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Medical and exercise consultation use for low back and knee pain among cardiovascular mass screening population: A cross-sectional study

Hiroshige Jinnouchi [a,b,c,d,*], Masahiko Kiyama [c], Akihiko Kitamura [e], Ko Matsudaira [f], Hironobu Kakihana [g], Mina Hayama-Terada [e], Isao Muraki [h], Eiko Honda [c], Takeo Okada [c], Kazumasa Yamagishi [b], Hironori Imano [c,h,i], Hiroyasu Iso [b,c,h,j]

[a] Department of Hygiene and Public Health, Nippon Medical School, 1-25-16 Nezu, Bunkyo-ku, Tokyo 113-0031, Japan
[b] Department of Public Health Medicine, Institute of Medicine, and Health Services Research and Development Center, University of Tsukuba, 1-1-1 Tenno-dai, Tsukuba, Ibaraki 305-8575, Japan
[c] Osaka Center for Cancer and Cardiovascular Disease Prevention, 1-6-107 Morinomiya, Joto-ku, Osaka 536-8588, Japan
[d] Research Team for Social Participation and Community Health, Tokyo Metropolitan Institute of Gerontology, 35-2 Sakae-cho, Itabashi-ku, Tokyo 173-0015, Japan
[e] Yao City Public Health Center, 1-2-5 Shimizu-cho, Yao, Osaka 581-0006, Japan
[f] Department of Medical Research and Management for Musculoskeletal Pain, 22nd Century Medical & Research Center, the University of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo 113-8655, Japan
[g] Department of Physical Therapy, Faculty of Rehabilitation, Kobe Gakuin University, 518 Arise, Ikawadani-cho, Nishi-ku, Kobe 651-2180 Japan
[h] Public Health, Department of Social Medicine, Osaka University Graduate School of Medicine, 2-2 Yamadaoka, Suita, Osaka 565-0871, Japan
[i] Department of Public Health, Kindai University Faculty of Medicine, 377-2 Ohnohigashi, Osakasayama, Osaka 589-8511, Japan
[j] Institute for Global Health Policy Research, Bureau of International Health Cooperation, National Center for Global Health and Medicine, 1-21-1 Toyama, Shinjuku-ku, Tokyo 162-8655, Japan

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ABSTRACT

Low back and knee pain, as major symptoms and early signs of osteoarthritis, have restricted healthy life expectancy, and numerous guidelines have recommended therapeutic exercise as the first-line treatment for chronic pain. Proportions of medical and exercise consultation use for those pain have been unclear, and these may change in the future. We performed a cross-sectional study of 2,954 persons aged over 30 years in 2017 as a part of the Circulatory Risk in Communities Study. A generalized linear model with logit link and 11-year age-group moving averages were used to estimate sex- and age-specific average proportions of lifetime pain, chronic pain, and dysfunctional chronic pain of the low back and knee, and history of medical and exercise consultation use. The medical consultation use increased in the order of lifetime pain, chronic pain, and dysfunctional chronic pain, reaching 69.1 % [65.2, 72.8] in women and 74.9 % [70.3, 79.0] in men for chronic low back pain, and 70.3 % [66.1, 74.2] in women and 55.6 % [49.3, 61.7] in men for chronic knee pain. On the other hand, the exercise consultation use accounted for 36.5 % [32.6, 40.6] in women and 28.8 % [24.4, 33.5] in men for chronic low back pain, and 40.8 % [36.5, 45.2] in women and 20.6 % [16.0, 26.0] in men for chronic knee pain. This survey revealed the differences in the multilayer proportions of medical and exercise consultation use for low back and knee pain in the cardiovascular mass screening, suggesting exercise consultation was less often provided compared to medical consultation.

1. Introduction

Musculoskeletal pain in low back and knee is not limited to symptoms associated with specific diseases. It is also observed as a symptom of non-specific low back pain and/or early pre-clinical sign of knee osteoarthritis, indicating a high prevalence and potential impact on healthy life expectancy (Shah et al., 2011; Yoshimoto et al., 2020; Woo et al., 2009; Nakamura et al., 2011). With increasingly recognized as frequent complaints, mass screening and prevention programs were becoming important from determining disability-adjusted life years (Nomura et al., 2022). However, most previous prevention programs have relied on cardiovascular mass screening (Iso et al., 1998; Ministry

* Corresponding author at: Department of Hygiene and Public Health, Nippon Medical School, 1-25-16 Nezu, Bunkyo-ku, Tokyo 113-0031, Japan.
E-mail address: h-jinnouchi@nms.ac.jp (H. Jinnouchi).

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Table 1
Basic characteristics of women and men aged 30 years or older participated in the Circulatory Risk in Communities Study in Japan: 2017.

	Women	Men
N	1 832	1 122
Age†, years	63, 30-91	65, 30-91
Body height†, m	1.53, 1.30–1.85	1.65‡, 1.41–1.87
Body mass index†, kg/m^2	22.8, 14.3-48.6	24.1‡, 13.9-39.2
Current job, %		
No job	14.1	38.3‡
Homemaker	46.5	0.1‡
Farmer	5.0	15.5‡
Other office worker	34.5	45.9‡
Current exercise habits, %	17.8	22.5
Current smoker, %	4.5	25.4‡
Current drinker, %	22.8	70.6‡
Self-reported sleeplessness, %	27.0	20.5‡
Depressive symptom, %	6.8	6.9

†Average, min-max (range of the value); ‡Statistical significant difference compared to women.

Table 2
Multilayered pain prevalence among women and men aged 30 years or older in Japanese cardiovascular mass screening: lifetime, chronic, dysfunctional chronic pain, and those pain with history of medical and exercise consultation use in 2017.

