0-10 points. Regression analysis was conducted to identify the relationship between health-related quality of life and pain.

Results: Participants who reported pain had significantly greater odds of having poor health compared to those with no pain (AOR = 3.99, 95% CI = 3.82-4.18, $P < .0001$). In general, participants who had a higher frequency and intensity of pain had significantly greater odds of having poor health compared to those with no pain. Compared to those with no pain, participants with pain had an average of 2.85 (95% CI = 2.07-3.63, $P < .0001$), 2.25 (95% CI = 1.52-2.99, $P < .0001$), 4.41 (95% CI = 3.39-5, $P < .0001$), and 1.9 (95% CI = 1.30-2.50, $P < .0001$) more physically unhealthy days, mentally unhealthy days, total unhealthy days, and days with activity limitation, respectively. Headache causes many more unhealthy days and more poor health than any other pain, including back pain, shoulder/neck pain, and joint pain.

Conclusion: Poor health status and the number of unhealthy days among Japanese workers are strongly associated with the presence of pain and increases with the intensity and frequency of pain.

KEYWORDS

pain, perceived health, unhealthy days, workers' health

1 | BACKGROUND

Although the World Health Organization (WHO) defined health in 1948 as “a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity”, morbidity and mortality, which provide information about lowest levels of health, have long been used throughout

the world as measures of health outcome. These traditional measures reveal very little about other problems, including physical functions, cognitive functions, and perceptions about health, which are considered to be important health domains. Although morbidity may indicate the need for treatment, such data do not always correlate with the way people feel.¹ Therefore, those who measure health outcomes have

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begun moving toward assessing a population's health not only on the basis of saving lives, but also in terms of improving the health-related quality of life (HRQOL).

HRQOL can be measured by self-assessment of health status and questions about perceived physical and mental health. The self-assessment of health status has been shown to be a more powerful predictor of mortality and morbidity than many objective measures of health,² because people generally seek health care when they feel unhealthy.

Pain is widely accepted as one of the most important determinants of HRQOL.³ It has been reported that the total annual financial cost of pain to society, which combines the health-care cost estimates and the work productivity estimates, ranges from US\$560 to US\$635 billion⁴ in USA. Inoue et al⁵ reported in 2015 that only work productivity loss due to chronic pain totalled approximately ¥1953 billion (US\$19.9 billion) in Japan. While these costs are enormous and pain is a critical piece of clinical medicine, one of the greatest tolls exacted by pain is in the context of HRQOL. Pain is a common problem among workers⁶; it affects the ability to work, which can lead to the risk of unemployment and poverty. In particular, loss of labor productivity caused by working with pain has become a new issue.^{7,8} However, unless pain is attributed to an occupational accident, it is relatively unlikely to be managed in an occupational health setting in Japan.

The current research aimed to study the relationship between HRQOL (poor perceived health/unhealthy days) and workers' pain by HRQOL-4. This tool, which was developed by the Centers for Disease Control and Prevention (CDC) of the USA,⁹ has come into increasingly common use because it provides a simple yet valid measurement of a population's overall health and serves as an indicator to identify health trends among employees.⁹

2 | METHODS

2.1 | Subjects

This cross-sectional study was conducted among 1360 Japanese workers of a Japanese company located in Kyushu. Participants were asked to fill out a self-administered questionnaire. All participants gave their informed consent for participating in the study. Data were collected during November and December, 2018. The study was approved by the ethics committee of the University of Occupational and Environmental Health, Japan.

2.2 | Pain

Participants were asked about the presence of pain, the intensity of the bodily (physical) pain they experienced on average, and the intensity of the pain they had experienced due to their most disturbing single pain during the 4 weeks prior

to the study day. In terms of the localization of pain, participants were asked whether they had experienced headache, stiff neck, backache, or joint pain during the prior month and, if such pain had been experienced, whether it had occurred once to three times in the month, 4-10 times a month, 11-20 times a month, and more than 20 times a month. Pain was scored on a numeric rating scale (NRS) that yields a unidimensional measure of pain intensity in adults.¹⁰ Although various iterations exist, the most commonly used is the 11-item NRS,¹¹ which has shown high reliability and validity.¹² The NRS asks respondents to indicate the numeric value on the segmented scale that best describes their pain intensity, where 0 represents "no pain" and 10 represents the "worst pain imaginable."¹⁰ A score of 0 was recorded as no pain, a score of 1 to 3.9 as mild pain, a score of 4 to 6.9 as moderate pain, and a score of 7 to 10 as severe pain.¹⁰

