

Pain and physical activity changes during the COVID-19 state of emergency among Japanese adults aged 40 years or older

A cross-sectional study

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Abstract

Understanding the relationship between pain and physical activity (PA) levels is beneficial for maintaining good health status. However, the impact of pain on changes in PA during the coronavirus disease 2019 (COVID-19) pandemic is unknown. The purpose of this study was to examine whether PA levels pre-, during, and post-COVID-19 state of emergency differ between Japanese adults who had pain after the COVID-19 state of emergency and those who did not.

Data were collected from a cross-sectional online survey conducted between October 19 and 28, 2020. The analytic sample consisted of 1967 Japanese adults aged ≥ 40 years who completed the online survey. Participants completed questionnaires on the presence of pain and duration of PA, defined as the total PA time per week based on activity frequency and time. Participants were asked to report their PA at 3 time points: October 2019 (before the COVID-19 pandemic), April 2020 (during the COVID-19 state of emergency), and October 2020 (after the COVID-19 state of emergency).

Among participants aged ≥ 60 years who reported pain in October 2020, the total PA time was significantly lower than participants who did not report having pain. Furthermore, the total PA time in April 2020 was significantly lower than that in October 2019; however, no significant difference in total PA time was observed between April and October 2020. Among participants aged 40 to 59 years, no significant differences were observed in total PA times at the 3 time points between those with and without pain. In addition, the total PA time in October 2020 significantly increased compared to that in April 2020, although it significantly decreased in April 2020 compared to October 2019.

This study suggests that older adults with pain have lower PA levels after the COVID-19 state of emergency.

Abbreviations: COVID-19 = coronavirus disease 2019, IPAQ = International Physical Activity Questionnaire, IQR = interquartile range, PA = physical activity.

Keywords: coronavirus disease 2019, older adults, pain, physical activity

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1. Introduction

Coronavirus disease 2019 (COVID-19) is associated with poor health status and increased mortality.^[1] The lockdown due to the COVID-19 pandemic has led to restrictions regarding physical activity (PA)^[2], which is associated with frailty^[3] and poor mental health.^[4] In Japan, a state of emergency due to COVID-19 was declared in 7 prefectures, including Tokyo, on April 7, 2020, and was extended to the entire country on April 16, 2020.^[5] On May 25, the state of emergency was lifted nationwide for the first time in about a month and a half. Although the declaration of the state of emergency is not legally binding, the prefectural governors of the target areas can request that residents refrain from going out as part of a collective effort to reduce infection, except when doing so is necessary for the maintenance of daily life. Among Japanese older adults aged ≥ 65 years, the total duration of PA per week during the COVID-19 state of emergency (April 2020) decreased by 65 minutes (−26.5%) when compared to January 2020.^[6]

Several studies have reported that lower PA levels due to the COVID-19 pandemic occur not only in older adults, but also in middle-aged adults.^[7] Reduced duration of PA in middle-aged adults has been identified as a risk factor for cardiovascular disease,^[8] metabolic syndrome,^[9] and neurodegenerative disorders.^[10] In addition, lower PA in this population is associated

with comorbidities and a declining quality of life.^[11] Thus, understanding the changes in PA levels due to the COVID-19 pandemic among older and middle-aged adults may play an important role in preventing several adverse health outcomes.

In the United States, the national cost related to pain is higher than the cost of the nation's priority health conditions, such as heart disease, cancer, and diabetes.^[12] In Japan, the number of older and middle-aged adults with pain is projected to increase markedly in the coming decades, and the national burden of pain is projected to increase in the next 50 years.^[13] Pain in older adults is associated with impaired physical and psychological health,^[14] frailty,^[15,16] and increased mortality.^[17] Furthermore, it has been reported that pain in middle-aged adults is associated with increased employment sick leave^[18,19] and a declining quality of life.^[18,20] These findings suggest that pain management among older and middle-aged adults is needed to maintain an overall good health status.