	Lifetime pain†		Chronic pain†		Dysfunctional chronic pain†	
	Women	Men	Women	Men	Women	Men
N	1 832	1 122	1 832	1 122	1 832	1 122
Low back pain						
Pain prevalence, %	78.4 [75.8, 80.7]	78.3 [76.4, 80.2]	30.9 [28.9, 33.1]	33.8 [31.1, 36.6]	8.6 [7.4, 10.0]	9.4 [7.8, 11.2]
History of medical consultation, %	55.3 [52.7, 57.8]	65.0‡ [61.7, 68.0]	69.1 [65.2, 72.8]	74.9 [70.3, 79.0]	85.4 [79.0, 90.1]	88.6 [80.9, 93.4]
History of exercise instruction, %	32.7 [30.4, 35.2[	25.6‡ [22.8, 28.6]	43.0 [39.0, 47.1]	31.7‡ [27.2, 36.5]	56.3 [48.5, 63.9]	42.9 [33.8, 52.5]
Histories of medical consultation & exercise instruction, %	25.9 [23.7, 28.2]	22.4 [19.8, 25.3]	36.5 [32.6, 40.6]	28.8 [24.4, 33.5]	51.9 [44.1, 59.6]	41.0 [32.0, 50.6]
Knee pain						
Pain prevalence, %	62.9 [60.7, 65.1]	49.6‡ [46.7, 52.6]	26.6 [24.7, 28.7]	22.1‡ [19.8, 24.6]	9.7 [8.4, 11.1]	4.7‡ [3.6, 6.1]
History of medical consultation, %	55.9 [53.1, 58.8]	46.3‡ [42.2, 50.5]	70.3 [66.1, 74.2]	55.6‡ [49.3, 61.7]	84.2 [78.0, 88.8]	81.1 [68.4, 89.5]
History of exercise instruction, %	34.5 [31.8, 37.3]	19.2‡ [16.1, 22.7]	46.1 [41.7, 50.5]	25.4‡ [20.4, 31.1]	61.6 [54.2, 68.5]	37.7‡ [25.8, 51.4]
Histories of medical consultation & exercise instruction, %	29.7 [27.2, 32.5]	15.6‡ [12.8, 18.9]	40.8 [36.5, 45.2]	20.6‡ [16.0, 26.0]	56.5 [49.1, 63.6]	37.7 [25.8, 51.4]

Prevalence [95 % confidence intervals]; †Lifetime prevalence was defined as the proportion of those that had experienced pain at some point in their life. Chronic pain was assessed based on the presence in the last 4 weeks and the persistence for at least 3 months excluded for fever- or injury-related pains. Dysfunctional chronic pain was defined as who had chronic pain with limit of daily activities; ‡Statistical significant difference compared to women in the each pain region.

of Health, 2007). In Japan, cardiovascular mass screening of community-dwelling people by local governments has been common since the 1960 s. The cardiovascular-related mortality rate has decreased, contributing to improved longevity through blood pressure control mainly via salt reduction and the appropriate widespread use of antihypertensive drugs (Ikeda et al., 2011). Conventional, non-communicable diseases have remained the most important targets for prevention including cardiovascular disease, diabetes, and cancer. In cardiovascular mass screening systems, there is considerable scope for developing prevention programs for musculoskeletal conditions such as low back and knee pain. This would be of equal interest in the future in regions with an ageing population.

The prevalence monitoring of chronic musculoskeletal pain and those with history of medical and exercise consultation use, therefore, could be crucial to help identify current and future actions to prevent those pains. There has been a deal of confusion in that the previous studies reported using a study-specific definition of time-frame, duration, frequency, or severity when estimating prevalence (Hoy et al., 2010; Walker, 2000; Hoy et al., 2012; Meucci et al., 2015; Noormohammadpour et al., 2017; Takahashi et al., 2018; Gilmartin-Thomas et al., 2021; Dell'Isola et al., 2016). For example, the prevalence of low back pain by asking about wider time-frames ('today', 'one month', or 'one year') varies between 18.3 %, and 38.0 % (Hoy et al., 2012; Meucci et al., 2015). Thus, international expert panels have suggested standardized definitions of low back pain (Dionne et al., 2008). Previous studies have not systematically surveyed several traits such as time-frames ('lifetime', 'last month'), duration ('chronic'), frequency ('weekly'), and severity ('pain intensity' and 'dysfunctional pain'), leading to difficulty in synthesizing, comparing, and interpreting sex- and age-specific pain prevalence between these different studies (Hoy et al., 2010). Furthermore, the majority of previous studies did not investigate history of exercise instruction use although numerous guidelines consistently recommending therapeutic exercise as the first-line treatment option for chronic musculoskeletal pain (Babatunde et al., 2017).

The aim of this study was to describe the sex- and age-specific musculoskeletal pain prevalence of the low back and knee and those with medical and exercise consultation use among the mass screening population, considering the multiple layers of pain definition.

2. Materials and methods

We performed a community-based survey in 2017 as a part of the Circulatory Risk in Communities Study (CIRCS). The details of the CIRCS have been described elsewhere (Yamagishi et al., 2019; Kakihana et al., 2021). As a mass screening program for cardiovascular disease, the survey was held in Ikawa (a rural region in northeastern of Japan, 1,367 people) and Minami-Takayasu (a sub-urban region in mid-western of Japan, 1,705 persons). The participation rates in all applicants (and all residents) for Ikawa and Minami-Takayasu were 71·4% (31·7%) and 88·2% (10·7%), respectively. The announcement of the mass screening followed the conventional method, and the participation rates in all applicants (and all residents) for Ikawa and Minami-Takayasu were 71·4% (31·7%) and 88·2% (10·7%), respectively. Workers in medium- and larger-sized enterprises were not partially included among the participants because of workplace health examinations. The total number of participants was 2,954 (30 years or older; women, 62 %), after excluding those without basic and pain information at baseline (n = 118). This study was approved by the Ethics Committees of the Osaka Center for Cancer (27-ethics-2) and Cardiovascular Disease Prevention and Osaka University (14285).