2.3 | Unhealthy days

The CDC HRQOL-4 obtains a self-rated health status by asking about the following four domains⁹: (a) self-rated health; (b) the number of physically unhealthy days in the past 30 days; (c) the number of mentally unhealthy days in the past 30 days; and (d) the number of days with activity limitation in past 30 days. We used these four measurements as an outcome measure. Self-rated health was recorded as excellent, very good, good, fair, and poor.⁹ We collapsed this into two levels, good (excellent, very good, good) and poor (fair, poor), for ease of statistical analysis, which is in line with similar studies in the literature¹³ and the Institute of Medicine (IOM) of the USA recommendation that a population's self-reported health should be assessed as a percentage of adults reporting fair or poor health.¹⁴ Total unhealthy days were computed by summing the number of days that each respondent reported being physically and/or mentally unhealthy, for a maximum of 30 days per person.⁹ The CDC HRQOL-4 tool was translated into Japanese by an experienced epidemiologist and a public health specialist.

2.4 | Statistical methods

Descriptive statistics, including the mean and standard deviation (SD) of the responses on the HRQOL-4, were calculated in relation to pain status. We conducted logistic regression to identify the relationship between self-rated health and each variable on pain status (presence of pain, intensity of most disturbing pain, average intensity of pain, and pain localization); and multivariate multiple linear regression analysis to determine the relationship between HRQOL-4 measurements and each variable on pain status. Adjusted odds ratios were calculated. We checked several models with each variable on pain status one by one and different combination of other covariates (eg, sex and work

type or; age, sex, and work type or age and work type) and their interaction with pain status. The best-fit model was selected based on the lowest Akaike information criterion. The model with combination of age, sex, and work type covariates had the lowest Akaike information criterion; thus, both logistic and regression models were adjusted for age, sex, and work type. Significance was set at the 5% level ($P < .05$). SAS Version 9.4 (SAS Institute, Inc) was used to analyze the data.

3 | RESULTS

A total of 1360 Japanese workers participated in this study. The mean age of the participants was 43.7(12.8); 58% were men and 42% were women. White-, pink- and blue-collar workers represented 54%, 26%, and 20% of all participants, respectively.

Table 1 shows the descriptive statistics for reported unhealthy days in relation to the current pain status. Among the workers who reported poor health, 85.5% had pain while

14.5% did not. Of the total cases of pain, 25.5% were attributed to headache, 30.1% to neck/shoulder pain, 27.5% to backache, and 17% to joint pain (Table 1).

Workers with pain reported a greater number of total unhealthy days (7.4; SD = 9.3) compared to those who were free of pain (3.0; SD = 5.9). The average number of days with activity limitation was 2.7 days among those who had pain, while it was 0.8 days for workers with no pain. With regard to the average pain intensity, participants who had no pain reported 2.6 unhealthy days while those with mild, moderate, and severe pain had averages of 4.4, 8.1, and 11 unhealthy days, respectively. The average number of days with activity limitation was 0.7 days among those who had no pain, compared to 1.7, 3.2, and 6.9 days for workers with mild, moderate and severe pain, respectively. For pain localization, workers reported experiencing headache, neck/shoulder pain, backache, and joint pain for an average of 7.8, 6.9, 7.3, and 8.9 days, respectively (Table 1).

Table 2 shows the relationship between self-rated health and pain status. In the adjusted models, participants who reported pain had significantly greater odds of having poor

TABLE 1 Descriptive statistics of self-rated health and unhealthy days by pain status

Pain status	Poor health		Unhealthy days						Activity limitation	
			Physical		Mental		Total		Mean	SD
	#	%	Mean	SD	Mean	SD	Mean	SD		
Presence of pain										
No	64	14.5	1.7	4.0	1.4	4.3	3.0	5.9	0.8	2.7
Yes	377	85.5	4.5	7.2	3.7	6.8	7.4	9.3	2.7	5.8
Total	441	100	NA							
Average pain intensity										
No pain	30	7.4	1.5	3.3	1.1	4.1	2.6	5.5	0.7	2.4
Mild	187	46.3	3.2	5.9	2.5	5.1	5.3	7.7	1.7	4.2
Moderate	132	32.7	5.6	7.9	5.1	7.8	9.6	10.1	3.2	6.2
Severe	55	13.6	9.6	10.4	7.5	9.4	14.1	11.5	6.9	9.5
Total	404	100	NA							
Pain intensity (Most disturbing pain)										
No pain	27	6.7	1.4	3.3	1.2	4.3	2.6	5.6	0.7	2.4
Mild	116	28.9	2.7	5.4	2.0	4.7	4.4	7	1.4	3.7
Moderate	141	35.1	4.7	6.9	4.3	7.2	8.1	9.4	2.7	5.5
Severe	118	29.4	7.4	9.1	5.3	7.8	11.0	10.5	4.5	7.6
Total	402	100	NA							
Pain localization										
Headache	309	25.5	4.6	7	4.1	7	7.8	9.4	2.8	5.8
Neck/Shoulder	365	30.1	4.1	6.8	3.6	6.7	6.9	9.1	2.4	5.5
Backache	333	27.5	4.3	7	3.8	6.8	7.3	9.2	2.6	5.6
Joint pain	206	17	5.4	7.9	4.7	7.3	8.9	10	3.4	6.5
Total	1213	100	NA							

