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ORIGINAL ARTICLE

Prevalence of low back pain and factors associated with chronic disabling back pain in Japan

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Abstract
Purpose This study aimed to report lifetime and 4-week low back pain (LBP) prevalence and examine factors associated with chronic LBP and back pain disability over a lifetime in a Japanese adult population.
Methods In February 2011, 1,063,083 adults aged 20–79 years registered as internet research volunteers were randomly selected to participate in a questionnaire survey. The data from 65,496 respondents were analyzed to calculate age-standardized lifetime and 4-week prevalence. Chronic LBP and back pain disability were defined as LBP lasting for ≥3 months and a consecutive ≥4-day-long absence, respectively. Factors associated with chronic disabling back pain over a lifetime were examined by multiple logistic regression modeling.
Results The lifetime LBP prevalence was 83 % and 4-week prevalence was 36 %; majority of the respondents had disability-free LBP. Smoking [adjusted odds ratio (aOR): 1.17; 95 % CI: 1.05, 1.30], lower educational level (aOR: 1.21; 95 % CI: 1.09, 1.34), history of disabling back pain among family members and/or significant others (aOR: 1.46; 95 % CI: 1.27, 1.67), occupational LBP (aOR: 1.34; 95 % CI: 1.16, 1.55), traffic injury (aOR: 2.81; 95 % CI: 2.07, 3.81), compensated work injury (aOR: 2.42; 95 % CI: 1.92, 3.05), radiating pain (aOR: 4.94; 95 % CI: 4.45, 5.48), low back surgery (aOR: 10.69; 95 % CI: 9.02, 12.68), and advice to rest upon back pain consultation (aOR: 3.84; 95 % CI: 3.36, 4.40) were associated with chronic disabling back pain over a lifetime.
Conclusions LBP is common in Japan as in other industrialized countries. The association between the advice to rest and chronic disabling back pain supports recent treatment guidelines emphasizing continuation of daily activities.

Keywords Low back pain · Prevalence · Disability

Background

Low back pain (LBP) is a common major health problem, especially in western countries. It is a primary cause of disability and work loss and results in direct and indirect social costs [1–4]. In Japan, LBP is also widespread among the general population and is the fifth most frequent reason for medical consultation among outpatients [5].

The reported LBP prevalence has varied across studies, and geographic differences have been reported. Cross-sectional studies from England, Canada, Germany, Australia, Denmark, and Hong Kong have examined LBP prevalence, the reported point prevalence ranged from 19 to 37 % and the reported lifetime prevalence from 40 to 86 % [6–13].

LBP is common, and the literature indicates that a majority of patients have low-grade LBP with limited disability [12, 13]. Nevertheless, some patients develop chronic and/or disabling back pain, and direct and indirect costs for chronic LBP are much higher than for acute LBP [14]. Therefore, determining the prevalence of LBP by the degree of disability and predictors of chronic disabling back pain will provide information to public health practitioners for developing treatment strategies and allocating

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resources. However, LBP prevalence in the Japanese population and factors associated with chronic disabling back pain have not yet been fully studied.

The aims of this study were to report lifetime and 4-week LBP prevalence and to examine factors associated with chronic disabling back pain over a lifetime in a Japanese adult population.

Methods

Study population

An internet survey on LBP was conducted in 2011. An internet research company was utilized having 1.8 million individuals aged 20–79 years registered as research volunteers. The volunteers were stratified by gender and age, and 1,063,083 individuals were randomly selected consistent with the Japanese demographic composition and invited to participate in research on LBP through an e-mail dated 11 February 2011 containing a link to the survey. There were 2,27,853 effective users among the potential 1,063,083 volunteers. The internet research company was not able to exclude non-users from dissemination of the e-mail for technical reasons. The participants received points for online shopping as an incentive. Double registration was prevented by checking the e-mail address and disabling the link to the questionnaire once the responder completed the survey. On 17 February 2011, the survey was closed when the number of respondents reached 77,709. Thus, the response rate is not relevant in this survey. Individuals whose reported age was <20 years or >79 years were excluded, resulting in 65,496 participants retained for the study. This study was approved by the Institutional Review Board of Kanto Rosai Hospital.