2.1. Measurement variables

We asked about pain presence, duration, intensity, frequency, and presence of dysfunction based on a previous questionnaire (Dionne

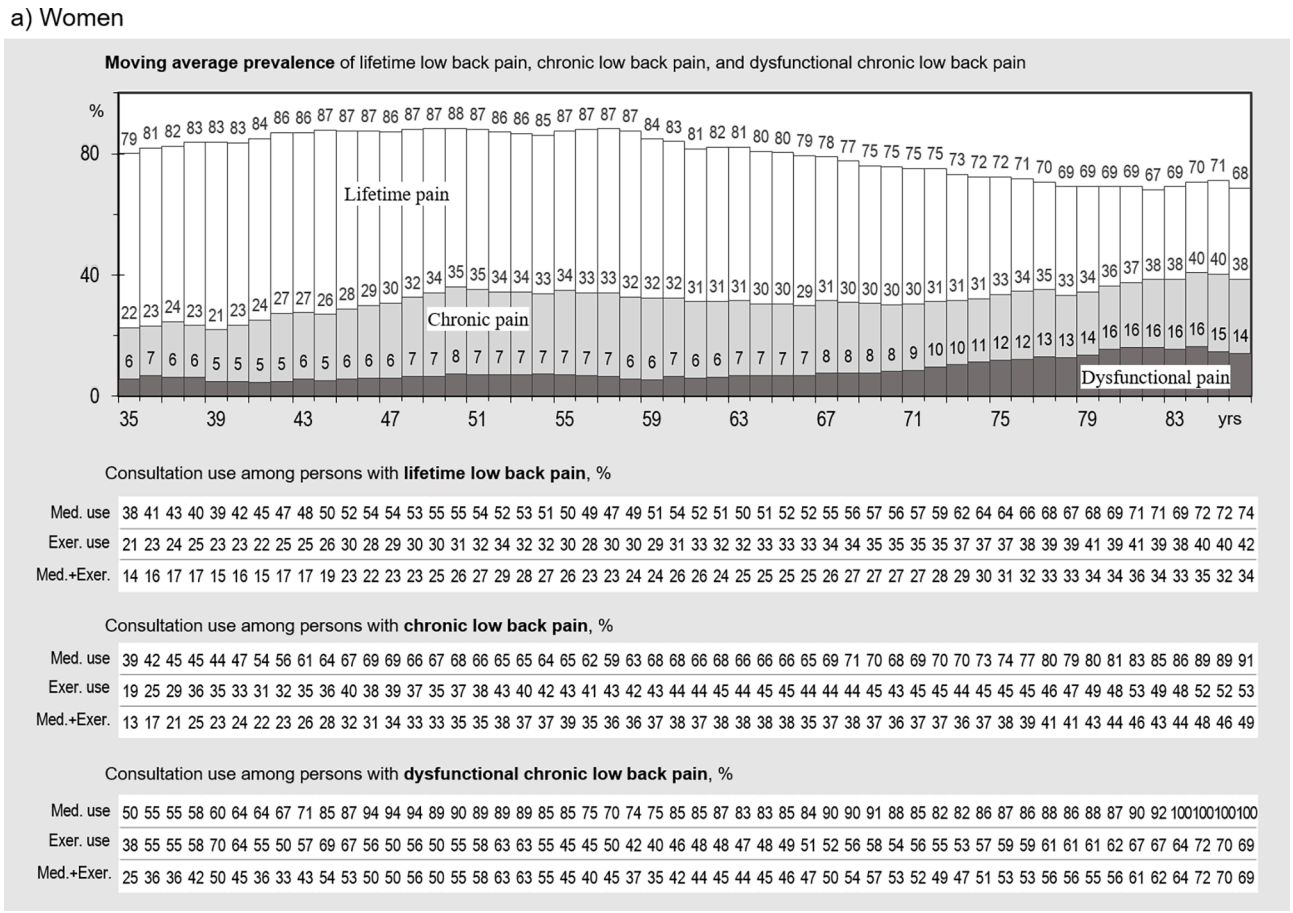

Fig. 1. Moving average prevalence of low back pain among women and men in Japanese cardiovascular mass screening: lifetime, chronic, dysfunctional chronic pain, and those pain with history of medical and exercise consultation use in 2017. Description: a) Women; b) Men; The each bar graph indicates 11-year moving averages prevalence of lifetime low back pain, chronic low back pain, and dysfunctional chronic low back pain. The tables show the proportions of medical and exercise consultation use among participants with lifetime low back pain and chronic low back pain, respectively. Overall point estimates [95% confidence intervals] were shown in the right of the graph box and the tables.

et al., 2008). Monthly prevalence was defined as the proportion of participants who experienced pain in previous four weeks and measured by asking "Have you had low back pain within last 4 weeks, excluding for fever- or injury-related pain?" and "Have you had knee pain within last 4 weeks, excluding for fever- or injury-related pain?". The pain sites were shown by an illustration of the low back in the region between the inferior costal margin and gluteal fold, and the knee in the region between the distal one-third of the thighs and the proximal one-third of the lower leg, respectively. Additionally, we asked the duration of pain. Our preliminary study using Cohen's kappa to test reliability of the current answer compared to the previous year's answer when answering one or more years of either persistent or without pain experience, indicated good agreements of 0·64 for low back and 0·67 for knee (Byrt, 1996). The pain duration was asked by less than 3 months, 3 months to 1 years, and 1 years or longer. If it was more than one year, we asked the number of years; when there was a range of answers, the shorter duration was chosen. We defined chronic pain as persistence for at least three months (WHO, 2003). For responders with chronic pain, we further asked the pain intensity (0 to 10 numeric rating scale), weekly pain frequency (less than one day/one to three days/four days or more), and presence of dysfunction (with/without). Dysfunctional chronic pain was defined as according to the following questions: "Is this pain enough to limit your daily activities such as walking, stair climbing, sitting, lying and carrying luggage?". According to our previous preliminary test, persons with dysfunctional chronic pain showed significantly more severe symptom-specific severity compared to those without (Kakihana et al., 2021). The use of medical consultation was determined by the question "Have you ever use medical consultation due to this pain(s)?", and whether they had ever received exercise therapy instruction was asked by "Have you ever been instructed on how to stretch or exercise by moving your body for improving these pains? (including group exercise)". Providers could be anybody such as physical therapists, doctors, health coaches, and judo therapists. Lifetime prevalence was defined as the proportion of those that had experienced pain at some point in their life and measured by asking "Have you ever had low back pain in your life?" and "Have you ever had knee pain in your life?". We obtained the baseline characteristics regarding sex, age, body mass index, current job (no job/homemaker/farmer/other office worker), current exercise habits (30 min or longer at least twice a week for more than a year), current smokers (more than one cigarette per day), drinker (more than once a week), self-reported sleeplessness, and depressive symptoms (both answered 'yes' as the following two questions: "Are you not interested in anything to do for the past month?", and "Are you unable to enjoy, feeling depressed or not having hope for the past month?"). Based on current age and pain duration, we estimated age at pain onset.