TABLE 2 Relation between self-rated health and pain status

Pain status	AOR	95% CI	P value
Presence of pain (Ref = No pain)			
Yes	3.99	3.82-4.18	<.0001
Pain intensity (Most disturbing pain) (Ref = No pain)			
Mild	2.54	2.36-2.72	<.0001
Moderate	5.22	4.86-5.61	<.0001
Severe	7.79	7.23-8.40	<.0001
Average pain intensity (Ref = No pain)			
Mild	3.15	2.95-3.36	<.0001
Moderate	6.13	5.71-6.57	<.0001
Severe	15.33	13.95-16.85	<.0001
Pain localization (Ref = No pain)			
Headache			
1-3 times a month	1.67	1.60-1.74	<.0001
4-10 times a month	4.44	4.20-4.70	<.0001
11-20 times a month	7.28	6.70-7.92	<.0001
More than 20 times a month	7.86	7.05-8.76	<.0001
Neck/Shoulder			
1-3 times a month	1.27	1.20-1.34	<.0001
4-10 times a month	2.20	2.08-2.33	<.0001
11-20 times a month	2.70	2.54-2.89	<.0001
More than 20 times a month	4.12	3.92-4.33	<.0001
Backache			
1-3 times a month	1.59	1.51-1.67	<.0001
4-10 times a month	2.55	2.42-2.69	<.0001
11-20 times a month	2.51	2.35-2.69	<.0001
More than 20 times a month	3.86	3.66-4.08	<.0001
Joint pain			
1-3 times a month	1.67	1.59-1.75	<.0001
4-10 times a month	3.58	3.35-3.84	<.0001
11-20 times a month	3.45	3.17-3.75	<.0001
More than 20 times a month	3.34	3.13-3.55	<.0001

Note: Probability modelled is Self-rated health = 'Poor'.

Abbreviation: AOR, adjusted odds ratio.

health compared to those with no pain (AOR = 3.99, 95% CI = 3.82-4.18, $P < .0001$).

For average pain intensity, compared to those with no pain, significantly greater poor health was reported by participants with mild pain (AOR = 3.15, 95% CI = 2.95-3.36, $P < .0001$),

moderate pain (AOR = 6.13, 95% CI = 5.71-6.57, $P < .0001$), and severe pain (AOR = 15.33, 95% CI = 13.95-16.85, $P < .0001$) (Table 2).

In general, participants who had a higher frequency of pain, including headache, neck/shoulder pain, backache, and joint pain, had significantly greater odds of having poor health compared to those with no pain. For example, compared to those who had no headache, participants who had headache 1-3 times a month (AOR = 1.67, 95% CI = 1.60-1.74, $P < .0001$), 4-10 times a month (AOR = 4.44, 95% CI = 4.20-4.70, $P < .0001$), 11-20 times a month (AOR = 7.28, 95% CI = 6.70-7.92, $P < .0001$), and more than 20 times a month (AOR = 7.86, 95% CI = 7.05-8.76, $P < .0001$) had significantly higher odds of having poor health. The same trend was also observed for neck/shoulder pain, backache, and joint pain (Table 2).

Table 3 shows the number of unhealthy days in relation to pain status. Compared to those with no pain, participants with pain had an average of 2.85 (95% CI = 2.07-3.63, $P < .0001$), 2.25 (95% CI = 1.52-2.99, $P < .0001$), 4.41 (95% CI = 3.39-5., $P < .0001$), and 1.9 (95% CI = 1.30-2.50, $P < .0001$) more physically unhealthy days, mentally unhealthy days, total unhealthy days, and days with activity limitation, respectively (Table 3).

With respect to average pain intensity, compared to those with no pain, participants with mild, moderate, and severe pain had an average of 2.29 (95% CI = 1.22-3.35, $P < .0001$), 6.61 (95% CI = 5.34-7.88, $P < .0001$), and 11.11 (95% CI = 9.16-13.07, $P < .0001$) more total unhealthy days, respectively (Table 3). There were also consistent increasing trends in the number of physically and mentally unhealthy days and days with activity limitation in relation to increased pain intensity (Table 3).