A systematic review suggested that older adults experiencing pain have significantly lower PA levels than those without pain.^[21] Furthermore, another systematic review indicated that staying active is more beneficial for pain relief than being bedridden for adults with acute lower back pain.^[22] Although a better understanding of the relationship between pain and PA levels may be beneficial for the maintenance of good health status, this is challenging with regard to the COVID-19 pandemic as the impact of pain on changes in PA during the pandemic is unknown. Therefore, the purpose of this study was to examine whether PA levels pre- (October 2019), during (April 2020), and post- (October 2020) COVID-19 state of emergency are different between Japanese adults aged ≥ 40 years who had pain after the COVID-19 state of emergency and those who did not. We examined these differences in each age group (40–49 years, 50–59 years, and ≥ 60 years), as the impact of the COVID-19 pandemic on pain and PA levels may depend on participants' age.

2. Methods

2.1. Study sample

Data for this study were collected from a cross-sectional online survey panel administered through the sampling of Y cloud systems among Japanese adults. The Y cloud system is a crowdsourcing service launched by Yahoo Japan Corporation, Inc. (Tokyo, Japan) in 2013. From October 19 to October 28, 2020, an online survey was completed by 3048 Japanese adults aged ≥ 40 years. Responders who reported a history of stroke, Parkinson disease, dementia, depression, and/or other neurological disorders known to influence reduced PA and cognitive impairment were excluded.^[23,24] In addition, based on a previous study,^[24] responders who reported more than 960 min/day or 0 min/day of total PA time and more than a tenfold change (increasing or decreasing) in total PA were also excluded. Finally, data from 1967 middle-aged and older Japanese adults were analyzed. This study was conducted in accordance with the guidelines proposed by the Declaration of Helsinki, and the study protocol was reviewed and approved by the Ethics Committee of the Faculty of Medicine, Kagoshima University (#200101).

2.2. Pain assessment

Using an online survey conducted in October 2020, participants were asked to answer “yes” or “no” to the following question:

“Do you currently have pain (except for headache and toothache)?” Participants who answered “yes” to this question were categorized as having pain. For those who reported having pain, we also investigated the pain sites (neck, shoulder, upper limb, lumbar, hip, knee, and below the knee area). To determine whether the pain was related to the COVID-19 state of emergency, participants were asked the following question: “Did you develop new pain due to the COVID-19 state of emergency?”

2.3. Assessment of physical activity

The abbreviated version of the International Physical Activity Questionnaire (IPAQ)^[25] which consists of three-dimensional activity items such as activity intensity level (light, moderate, and vigorous intensity), activity frequency per week, and activity time per day, was used to assess PA. Participants were asked to report their PA during 3 specific time periods: October 2019: before the COVID-19 pandemic, April 2020: during the first wave of the COVID-19 stage of emergency; and October 2020: after the COVID-19 state of emergency. Therefore, they were asked to recall answers regarding October 2019 and April 2020, as well as to report their current situation as of October 2020. Following the guidelines for data processing and analysis of the IPAQ, only values of 10 or more minutes of PA were included in the calculation of summary scores. Responses of less than 10 minutes (and their associated days) were re-coded to “zero”. Also, activity time variables of each level exceeding “3 hours” or “180 minutes” were truncated to be equal to “180 minutes” in a new variable. We defined the total PA time (min/week) as the added value for each activity level, which was then multiplied by activity frequency per week and activity time per day (minutes) at each activity level.^[6]

2.4. Statistical analysis

A Student *t* test and chi-squared test were used to examine differences in demographics including age, sex, and education, and the Mann–Whitney *U* test was used to examine differences in total PA time between the participants with and without pain in the 40 to 49, 50 to 59, and ≥ 60 years age groups. PA time was presented as a median with an interquartile range (IQR). The IPAQ guidelines state that PA is non-normally distributed in many populations and suggest reporting medians.^[26] Among the participants with pain in each age group, the Friedman test and Wilcoxon test with the Bonferroni adjustment were used to assess differences in total PA time at the aforementioned 3 points: October 2019, April 2020, and October 2020. Additionally, these tests were used to separately assess patients without pain in each age group. All analyses were performed using SPSS statistics for Windows (version 25.0; IBM Corp., Armonk, NY), and *P*-values $< .05$ were considered significant.