2.2. Prevalence calculation

Regarding the prevalence of lifetime, monthly, and chronic pain, ever having medical consultation, and ever receiving exercise

b) Men

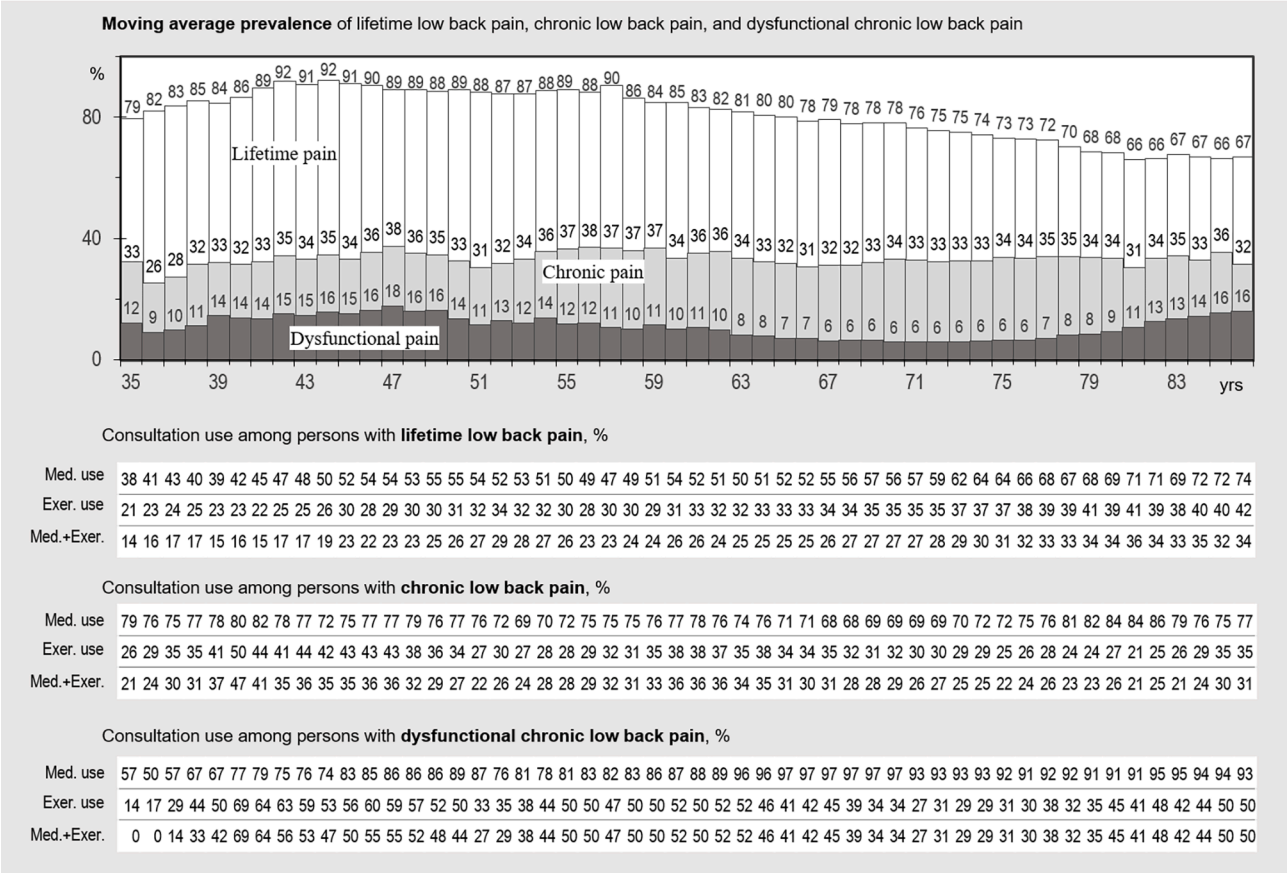

Fig. 1. (*continued*).

instruction among medical consultation users, we calculated 7-, 9-, 11-, and 13-year moving age-group averages using an equal number of years above and below the current age. We set an 11-year moving average, which was identified as providing the best balance between retention of definition of changing features of the graph through all age-groups for the prevalence by minimizing discontinuous changes between the peaks and troughs in the graph while still smoothing spikes in the data (van Woerden et al., 2007), although it was not completely eliminated in men with dysfunctional chronic knee pain due to lower prevalence. Additionally, we used generalized linear models with logit link function to estimate overall or sex-specific average prevalence and 95 % confidence interval based on maximum likelihood estimation using SAS 9.4 software (SAS Institute, Inc., Cary, NC). Non-overlapping of those confidence intervals was to determine statistically significant differences between groups. We also calculated the proportion of dysfunctional chronic pain in persons with severe pain (numeric rating scale, 7 to 10), and estimated the difference in the dysfunctional chronic pain proportion with an overall 1- or 2-point pain intensity reduction.

3. Results

The basic characteristics of 2,954 participants (1,832 women, 1,122 men) are shown in Table 1. The average age of the participants was 64 years, ranging from 30 to 91 years. Current exercise habits and depressive symptoms were observed in about 20 % and 7 %, respectively. Height and body mass index were tended to be greater, and no job, farmer, other office workers, current drinker, and current smoker tended to be more frequent in men while homemaker and self-reported sleeplessness were more frequent in women.