In general, compared to those with no pain, participants with more frequent pain had more unhealthy days and days with activity limitation. For example, compared to those with no headache, participants who had headaches 1-3 times a month averaged 1.87 more total unhealthy days and those who had headaches for more than 20 days a month averaged 9.88 more unhealthy days. The numbers of unhealthy days and days with activity limitation caused by headache were greater than those caused by neck and shoulder pain, back pain, or joint pain (Table 3).

4 | DISCUSSION

The current study provides compelling evidence that the presence of pain strongly contributed to a lower quality of life. To measure the quality of life of Japanese workers, we first time used the CDC's HRQOL-4 tool in Japan, which surveys the self-reported health status (percentage of those reporting fair or poor health), the number of physically

TABLE 3 Relation between unhealthy days and pain

Pain status	Physically unhealthy days			Mentally unhealthy days			Total unhealthy days			Activity limitation		
	PE	95%CI	P	PE	95%CI	P	PE	95%CI	P	PE	95%CI	P
Presence of pain												
Yes	2.85	2.07-3.63	<.0001	2.25	1.52-2.99	<.0001	4.41	3.39-5.42	<.0001	1.9	1.3-2.50	<.0001
Pain intensity (Most disturbing pain)												
Mild	0.99	0.10-1.89	.030	0.40	-0.46-1.26	.361	1.28	0.12-2.44	.031	0.43	-0.27-1.14	.225
Moderate	2.87	1.91-3.82	<.0001	2.57	1.66-3.49	<.0001	4.83	3.60-6.07	<.0001	1.58	0.84-2.33	<.0001
Severe	5.91	4.85-6.97	<.0001	3.75	2.73-4.77	<.0001	8.21	6.84-9.58	<.0001	3.62	2.79-4.45	<.0001
Average pain intensity												
Mild	1.54	0.72-2.37	.0002	0.91	0.13-1.69	.023	2.29	1.22-3.35	<.0001	0.83	0.19-1.47	.011
Moderate	3.96	2.98-4.94	<.0001	3.52	2.59-4.45	<.0001	6.61	5.34-7.88	<.0001	2.19	1.43-2.95	<.0001
Severe	8.03	6.50-9.57	<.0001	6.01	4.54-7.47	<.0001	11.11	9.16-13.07	<.0001	6.16	4.96-7.35	<.0001
Headache												
1-3 times a month	0.94	0.15-1.74	.021	0.96	0.22-1.69	.011	1.87	0.86-2.89	.000	0.42	-0.18-1.02	.171
4-10 times a month	2.67	1.51-3.83	<.0001	3.17	2.11-4.24	<.0001	5.42	3.94-6.89	<.0001	2.23	1.36-3.11	<.0001
11-20 times a month	5.47	3.83-7.11	<.0001	7.14	5.64-8.65	<.0001	10.58	8.49-12.67	<.0001	5.84	4.61-7.06	<.0001
More than 20 times a month	6.32	4.22-8.42	<.0001	6.95	5.00-8.90	<.0001	9.88	7.21-12.55	<.0001	5.80	4.20-7.40	<.0001
Neck/Shoulder												
1-3 times a month	-0.11	-1.11-0.90	.838	0.37	-0.56-1.31	.433	0.37	-0.93-1.67	.574	0.18	-0.60-0.95	.656
4-10 times a month	0.86	-0.28-2.01	.138	1.24	0.17-2.31	.023	1.82	0.34-3.30	.016	0.54	-0.34-1.42	.232
11-20 times a month	1.95	0.63-3.27	.004	2.63	1.39-3.86	<.0001	3.95	2.24-5.65	<.0001	1.22	0.20-2.24	.019
More than 20 times a month	3.03	2.05-4.00	<.0001	3.32	2.40-4.23	<.0001	5.38	4.12-6.64	<.0001	2.46	1.71-3.22	<.0001
Backache												
1-3 times a month	0.72	-0.20-1.64	.1244	0.35	-0.51-1.21	.423	1.14	-0.05-2.32	.060	0.35	-0.36-1.06	.339
4-10 times a month	1.83	0.73-2.93	.0011	2.23	1.21-3.26	<.0001	3.49	2.08-4.91	<.0001	1.14	0.28-1.99	.009
11-20 times a month	1.89	0.49-3.30	.0083	1.62	0.32-2.92	.015	3.77	1.96-5.57	<.0001	0.88	-0.20-1.96	.112
More than 20 times a month	3.46	2.37-4.54	<.0001	4.05	3.04-5.06	<.0001	6.54	5.14-7.93	<.0001	2.27	1.43-3.11	<.0001

(Continues)

TABLE 3 (Continued)