Measurement endpoints

The questionnaire requested demographic data, weight, height, smoking habits, marital status, highest education attained, work status, history of disabling back pain among family members and/or significant others, lifetime experience with LBP, work or other absence due to LBP, history of radiating pain below the knee, duration and cause of the most severe LBP, history of low back surgeries, history of workers' compensation for LBP, whether the respondent had ever had a back pain consultation at a hospital, clinic or alternative medicine provider such as a chiropractor, massage therapist or acupuncturist, whether the respondent was advised to rest when they had a back pain consultation, and whether they had had LBP within the previous 4 weeks.

Four-week and lifetime experience with LBP were examined through direct questions. LBP was defined as pain in the area between the lower costal margin and the gluteal folds lasting more than 1 day regardless of accompanying radiating pain, that was not merely associated with febrile illness, menstrual periods or pregnancy. Respondents were provided with a mannequin with a shaded area illustrating the area of pain, and asked, "Have you ever had LBP?" for lifetime LBP and "Have you had LBP within 4 weeks?" for 4-week LBP.

Table 1 Low back pain grade

Pain grade	Interpretation
0	No pain
1	Low back pain without disability
2	Low back pain with disability without absence[a]
3	Low back pain with disability with absence for <4 days[b]
4	Low back pain with disability with absence for ≥4 days[c]

[a] Absence from social activity, i.e., work or school

[b] Consecutive absence for <4 days

[c] Consecutive absence for ≥4 days

Prevalence calculation

Lifetime LBP prevalence and 4-week LBP prevalence by gender and age groups were determined and standardized prevalence with 95 % confidence interval (CI) was calculated using the direct method with 2011 Japanese demographic data as a reference.

LBP was classified as follows (Table 1): grade 0, no pain; grade 1, LBP without disability; grade 2, LBP with disability without absence from social activity such as work or school; grade 3, LBP with disability with consecutive absence for <4 days; and grade 4, LBP with disability with consecutive absence for ≥4 days.

Factors associated with chronic disabling back pain

Among respondents who had ever had LBP, factors associated with having chronic LBP and back pain disability over a lifetime were examined using a multiple logistic regression model. Respondents whose LBP was attributed to a spine tumor, spine metastasis, infection of the spine, spine fractures, aneurysm or lithiasis were excluded. The outcome variable (chronic disabling back pain) was defined as having experienced chronic back pain lasting for ≥3 months and disabling back pain defined as grade 4 LBP over a lifetime. Smoking habits, educational level, history of disabling back pain among family members and/or significant others, cause of the most severe LBP, history of workers' compensation for LBP, history of radiating pain below the knee, history of low back surgery, whether the

Table 2 Demographic characteristics of respondents ($N = 65,496$)

	Frequency (%)
Age (mean, SD)	47.65 (14.83)
Male	33,837 (51.66)
BMI (mean, SD)	22.59 (3.55)
Smoking	
Non-smoker	38,643 (59.00)
Former smoker	12,901 (19.70)
Current smoker	13,952 (21.30)
Married	41,642 (63.58)
Education (school completed)	
No college	32,673 (49.89)
College	32,485 (49.60)
Other	338 (0.52)
Work status	
Worker	40,349 (61.61)
Student	1,686 (2.57)
Housewife/househusband	11,938 (18.23)
Unemployed	9,964 (15.21)
Other	1,559 (2.38)
History of disabling back pain among family members and/or significant others	42,365 (64.68)

BMI body mass index, *SD* standard deviation

respondent had ever had a back pain consultation, and whether the respondent was advised to rest at the consultation were assessed for associations with history of chronic disabling back pain.