3.1. Multilayered pain prevalence: lifetime, chronic, and dysfunctional chronic pain

The average lifetime prevalence of low back pain was 78·4% in women and 78·3% in men (Table 2). Chronic low back pain prevalence was 30·9% in women and 33·8% in men, and dysfunctional chronic low back pain prevalence was 8·6% in women and 9·4% in men. Those prevalence were not significantly different between the sexes. As shown in Fig. 1, lifetime pain peaked at more than 85 % at around the 40 s, but gradually fell again with increasing age to less than 70 % in both sexes. In women, there was a gradual rise for chronic pain with increasing age, especially under the 50, and from the 70 s dysfunctional chronic pain increased. Men demonstrated relatively constant proportions for chronic pain, but a bimodal form was observed for dysfunctional chronic pain: with peaks in the late 40 s and late 80 s. However, the average lifetime prevalence of knee pain was 62·9% in women and 49·6% in men (Table 1). Chronic knee pain prevalence was 26·6% in women and 22·1% in men, and dysfunctional chronic knee pain prevalence was 9·7% in women and 4·7% in men. Those prevalence were significantly higher in women than in men. As shown in Fig. 2, lifetime, chronic, and dysfunctional chronic pain gradually rose with increasing age in women, while men demonstrated relatively constant proportions for lifetime and chronic pain. Dysfunctional chronic pain in men showed a gradual rise with increasing age over 70 years. All knee pain prevalence tended to be greater in women than men except for early middle age (less than 40 years).

3.2. Pain characteristics of chronic low back pain and knee pain

As shown in Table 3, among the cases with chronic low back pain,

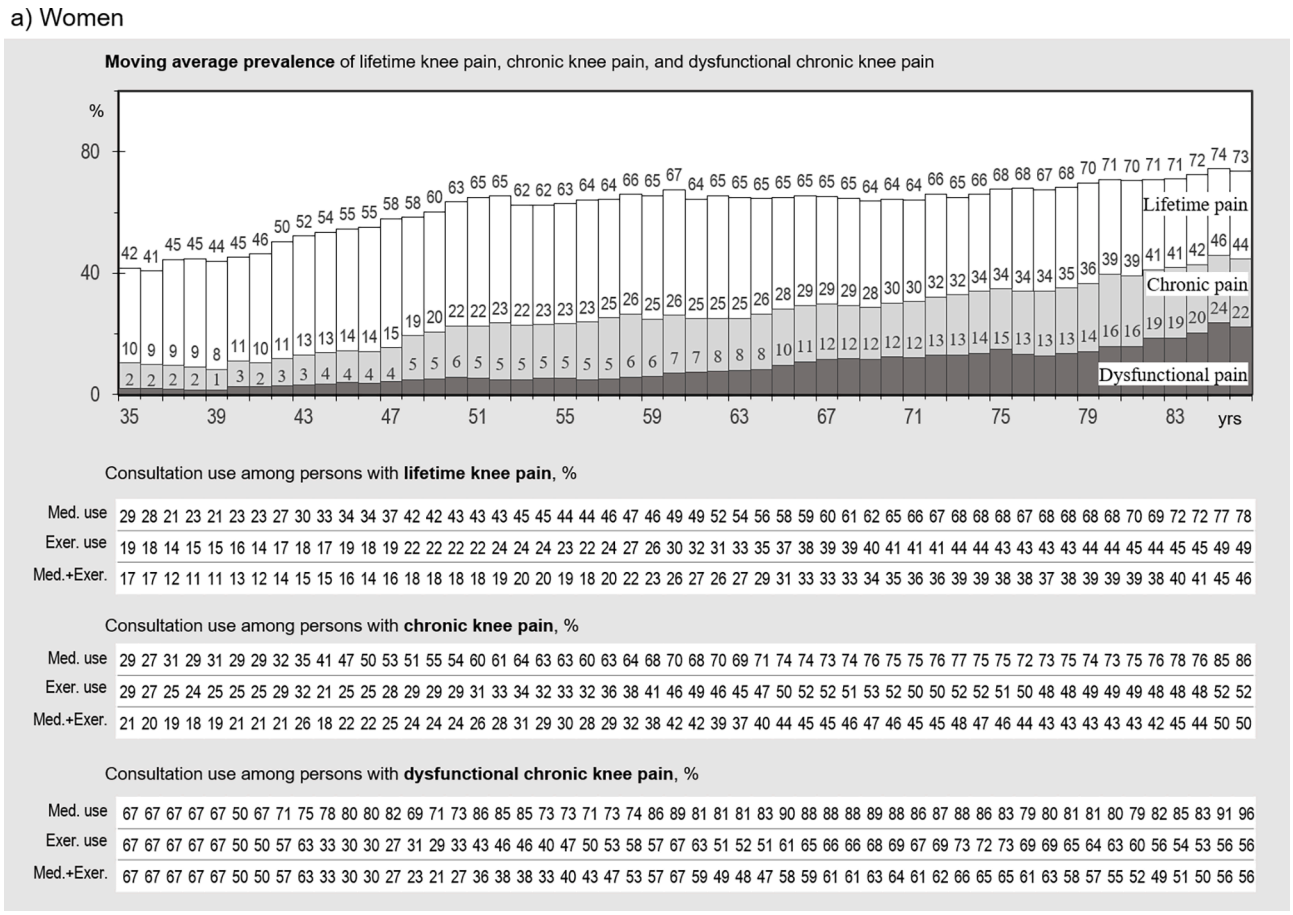

Fig. 2. Moving average prevalence of knee pain among women and men in Japanese cardiovascular mass screening: lifetime, chronic, dysfunctional chronic pain, and those pain with history of medical and exercise consultation use in 2017. Description: a) Women; b) Men; The each bar graph indicates 11-year moving averages prevalence of lifetime knee pain, chronic knee pain, and dysfunctional chronic knee pain. The tables show the proportions of medical and exercise consultation use among participants with lifetime knee pain and chronic knee pain, respectively. Overall point estimates [95% confidence intervals] were shown in the right of the graph box and the tables. In men, the proportions of medical consultation use and medical plus exercise consultation use are the same (not typographical errors).

pain duration was significantly longer in men than women as follows: longer duration (15 years or more), 37·2% in men and 25·0% in women. The most common onset-age was late middle age (40 to 59 years; 35·3% in women and 32·7% in men). Men showed significantly more frequent in early middle age (less than 40 years; 27·2% in men and 19·4% in women). The proportion of moderate-to-severe pain (4 to 10 points in the numerical rating scale) tended to be more frequent in men: 70·2% in men and 63·1% in women. Frequent pain (four or more days per week) accounted for 35·1% for women and 38·0% for men. Among the cases with chronic knee pain, the most common pain duration was less than five years; 57·6% in women and 56·0% in men. The most common onset-age was late adulthood (60 to 69 years; 33·4% in women and 39·9% in men). Moderate-to-severe pain was experienced by 63·1% of women and 59·3% of men. There were few findings related to sex-difference in chronic pain characteristics except for pain frequency. The proportion of less frequent pain (less than 1 day) tended to be more frequent in men: 45·2% in men and 33·2% in women.