Pain status	Physically unhealthy days			Mentally unhealthy days			Total unhealthy days			Activity limitation		
	PE	95%CI	P	PE	95%CI	P	PE	95%CI	P	PE	95%CI	P
Joint pain												
1-3 times a month	0.72	-0.28-1.73	.157	0.64	-0.31-1.60	.187	1.38	0.07-2.69	.039	0.36	-0.41-1.13	.362
4-10 times a month	0.79	-0.65-2.22	.283	2.13	0.77-3.49	.002	2.97	1.09-4.84	.002	0.91	-0.19-2.02	.104
11-20 times a month	3.93	2.21-5.65	<.0001	3.80	2.13-5.46	<.0001	7.45	5.21-9.70	<.0001	1.56	0.21-2.91	.024
More than 20 times a month	5.92	4.58-7.27	<.0001	4.08	2.79-5.36	<.0001	7.22	5.48-8.97	<.0001	4.99	3.95-6.03	<.0001

Note: Reference category is "No pain."

Abbreviation: PE, parameter estimates; P, P value.

and mentally unhealthy days and the number of days with limitation of daily activities in the prior 30 days. We found that the chance of having poor health and the number of unhealthy days increased with the intensity and frequency of pain. For example, compared to workers with no pain, those with moderate pain had 2.87 and 2.57 more physically and mentally unhealthy days, respectively, while those with severe pain had 5.91 and 3.75 more physically and mentally unhealthy days, respectively. This reflects that bodily pain does not affect only physical health; it also greatly influences mental health. Our finding is consistent with those of other studies, such as those showing that individuals with neuropathic pain displayed more symptoms of anxiety and depression and experienced greater interference with sleep than those without pain,^{5,15} and a WHO study showing that individuals who live with persistent pain are four times more likely than those without pain to suffer from depression or anxiety, and more than twice as likely to have difficulty working.¹⁶

Workers with higher pain intensity reported more days during which they experienced limitations in their daily activities. Many studies have revealed that lower back pain and joint pain limit daily activities to a certain level,^{17,18} but relatively few studies have supported the relationship between headache and limitations in daily activity. Our study showed that headache causes greater daily activity limitation than the other studied pains, and that this limitation increases with pain frequency.

We studied the number of unhealthy days in relation to pain in the four main localizations found to be the most prevalent among Japanese workers^{6,19}: headache, neck/shoulder pain, backache, and joint pain. We again found that workers felt unhealthier and reported much poorer health due to headache compared to pain in other locations. For example, compared with those with no pain, those who reported headaches for more than 20 days a month had 9.88 more unhealthy days, while workers with neck/shoulder pain had 5.37 more days, those with backache had 6.54 more days, and those with joint pain had 7.22 more days. Although recent studies support the idea that migraines and strong headache cause daily productivity loss and a high annual cost per person, this was not found to be on the same level as backache.²⁰ Occupational back pain is common among workers in Japan as well as those in other countries.²¹ However, we found that headache is more contributed to number of unhealthy days. These headache-related findings are supported by the discovery done by Duke University scientists, which showed that sensory neurons serving the head and face are wired directly into brain's principal emotional signaling hubs while sensory neurons in other part of body indirectly connected to this hub. It makes head and face pain to be more disruptive and more emotionally draining than pains in other part of body.²²

Although we estimated the number of unhealthy days and the chance of having poor health due to a single pain (headache, neck/shoulder pain, backache, joint pain), the majority of studied workers reported combinations of more than one pain. Thus, the present work is likely to have underestimated the number of unhealthy days during the prior 30 days.

Many other environmental (eg, weather changes, second hand tobacco smoke), personal factors (eg, stress, family conflict), and job stressors (eg, work harassment, job insecurity, and organizational burnouts) beyond pain can influence the number of unhealthy days experienced by workers. There are many job stressors which significantly affect the workers' poor health either by themselves or synergizing the effect of pain. For example, Goh J et al²³ found out that work-family conflict increases the odds of self-reported poor physical health by about 90%, and low organizational justice increases the odds of having a physician-diagnosed condition by about 50%. Khubchandi et al²⁴ reported that compared to those without job insecurity, workers who are job insecure had much higher possibility of having serious mental illness and were more likely to report pain conditions (eg, headaches, neck pain, and low back pain). Yang et al²⁵ also studied that exposure to hostile work, job insecurity, and long working hours are strongly associated with low back pain among American workers. In the current study, we were not able to control any job-related factors except work type. Therefore, we carefully interpreted the study result that pain has significant influence/or greatly contribute on/to number of unhealthy days among workers, as our study clearly shows that the number of unhealthy days increases with the presence, frequency, and intensity of pain. In the next step, we plan comprehensive factor analysis including physical (exercise, diet, physical comfort, hygiene, pain relief), intellectual (stimulation, engaging in activities), emotional (privacy, dignity, psychological security), and social (social support) factors on poor physical and mental health among Japanese workers.