Initially, simple descriptive analysis was performed, and comparisons between respondents who had experienced chronic disabling back pain and those who had not were conducted using a *t* test for age and a Chi-square test or a simple logistic regression model for other categorical variables. In the multiple regression model described above, potential predictive variables were included and age and gender were controlled for. Because the outcome was chronic and disabling back pain over a lifetime, it was assumed that the prevalence of the outcome would increase with age. Smoking habits (ever smoked vs. never smoked), educational level (no college vs. college graduate or higher), history of disabling back pain among family members and/or significant others (yes vs. no), history of workers' compensation for LBP (yes vs. no), history of radiating pain below the knee (yes vs. no), and history of low back surgery (yes vs. no) were dichotomous variables, and the latter categories were used as reference categories for each variable. Seven causes of the most severe LBP were analyzed: 1, no particular cause; 2, occupational back pain; 3, motion or posture in everyday life; 4, traffic injury; 5, sports injury; 6, disease; and 7, other; the first category was used as the reference category. The rest variable had three categories: 1, the respondent had never had a back pain consultation; 2, the respondent had had a back pain consultation but was not advised to rest; and 3, the respondent had had a back pain consultation and was advised to rest; the second category was used as the reference category. The aOR, its 95 % CIs, and the *p* value were calculated.

Statistical analysis was conducted using SAS 9.2 (SAS Institute Inc., Cary, NC) and a significance level of 0.05 was used.

Results

Demographic data for the respondents are shown in Table 2. The mean age was 47.7 years and 52 % were males. The prevalence of current smokers was 21 %. The majority of the respondents were workers and half of the respondents had completed college-level education or more.

LBP prevalence

The standardized lifetime prevalence of LBP is shown in Table 3. The lifetime prevalence of LBP was 82.4 and 84.5 % in males and females, respectively. The majority had had LBP without disability (43.1 % of male respondents and

Table 3 Life time low back pain prevalence ($N = 65,496$)

Pain grade	Male			Female			Total		
	Prevalence[a]	95 % CI		Prevalence[a]	95 % CI		Prevalence[a]	95 % CI	
0	17.63	17.22	18.03	15.52	15.06	15.99	16.56	16.25	16.87
1	43.14	42.61	43.67	48.65	48.02	49.27	45.93	45.52	46.34
2	13.29	12.92	13.65	12.50	12.09	12.90	12.89	12.61	13.16
3	15.88	15.49	16.27	14.19	13.76	14.62	15.02	14.73	15.32
4	10.07	9.75	10.39	9.14	8.75	9.53	9.60	9.35	9.85
1–4	82.37	81.97	82.78	84.48	84.01	84.94	83.44	83.13	83.75

[a] Age-standardized prevalence

Table 4 Four-week low back pain prevalence ($N = 65,496$)

Pain grade	Male			Female			Total		
	Prevalence[a]	95 % CI		Prevalence[a]	95 % CI		Prevalence[a]	95 % CI	
0	65.84	65.34	66.35	62.71	62.10	63.31	64.26	63.86	64.65
1	30.32	29.83	30.81	33.21	32.62	33.80	31.78	31.40	32.17
2	2.48	2.31	2.65	2.54	2.34	2.75	2.51	2.38	2.65
3/4	1.36	1.23	1.48	1.54	1.37	1.71	1.45	1.34	1.55
1–4	34.16	33.65	34.66	37.29	36.69	37.90	35.74	35.35	36.14

[a] Age-standardized prevalence

48.7 % of female respondents). On the other hand, 10.1 % of males and 9.1 % of females had experienced LBP resulting in consecutive absence for ≥4 days.

The standardized 4-week LBP prevalence is shown in Table 4. Grades 3 and 4 were combined, because of their low frequency. LBP prevalence within 4 weeks was 34.2 and 37.3 % in males and females, respectively. Most had had LBP without disability (30.3 % of males and 33.2 % of females). A small percentage of the respondents had had LBP with disability resulting in an absence within the previous 4 weeks (1.4 % of males and 1.5 % of females).