3.3. Proportions of pain in patients with history of medication and exercise consultations

The history of medical consultation use increased in the order of lifetime pain, chronic pain, and dysfunctional chronic pain, reaching 69·1% in women and 74·9% in men for chronic low back pain, although those with history of exercise consultation showed 36·5% in women and 28·8% in men (Table 2). For chronic knee pain, the history of medical consultation use accounted for 70·3% in women, which was significantly more common than men (55·6%). As well, those with history of exercise consultation of 40·8% in women was significantly more common than men (20·6%), indicating significantly more common medical and exercise consultations in women than men. All proportions of pain demographic segmentations are shown in Supplemental Table 1. Those with a history of exercise consultation for chronic pain represented only about half of individuals with having medical consultation: 316/800 (40 %) for low back and 250/481 (52 %) for knee. In the additional analysis in both low back and knee (Fig. 3), the greater pain intensity associated to the larger proportions of dysfunctional chronic pain. Among those with both chronic moderate-to-high intensity pains, history of medical consultation accounted for approximately 75 to 85 % of participants, but those who received exercise instruction only accounted for 30 to 50 %. The prevalence of chronic low back and knee pain stratified by age-groups, job categories, region, and history of consultation use were shown in Supplemental Table 2.

4. Discussion

This cross-sectional survey of a mass screening population revealed the prevalence of lifetime, chronic, and dysfunctional chronic pain of the low back and knee, and histories of medical or exercise consultation use, as well as sex- and age-related trends.

b) Men

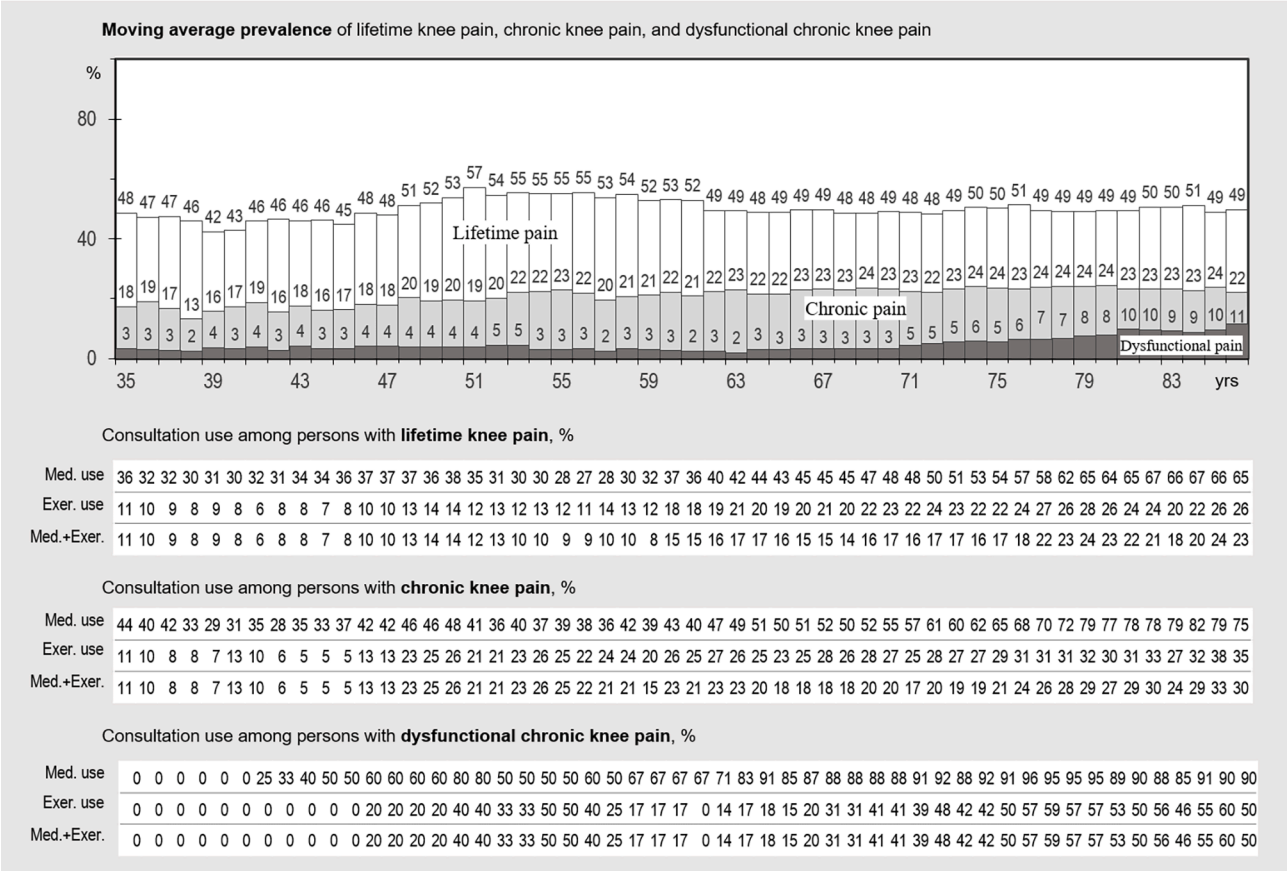

Fig. 2. (*continued*).