The approach/method used in the current study could address the physical and mental health of large number of workers by incorporating social determinants of workers' health along with individual determinants. Continues monitoring of workers' HRQOL gives public health and occupational health agencies greater insights which they need to assess, protect, and promote workers' health. Even tracking workers' HRQOL over time also helps decision makers and employers to evaluate the workers' overall condition, health disparity among workers, and introduce any health promoting program at work.

The problem of pain has primarily been regarded as a medical problem, and thus is more often studied in the clinical setting. As such, it has not been thoroughly addressed by the fields of public health²⁶ and occupational health. Pain is a multivalent, dynamic, and ambiguous phenomenon; it is notoriously difficult to quantify, and caution is warranted in

issuing broad assessments regarding the epidemiology of pain across the globe.²⁶ Even given these limitations, however, we believe that a simple method of evaluating the impact of pain on quality of life (such as used herein) can provide important information regarding workers with pain and emphasize the need to treat them. Occupational physicians could focus more on workers who often complain of pain; such workers might need to be referred to a next-level health-care facility for a detailed investigation of the causes of their pain or investigated for any other job stressors which could cause pain, and/or pain-reducing and -preventing strategies may need to be implemented to help maintain the working ability of workers.

As mentioned earlier, pain is typically not taken into account in the occupational health and management settings of Japan unless it is attributable to an occupational accident. Many occupational physicians in Japan find that the majority of workers with pain tend not to seek medical treatment and thus remain untreated.²⁷

Our present data and the previous findings suggest that lack of management for workers' pain will decrease both the workers' quality of life and the company's productivity.

The loss of labor productivity includes both absenteeism and presenteeism caused by unhealthy working days. Some studies have found that the latter is associated with a much greater impact on labor productivity.²⁸ Nakata et al²⁹ reported that workers with substantially lower HRQOL had a higher rate of presenteeism than those with a better HRQOL. Other studies have shown that work impairment due to musculoskeletal pain is more highly impacted by presenteeism than absenteeism.^{30,31} In particular, Japanese workers tend not to take sick leave³² due to cultural characteristics and surrounding concerns about absence from work. Thus presenteeism is a more compelling problem than absenteeism among Japanese workers.³³ Previous studies showed that among workers with musculoskeletal pain, higher presenteeism was seen among workers in Japan compared to other countries.³² Thus, the presence of pain-afflicted workers in the workplace needs to be considered, as their job productivity may be considerably reduced. Thus, presenteeism caused by unhealthy days due to pain would be examined among workers in future work.

In clinical practice, an ideal therapeutic strategy seeks to not only suppress pain but also to maintain the patient's social participation and ability to work and engage in daily activities. The maintenance of working ability is believed to have positive effects on a patient's self-awareness of physical function and their self-efficacy.³⁴ This is engaged by (for example) the Treat to Target treatment strategy, in which the clinician treats the patient aggressively enough to reach and maintain explicitly specified and sequentially measured goals, such as remission or low disease activity.³⁵ Therefore, occupational physicians can make tremendous contributions to managing the pain of workers.

Our observation that there is a strong association between pain and lower quality of life is not a new discovery. There have been numerous efforts to investigate the influence of pain on quality of life, using different measurement tools in different populations and patient groups.^{5,13} The present study is the first to use the CDC HRQOL-4 to assess HRQOL in relation to the presence of pain and its frequency, intensity, and localization among Japanese workers. Various tools have been used to measure HRQOL, including SF (short form health survey)-36, SF-12, EQ-5D, and WHOQOL, each of which has advantages and disadvantages. CDC HRQOL-4 can be used as a proxy to preliminarily estimate EQ-5D scores with acceptable validity,³⁶ and it measures domains similar to those assessed by SF-36.³⁷ CDC HRQOL-4 takes about 1 minute to administer and may even be completed via telephone. The scoring is very direct, as its expressed by the absolute number of unhealthy days; in contrast, most of the other tools use summary scores and/or subscale scores based on psychometrically derived or preference-based weighting,⁹ making their interpretation less straightforward. Therefore, we believe that our use of CDC HRQOL-4 is a strength of the current study, and that this tool can be further used to track workers' healthy days. That said, the healthy-days measurement is self-assessed relative to the prior 30 days, and thus might suffer from some level of recall bias. We used Japanese version of CDC HRQOL-4 tool without checking its validity by taking into account of wide acceptance of its construct and criterion validity in many international researches.³⁸⁻⁴⁰ However, we accept that this might be one of the limitations in the current study.