3. Results

Table 1 presents the demographics and pain assessment for each age group (40–49 years, 50–59 years, and ≥ 60 years). Overall, the mean age of the participants was 50.5 years, and 760 (38.6%) were women. Regarding pain assessment, 671 (34.1%) had pain, with lumbar pain (36.4%) exhibiting the highest incidence, followed by the shoulder (17.7%), and neck (14.9%) regions. Of the 1022 participants in the age group of 40 to 49 years, 351

Table 1**Demographics and pain assessment of the participants in each age group.**

	Overall (n=1967)	40 to 49 years (n=1022)	50 to 59 years (n=683)	60 years and older (n=262)
Age (yr)	50.5 (7.6)	44.8 (2.8)	53.7 (2.8)	65.0 (4.6)
Women, n (%)	760 (38.6)	454 (44.4)	237 (34.7)	69 (26.3)
Education, n (%)				
Master/doctorate degree	114 (5.8)	56 (5.5)	37 (5.4)	21 (8.0)
Bachelor's degree	998 (50.7)	521 (51.0)	332 (48.6)	145 (55.3)
Professional degree	299 (15.2)	174 (17.0)	100 (14.6)	25 (9.5)
High school graduate	473 (24.0)	229 (22.4)	178 (26.1)	66 (25.2)
Others	83 (4.2)	42 (4.1)	36 (5.3)	5 (1.9)
Pain (yes), n (%)	671 (34.1)	351 (34.3)	229 (33.5)	91 (34.7)
Pain sites, n (%)				
Neck	100 (14.9)	63 (17.9)	31 (13.5)	6 (6.6)
Shoulder	119 (17.7)	58 (16.5)	49 (21.4)	12 (13.2)
Upper limb	64 (9.5)	28 (8.0)	24 (10.5)	12 (13.2)
Lumbar	244 (36.4)	129 (36.8)	76 (33.2)	39 (42.9)
Hip	27 (4.0)	13 (3.7)	11 (4.8)	3 (3.3)
Knee	69 (10.3)	36 (10.3)	25 (10.9)	8 (8.8)
Below the knee area	48 (7.2)	24 (6.8)	13 (5.7)	11 (12.1)
Onset of pain during the first wave of the COVID-19 state of emergency (yes), n (%)	162 (8.2)	82 (8.0)	59 (8.6)	21 (8.0)

Values are expressed as mean (standard deviation) or n (percentage).

(34.3%) had been experiencing pain, while 82 (8.0%) reported the onset of pain due to the COVID-19 state of emergency. Of the 683 participants in the 50 to 59 years group, 229 (33.5%) had been experiencing pain, and 59 (8.6%) reported the onset of pain due to the COVID-19 state of emergency. Of the 262 participants in the ≥ 60 years group, 91 (34.7%) had been experiencing pain, while 21 (8.0%) reported the onset of pain due to the COVID-19 state of emergency.

Table 2 presents the comparisons of demographics and total duration of PA between participants with and without pain in each age group. There were no significant differences in the mean ages of the participants. In the 40 to 49 years group, the participants with pain had significantly lower education levels than those without pain ($P = .016$). In the 50 to 59 years group, a higher proportion of women with pain were observed than those without pain ($P = .008$). In the ≥ 60 years group, the total duration

Table 2**Comparison of demographics and physical activity between the participants with and without pain in each age groups.**