4.1. Prevalence of lifetime, chronic, and dysfunctional chronic pain

There have been several studies that surveyed the prevalence of chronic low back and/or knee pain among community-dwelling adults. These studies reported a wide range of prevalence among general adults: 4 to 27 % for chronic low back pain (Meucci et al., 2015; Noormohammadpour et al., 2017; Takahashi et al., 2018; Gilmartin-Thomas et al., 2021), and 10 to 30 % for chronic knee pain (Noormohammadpour et al., 2017; Takahashi et al., 2018; Gilmartin-Thomas et al., 2021; Dell'Isola et al., 2016). The studies used different definitions regarding time-frame, duration, frequency, and severity (Dionne et al., 2008). This study showed about 5 to 10 % discrepancy in the prevalence of chronic pain: 30·9 to 33·8% for low back and 22·1 to 26·6% for knee when compared to a previous survey, which found 20·9% and 18·3% for chronic low back and knee pain, respectively, among 14,217 Japanese women and men (40 to 74 years) (Takahashi et al., 2018). This is partially because they investigated a different time-frame ('current'). In addition, the prevalence of low back pain indicated to be higher in men than that in women although the previous national survey in Japan showed higher in women (Ministry of Health, 2016). The cause of the difference is not clear. However, the question used in the national survey, 'Have you experienced any subjective symptoms related to illness or injury in the past few days?', seems to be adequate to self-perceived symptoms related to clinical diagnosis (e.g., osteoarthritis and/or osteoporosis) rather than non-specific low back pain (including work-related low back pain).

In our results, lifetime low back pain showed a downward trend from the 40 s in both sexes, although the age-related musculoskeletal degeneration in imaging (Yoshimura and Nakamura, 2016) were assumed to be an upward association. The reasons for the increase trend of low back pain are unclear. However, it can suggest that low back pain, especially in non-specific low back pain, has become more common in younger generations.

4.2. Medical consultation and exercise instruction use

In this study, the proportions of ever having used medical consultation reached more than 70 %, but that of ever exercise instruction use were only just more than 40 % in women and around 35 % in men. Even in those with a history of medical consultation, only about half reported experience with instructed therapeutic exercise. Instructed therapeutic exercise could be one of the first-line options for treatment of chronic musculoskeletal pain (Babatunde et al., 2017). A previous qualitative study of primary care physicians and nurses and revealed that they believe therapeutic exercise can be beneficial in the treatment of chronic low back pain but do not necessarily prescribe it, rather tending to limit physical exercise and work activity in patients (García-Martínez et al., 2022). This could be due to fear-avoidance beliefs of the medical professional themselves (Darlow et al., 2012). Thus, further research of the barriers and facilitators of therapeutic exercise instruction is required.

4.3. Strengths and limitations

This study demonstrated multilayered and implied different prevalence in two communities in Japan. Moving averages enabled the visualization of age-trend of lifetime and chronic pain prevalence of low back and knee pain, as well as medical and exercise consultation use. These findings can be useful for planning mass screening approaches and comparing and/or synthesizing the results with our results. Simultaneously, there were several limitations. Age-specific difference of

Table 3
Pain characteristics of chronic low back and knee pain among women and men aged 30 years or older in Japanese cardiovascular mass screening: lifetime, chronic, dysfunctional chronic pain, and those pain with history of medical and exercise consultation use in 2017.

	Chronic low back pain[†]		Chronic knee pain[†]	
	Women	Men	Women	Men
N	1 832	1 122	1 832	1 122
% of monthly pain	83.9 [80.9, 86.5]	86.9 [83.4, 89.8]	85.0 [81.9, 87.7]	84.9 [80.4, 88.6]
Pain duration, %				
3 months to 4 years	44.1 [40.1, 48.2]	33.8[‡] [29.2, 38.7]	57.6 [53.1, 61.9]	56.0 [49.8, 62.1]
5 to 14 years	30.9 [27.2, 34.8]	29.0 [24.7, 33.8]	32.2 [28.2, 36.4]	34.7 [29.0, 40.8]
15 years or longer	25.0 [21.6, 28.8]	37.2[‡] [32.5, 42.2]	10.2 [7.9, 13.3]	9.3 [6.2, 13.6]
Estimated age at pain onset, %				
Less than 40 years	19.4 [16.4, 22.9]	27.2[‡] [22.9, 31.9]	5.9 [4.2, 8.4]	8.9 [5.9, 13.1]
40 to 59 years	35.3 [31.4, 39.3]	32.7 [28.2, 37.6]	29.3 [25.4, 33.5]	25.4 [20.4, 31.2]
60 to 69 years	23.8 [20.5, 27.5]	23.5 [19.5, 28.0]	33.4 [29.4, 37.7]	39.9 [34.0, 46.1]
70 years or older	21.5 [18.3, 25.1]	16.6 [13.2, 20.7]	31.4 [27.4, 35.6]	25.8 [20.7, 31.6]
Pain intensity, %				
Mild (1 to 3)	36.9 [33.0, 40.9]	29.8 [25.4, 34.6]	36.9 [32.7, 41.3]	40.7 [34.8, 47.0]
Moderate (4 to 6)	42.7 [38.7, 46.8]	47.5 [42.5, 52.5]	31.2 [36.9, 45.6]	41.1 [35.2, 47.4]
Sever (7 to 10)	20.5 [17.3, 24.0]	22.7 [18.8, 27.2]	21.9 [18.5, 25.8]	18.1 [13.8, 23.4]
Weekly pain frequency, %				
Less than 1 day	32.1 [28.4, 36.1]	30.6 [26.2, 35.4]	33.2 [29.2, 37.5]	45.2[‡] [39.1, 51.4]
1 to 3 days	32.8 [29.1, 36.8]	31.4 [26.9, 36.2]	32.0 [28.0, 36.2]	24.6 [19.6, 30.3]
4 days or more	35.1 [31.3, 39.1]	38.0 [33.2, 43.0]	34.8 [30.7, 39.2]	30.2 [24.8, 36.2]
Presence of dysfunction, %				
With dysfunction	27.9 [24.3, 31.7]	27.7 [23.4, 32.4]	36.2 [32.1, 40.6]	21.4 [16.7, 26.9]