5 | CONCLUSION

Poor health status and the number of unhealthy days among Japanese workers are strongly contributed by the presence of pain and increases with the intensity and frequency of pain. Headache causes more unhealthy days and more poor health than any other pain, including back pain, shoulder/neck pain, and joint pain. The greater number of physically unhealthy days, mentally unhealthy days, and activity limitation days among workers is a concern for occupational and population health, as these findings might indicate an increased risk of for occupational hazards, improper working conditions and/or lifestyle imbalances that may have serious consequences for workers' overall health and lost work productivity. Therefore, further studies are needed to comprehensively address possible pain management along with job stressors for workers in Japan, especially within the workplace.

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DISCLOSURE

Approval of the research protocol: The study was approved by the ethics committee of the University of Occupational and Environmental Health, Japan on 5 April 2018. *Informed consent:* All participants gave their informed consent for participating in the study. *Registry and the registration no. of the study/trial:* N/A. *Animal studies:* N/A. *Conflict of interest:* Authors declare that they have no conflict of interest.

AUTHOR CONTRIBUTIONS

OC analyzed the data and wrote the manuscript; YM took responsibility of data cleaning and data entering; YF collected data and reviewed analysis and manuscript.

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REFERENCES

- Gill TM, Feinstein AR. A critical appraisal of the quality of quality-of-life measurements. *JAMA*. 1994;272:619-626.
- Idler EL, Benyamini Y. Self-rated health and mortality: a review of twenty-seven community studies. *J Health Soc Behav*. 1997;38:21-37.
- Rummans TA, Frost M, Suman VJ, et al. Quality of life and pain in patients with recurrent breast and gynecologic cancer. *Psychosomatics*. 1998;39:437-445.
- Gaskin DJ, Richard P. The economic costs of pain in the United States. In: Institute of the medicine of the national academies. *Relieving Pain in America: A Blueprint for Transforming Prevention, Care, Education, and Research*. Washington DC: National Academies Press (US); 1994:302-338.
- Inoue S, Taguchi T, Yamashita T, Nakamura M, Ushida T. The prevalence and impact of chronic neuropathic pain on daily and social life: a nationwide study in a Japanese population. *Eur J Pain*. 2017;21:727-737.
- Ministry of Health, Labour and Welfare of Japan. Basic national life survey. Result of 2016. <https://www.mhlw.go.jp/toukei/saikin/hw/k-tyosa/k-tyosa16/index.html>. Accessed July 23, 2019.
- Inoue S, Kobayashi F, Nishihara M, et al. Chronic pain in the Japanese community—prevalence, characteristics and impact on quality of life. *PLoS ONE*. 2015;10(6):e0129262.
- Stewart WF, Ricci JA, Chee E, Morganstein D, Lipton R. Lost productive time and cost due to common pain conditions in the US workforce. *JAMA*. 2003;290:2443-2454.
- Centers for Disease Control and Prevention (CDC). Measuring Healthy Days. <http://www.cdc.gov/hrqol>. Accessed June 22, 2019.
- Childs JD, Piva SR, Fritz JM. Responsiveness of the numeric pain rating scale in patients with low back pain. *Spine*. 2005;30:1331-1334.
- Farrar JT, Young JP, LaMoreaux L, Werth JL, Poole RM. Clinical importance of changes in chronic pain intensity measured on