	Overall		40 to 49 years		50 to 59 years	
	Participants with pain (n=671)	Participants without pain (n=1296)	Participants with pain (n=351)	Participants without pain (n=671)	Participants with pain (n=229)	Participants without pain (n=454)
Age (yr)	50.5 (7.4)	50.6 (7.7)	44.7 (2.8)	44.9 (2.8)	53.5 (2.8)	53.8 (2.8)
Women, n (%)	283 (42.2)*	477 (36.8)	162 (46.2)	292 (43.5)	95 (41.5)*	142 (31.3)
Education (bachelor/master/doctorate degree), n (%)	356 (53.1)*	756 (58.3)	180 (51.3)*	397 (59.2)	124 (54.1)	245 (54.0)
Total PA time, min						
October-2019, median (IQR)	360 (120–720)	305 (125–630)	360 (125–720)	300 (120–630)	360 (120–718)	300 (124–600)
April-2020, median (IQR)	240 (60–540)	225 (70–521)	240 (60–600)	210 (60–500)	240 (68–525)	210 (80–480)
October-2020, median (IQR)	300 (90–600)	270 (105–600)	300 (90–610)	240 (80–585)	280 (90–560)	270 (120–597)
					60 years and older	
					Participants with pain (n=91)	Participants without pain (n=171)
Age (yr)					64.4 (4.6)	65.3 (4.6)
Women, n (%)					26 (28.6)	43 (25.1)
Education (bachelor/master/doctorate degree), n (%)					52 (57.1)	114 (66.7)
Total PA time, min						
October-2019, median (IQR)					330 (120–660)	420 (180–720)
April-2020, median (IQR)					200 (60–530)	300 (120–600)
October-2020, median (IQR)					210 (90–510)*	360 (140–690)

Values are expressed as mean (standard deviation) or n (percentage).

IQR = interquartile range, PA = physical activity.

* Significant difference between participants with and without pain ($P < .05$).

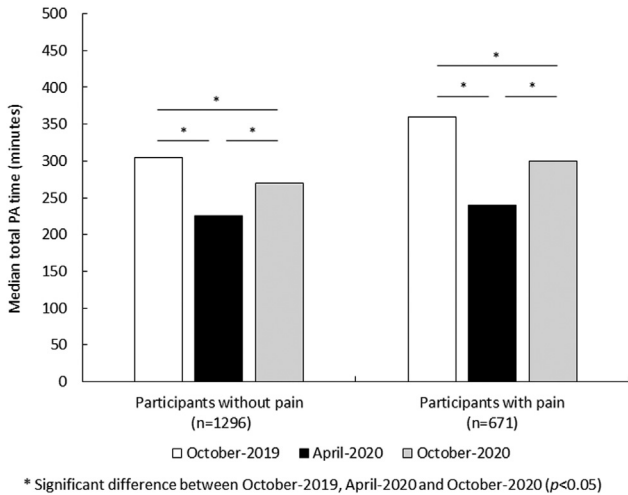


Figure 1. Changes in the total duration of physical activity in October 2019, April 2020, and October 2020 among the participants with and without pain (n = 1967).

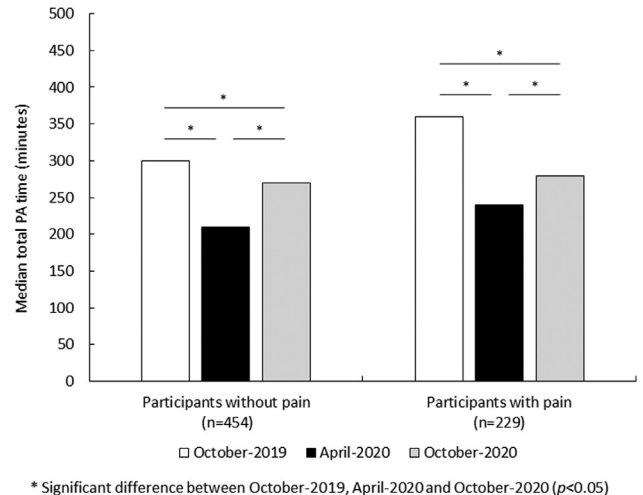


Figure 3. Changes in the total duration of physical activity in October 2019, April 2020, and October 2020 among the participants with and without pain in the 50 to 59 years group (n = 683).

of PA in October 2020 (median [IQR], 210 [90–510]) among the participants with pain was significantly lower than among those without pain (median [IQR], 360 [140–690]) ($P = .021$).