[†] Chronic low back and knee pain were assessed based on the presence in the last 4 weeks and the persistence for at least 3 months excluded for fever- or injury-related pain; [‡]Statistical significant difference compared to women in the each pain region.

prevalence cannot directly indicate the underlying causes, such as aging effect (e.g. age-related degeneration of musculoskeletal organs, sex hormone modulation, and cognitive impairment and/or pain perception decrease), cohort effect (e.g. born in a certain time, having the same life experiences or education), changes in lifestyle (e.g. changes in working style, housework style, mobility), social role (e.g. retirement, housework, child and/or older care), and treatment environment (e.g. development and spread of surgery, widespread of drug and/or non-drug therapy options; and compensatory strategy, e.g. orthosis use, avoiding of pain-related activities), of these differences. Future researches based on the standardized monitoring are required in order to establish the underlying causes. The present findings may contribute to the development of musculoskeletal mass screening to generate new synergies in cardiovascular disease prevention (Williams et al., 2018). For example, a program could be designed for individuals with overweight not only to initiate exercise for cardiovascular disease prevention but also to reduce musculoskeletal pain that may interfere with initiating the exercise (Messier et al., 2004).

5. Conclusions

This cross-sectional survey revealed the prevalence of chronic low back (30 %) and knee (25 %) pain of mass screening population. This survey revealed the differences in the multilayer proportions of medical and exercise consultation use for low back and knee pain in the cardiovascular mass screening, suggesting exercise consultation was less often provided compared to medical consultation. Standardized monitoring could be crucial for that population-level treatment and management of musculoskeletal pain should implement exercise therapy-related education.

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7. Ethics approval and consent to participate

This study have been performed in accordance with the Declaration of Helsinki, and was approved by the Ethics Committees of the Osaka Center for Cancer and Cardiovascular Disease Prevention (27-ethics-2) and Osaka University (14285). Informed consent was not obtained from individual participants. Instead, according to the Japanese ethical guidelines, the participants provided their consent to participate using opt-out methodology with provided information about our study at the survey sites.

CRediT authorship contribution statement

Hiroshige Jinnouchi: Writing – review & editing, Writing – original draft, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Masahiko Kiyama:** Writing – review & editing, Supervision, Project administration, Methodology, Funding acquisition, Data curation. **Akihiko Kitamura:** Writing – review & editing, Supervision, Methodology, Investigation, Data curation, Conceptualization. **Ko Matsudaira:** Writing – review & editing, Validation, Supervision, Methodology. **Hironobu Kakihana:** Methodology, Project administration, Writing – review & editing. **Mina Hayama-Terada:** Writing – review & editing, Project administration. **Isao Muraki:** Writing – review & editing, Project administration. **Eiko Honda:** Writing – review & editing, Data curation. **Takeo Okada:** Writing – review & editing, Project administration, Data curation. **Kazumasa Yamagishi:** Writing – review & editing, Supervision, Project administration. **Hironori Imano:** Writing – review & editing, Project administration. **Hiroyasu Iso:** Writing – review & editing, Supervision, Project administration, Methodology, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial

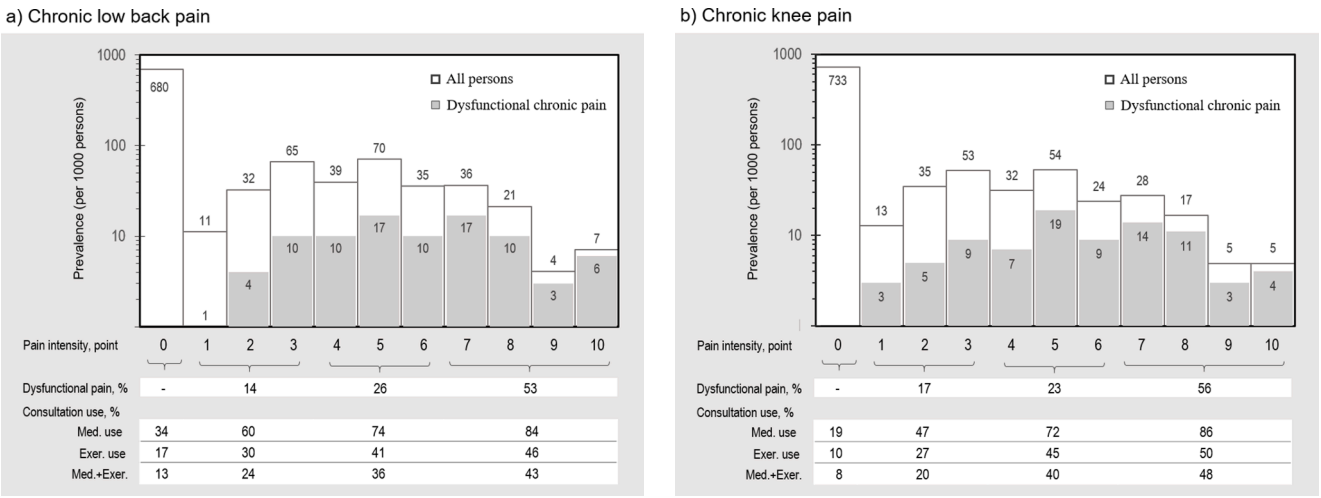

Fig. 3. Distribution of chronic low back and knee pain according to pain intensity, and its association with dysfunctional chronic pain among adults aged 30 years or older in Japanese cardiovascular mass screening in 2017. Description: a) Chronic low back pain; b) Chronic knee pain; The number of persons (per 1000 persons) at each pain intensity is shown. The vertical axis is a logarithmic scale. The pain intensity was divided into four categories: 0 = no pain, 1 to 3 = light pain, 4 to 6 = moderate pain, and 7 to 10 = severe pain. The grey bars are the number of participants with dysfunctional chronic pain.

interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

The datasets analysed during the present study are not publicly available because the data of the Circulatory Risk in Communities Study belongs to the Osaka Center for Cancer and Cardiovascular Disease Prevention and related institutions but are available from the corresponding author on reasonable request.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.pmedr.2024.102684.

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