- an 11-point numerical pain rating scale. *Pain*. 2001;94:149-158.
12. Thong SK, Jensen MP, Miró J, Tan G. The validity of pain intensity measures: what do the NRS, VAS, VRS, and FPS-R measure? *Scand J Pain*. 2018;18(1):99-107.
 13. Cavlak U, Yagci N, Aslan UB, Ekici G. A new tool measuring health-related quality of life (HRQOL): The effects of musculoskeletal pain in a group of older Turkish people. *Arch Gerontol Geriatr*. 2009;49:298-303.
 14. Institute of Medicine. *State of the USA Health Indicators: Letter Report*. Washington DC: The National Academies Press; 2009.
 15. Attal N, Cruccu G, Baron R, et al. European Federation of Neurological Societies. EFNS guidelines on the pharmacological treatment of neuropathic pain: 2010 revision. *Eur J Neurol*. 2010;2010(17):1113-1188.
 16. Gureje O, Von Korff M, Simon GE, et al. Persistent pain and well-being: A World Health Organization study in primary care. *JAMA*. 1998;280:147-151.
 17. Ahlstrand I, Björk M, Thyberg I, Börsbo B, Falkmer T. Pain and daily activities in rheumatoid arthritis. *Disabil Rehabil*. 2012;34(15):1245-1253.
 18. Kose G, Tastan S, Temiz NC, Sari M, Izci Y. The effect of low back pain on daily activities and sleep quality in patients with lumbar disc herniation: a pilot study. *J Neurosci Nurs*. 2019;51(4):184-189.
 19. Takura T, Ushida T, Ts K, et al. The societal burden of chronic pain in Japan: an internet survey. *J Orthop Sci*. 2015;20:750.
 20. Allen D, Hines EW, Pazdernik V, Konecny LT, Breitenbach E. Four-year review of presenteeism data among employees of a large United States health care system: a retrospective prevalence study. *Hum Resour Health*. 2018;16(1):59.
 21. Volinn E, Nishikitani M, Volinn W, Yo N, Back YE. Pain claim rates in Japan and the United States: framing the puzzle. *Spine*. 2005;30(6):697-704.
 22. Rodriguez E, Sakurai K, Xu J, et al. A craniofacial-specific monosynaptic circuit enables heightened affective pain. *Nat Neurosci*. 2017;20:1734-1743.
 23. Goh J, Pfeffer J, Zenios SA, Rajpal S. Workplace stressors & health outcomes: health policy for the workplace. *Behav Sci Policy*. 2015;1(1):43-52.
 24. Khubchandani J, Price JH. Association of job insecurity with health risk factors and poorer health in American workers. *J Community Health*. 2017;42(2):242-251.
 25. Yang H, Haldeman S, Lu ML, Baker D. Low back pain prevalence and related workplace psychosocial risk factors: a study using data from the 2010 National Health Interview Survey. *J Manipulative Physiol Ther*. 2016;39(7):459-472.
 26. Goldberg D, McGee: Pain as a global public health priority. *BMC Public Health*. 2011;11:770.
 27. Pfizer Japan Inc LLC. Survey on long-lasting pain: 2012/2017 Comparison. Press release (In Japanese). <https://www.pfizer.co.jp/pfizer/company/press/2017/documents/2017082301.pdf>. Accessed August 1, 2019.
 28. Nagata T, Mori K, Ohtani M, et al. Total health-related costs due to absenteeism, presenteeism, and medical and pharmaceutical expenses in Japanese employers. *J Occup Environ Med*. 2018;60(5):273-280.
 29. Nakata K, Tsuji T, Vietri J, Jaffe D. Work impairment, osteoarthritis, and health-related quality of life among employees in Japan. *Health Qual Life Outcomes*. 2018;16:64.
 30. Kingsbury SR, Gross HJ, Isherwood G, Conaghan PG. Osteoarthritis in Europe: impact on health status, work productivity and use of pharmacotherapies in five European countries. *Rheumatology*. 2014;53:937-947.
 31. DiBonaventura M, Gupta S, McDonald M, Sadosky A, Pettitt D, Silverman S. Impact of self-rated osteoarthritis severity in an employed population: cross-sectional analysis of data from the national health and wellness survey. *Health Qual Life Outcomes*. 2012;10:30.
 32. Harris EC, Coggon D. Hip osteoarthritis and work. *Best Pract Res Clin Rheumatol*. 2015;29:462-482.
 33. Odgerel CH, Nagata T, Nagata M, Kajiki S, Mori K, Fujino Y. Potential worktime lost due to sickness absence and presence among Japanese workers. *J Occup Environ Med*. 2019;61(8):682-688.
 34. Feuerstein M, Shaw WS, Lincoln AE, Miller VI, Wood PM. Clinical and workplace factors associated with a return to modified duty in work-related upper extremity disorders. *Pain*. 2003;102(1):51-61.
 35. Solomon D, Bitton A, Katz J, Radner H, Brown E, Fraenkel L. Treat to target in rheumatoid arthritis: Fact, fiction or hypothesis? *Arthritis Rheumatol*. 2014;66(4):775-782.
 36. Jia H, Lubetkin E. Estimating EuroQol EQ-5D scores from population healthy days data. *Med Decis Making*. 2008;28(4):491-499.
 37. Barile J, Johnson WH, Krahn G, et al. Measurement characteristics for two health-related quality of life measures in older adults: The SF-36 and the CDC Healthy Days items. *Disabil Health J*. 2016;9(4):567-574.
 38. Ounpuu S, Kreuger P, Vermeulen M, Chambers L. Using the U.S Behavioral Risk Factor Surveillance System's health related quality of life survey tool in a Canadian city. *Can J Public Health*. 2000;91(1):67-72.
 39. Centers for Disease Control and Prevention. Health-related quality of life—Puerto Rico, 1996–2000. *MMWR Morb Mortal Wkly Rep*. 2002;51(8):166-168.
 40. Toet J, Raat H, Ameijden E. Validation of the Dutch version of the CDC core healthy days measures in a community sample. *Qual Life Res*. 2006;15:179-184.

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