The changes in total PA time in October 2019, April 2020, and October 2020 among the participants with and without pain in each age group are presented in Figures 1 to 4. Among the participants with and without pain in the age groups 40 to 49 years and 50 to 59 years, the total duration of PA in April 2020 was significantly decreased compared to that in October 2019, while the total duration of PA in October 2020 was significantly increased compared to that in April 2020 (Figs. 2 and 3). Similar results were observed among participants without pain in the ≥ 60 years group (Fig. 4). Moreover, among the participants with pain in the ≥ 60 years group, the total duration of PA in April 2020 was observed to be significantly decreased compared to that in October 2019; however, there was no significant difference in

the total duration of PA between April 2020 and October 2020 (Fig. 4).

4. Discussion

This study examined PA time across 3 time periods: pre- (October 2019), during (April 2020), and post- (October 2020) COVID-19 state of emergency and compared PA times in the 3 time periods between Japanese adults aged 40 years and older who had pain after the COVID-19 state of emergency and those who did not. Our results revealed that PA time after the COVID-19 state of emergency among older adults with pain was shorter than that among those without pain, whereas no significant differences were observed in PA time after the COVID-19 state of emergency between middle-aged adults with and without pain.

Our results showed that the prevalence of pain in the 40 to 49, 50 to 59, and ≥ 60 years groups was 34.3%, 33.5%, and 34.7%,

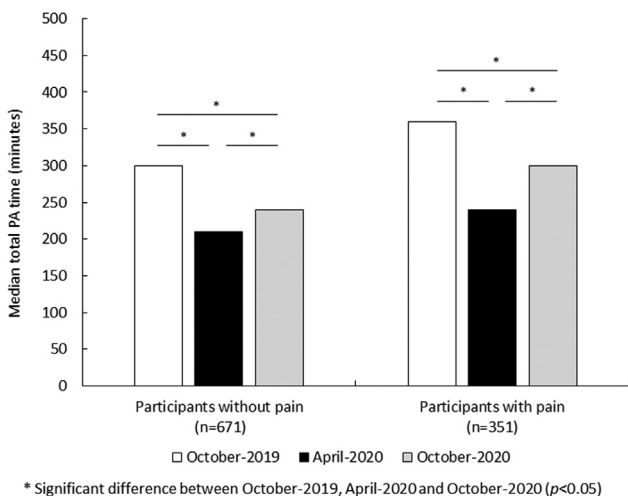


Figure 2. Changes in the total duration of physical activity in October 2019, April 2020, and October 2020 among the participants with and without pain in the 40 to 49 years group (n = 1022).

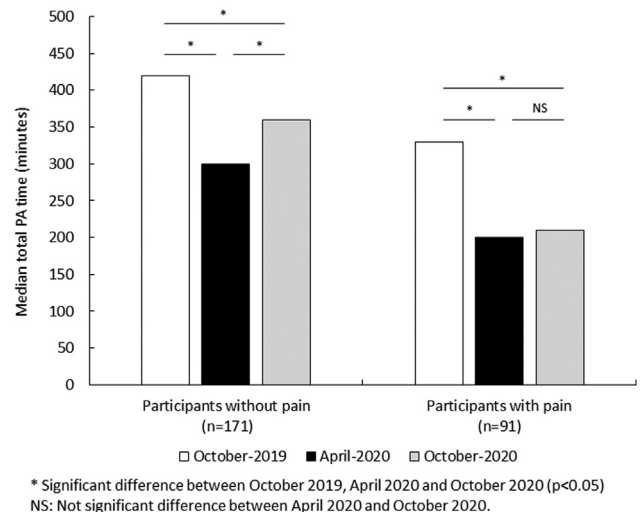


Figure 4. Changes in the total duration of physical activity in October 2019, April 2020, and October 2020 among the participants with and without pain in the ≥ 60 years group (n = 262).

respectively, which is lower than that reported in previous studies.^[27–29] Based on a survey by the mail conducted in the Netherlands, 1975 (53.9%) of 3664 adults reported pain, and 1627 (44.4%) reported pain lasting longer than 3 months.^[27] In a survey conducted by face-to-face interview among 3188 Japanese adults, the overall prevalence of pain was 41.4%, with a significant increase with age.^[28] Among these populations, in addition to differences in racial and cultural backgrounds, the differences in survey methods and definitions may explain most of the discrepancies observed in the prevalence of pain. Our results indicated that the lumbar, neck, and shoulder areas showed the highest prevalence of pain, which aligns with the existing literature.^[27–29] To the best of our knowledge, no studies have investigated the association between the onset of pain and the COVID-19 pandemic. The current study revealed that the overall prevalence of the onset of pain due to the COVID-19 state of emergency was 8.2%. It has been previously shown that the COVID-19 pandemic has led to physical inactivity,^[2] and several systematic reviews have indicated a cross-sectional association between physical inactivity and pain.^[21,22] Although the current study cannot confirm the causality between physical inactivity and pain, our study indicated that physical inactivity due to the COVID-19 state of emergency may result in the onset of pain.

Our findings that the participants with pain in the 40 to 49 years group had lower education levels and those with pain in the 50 to 59 years group had a higher proportion of women than those without pain are consistent with the existing literature.^[30,31] Among those with pain in the ≥ 60 years group, the total duration of PA in October 2020 was significantly lower than that among those without pain, while the total duration of PA between April 2020 and October 2020 did not differ significantly. These findings suggest that older adults with pain had reduced PA time after the COVID-19 state of emergency. Our previous cross-sectional study found that pain was associated with lower daily step counts and activity times in community-dwelling older adults.^[14] Furthermore, a systematic review indicated that older adults with pain are less active than those without pain.^[21] Therefore, the association between pain and physical inactivity in older adults may explain the reduced PA levels after the COVID-19 state of emergency.

In the 40 to 49 years and 50 to 59 years groups, no significant differences were observed in PA time after the COVID-19 state of emergency between the participants with and without pain. This suggests that only a simple pain assessment might not explain the difference in PA time between middle-aged adults with and without pain because they are healthy and high-functioning compared to older adults. In addition, a systematic review investigating the association between pain and domain-specific PA in adults with nonspecific low back pain indicated that pain is associated with a medium level of leisure-time PA.^[32] Thus, further research including detailed pain assessments, such as intensity, duration, and interference in activities of daily living, and PA assessments of the type and intensity are required to provide conclusive evidence on the difference in PA time between middle-aged adults with and without pain.

Our findings reinforce the importance of providing pain management strategies to increase PA levels in older adults. Additionally, our previous randomized controlled trial demonstrated that exercise combined with a psychosocial intervention to lessen participants' focus on pain was effective in reducing pain intensity and increasing PA levels in older adults with pain.^[33] Thus, pain management strategies implemented for older adults

who are already experiencing pain may require tailored approaches to address these factors, such as exercise programs to maintain mobility and psychological counseling.

This study had certain limitations. First, this study had a cross-sectional design and could not examine the associations between pain and changes in PA levels during the COVID-19 state of emergency. Second, the pain assessments were not detailed, and confounding factors between pain and PA were not considered. Thus, additional pain assessments including intensity, duration, and interference in activities of daily living, control for potential confounders, such as age, sex, body weight, and physical and psychological factors, and future prospective researches are needed to better understand the association between pain and changes in PA levels during the COVID-19 state of emergency. Third, pain related to COVID-19 may fall under numerous categories that may have no connection with COVID-19 (eg, neuropathic pain, ischemic pain, pain related to conditions such as fibromyalgia, arthritis, and multiple sclerosis). Fourth, participants were asked to recall their PA levels before the COVID-19 pandemic (October 2019), which was 1 year before the survey. Thus, their subjective PA durations may be underestimated or overestimated. Finally, participants in this study were recruited via online service registration, and pain and PA levels were assessed using an online survey because of the COVID-19 pandemic. Therefore, care must be taken when generalizing the current results.

In conclusion, the total duration of PA per week following the COVID-19 state of emergency among older adults with pain was lower than that among those without pain. In addition, among older adults with pain, the total duration of PA per week during the COVID-19 state of emergency was decreased compared to before the pandemic; however, it did not change significantly during and after the emergency. These findings suggest that older adults with pain have lower PA levels after the COVID-19 state of emergency.

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