Factors associated with chronic and disabling back pain

Of the 65,496 respondents, 54,711 had ever had LBP. Among them 2,061 (3.8 %) had LBP attributed to a spine tumor, spine metastasis, infection of the spine, spine fractures, aneurysm or lithiasis, and were excluded from the analysis. Of the remaining 52,650 respondents, 2,039 (3.87 %) had experienced chronic disabling back pain during their lifetime. The characteristics of these individuals are shown in Table 5. In the multiple logistic regression model, all predictive variables were significant after controlling for age, gender, and other variables (Table 6). Smoking (aOR: 1.17, 95 % CI: 1.05, 1.30) and lower educational level (aOR: 1.21; 95 % CI: 1.09, 1.34) were associated with chronic disabling LBP. Individuals with occupational LBP (aOR: 1.34; 95 % CI: 1.16, 1.55), those with LBP caused by a traffic injury (aOR: 2.81; 95 % CI: 2.07, 3.81), and those with LBP caused by disease (aOR: 1.99; 95 % CI: 1.43, 2.76) were more likely to have experienced chronic disabling back pain compared to LBP without a particular cause. LBP caused by motion or posture in daily life was inversely associated with chronic disabling back pain. Individuals whose back pain was related to a compensated work injury were 2.4 times more likely to have chronic disabling back pain (aOR: 2.42; 95 % CI: 1.92, 3.05). Individuals with radiating pain were five times more likely to have chronic disabling back pain (aOR: 4.94; 95 % CI: 4.45, 5.48) and individuals who had had low back surgery were ten times more likely to have chronic disabling back pain (aOR: 10.69; 95 % CI: 9.02, 12.68). Back pain consultation was associated with chronic disabling back pain (aOR: 0.17; 95 % CI: 0.12, 0.23 for no consultation) and those who were advised to rest were four times more likely to have chronic disabling back pain compared to those who were not advised to rest at the back pain consultation (aOR: 3.84; 95 % CI: 3.36, 4.40).

Discussion

The present study examined LBP prevalence in Japanese adults in detail. Lifetime LBP prevalence was 83.4 % and 4-week LBP prevalence was 35.7 %; these prevalence values were similar to those reported for Canada, Germany, and Australia [6, 12, 13]. This is not surprising, since lifestyles in Japan have become highly westernized.

In this study population, LBP was quite common, and the majority of people had had LBP without disability. However, 26 % of males and 23 % of females had had absences from work or other activities due to LBP. These patients should be focused on and factors associated with LBP should be assessed to prevent them from developing chronic disabling back pain, which may result in direct and indirect costs.

Studies have reported several risk factors for chronic and/or disabling back pain. A systematic review reported that individual factors such as age, gender, education level, smoking status, and weight were not predictive of worse outcomes, and leg pain slightly increased worse outcomes [15]. In occupational LBP, smoking, frequent analgesic use, presence of other chronic diseases, and years of education were associated with disability pensions due to lower back disorders [16]. A prospective study reported that the incidence of lumbar disc herniation was associated with smoking, suggesting that atherosclerosis might be involved in spinal disc degeneration [17]. In the current study, smoking was associated with chronic disabling back pain, but the magnitude of increased odds was not high

Table 5 Characteristics of individuals with low back pain, non-chronic non-disabling back pain, and chronic disabling back pain

	All ($N = 52,650$)	Non-chronic non-disabling LBP $N = 50,611$ (96.13 %)	Chronic disabling LBP $N = 2,039$ (3.87 %)	P value
Age (mean, SD)	48.25 (14.49)	47.99 (14.48)	54.53 (13.12)	<0.0001
Male, *N* (%)	26,779 (50.86)	25,648 (50.68)	1,131 (55.47)	<0.0001
Ever smoked, *N* (%)	22,450 (42.64)	21,382 (42.25)	1,068 (52.38)	<0.0001
College, *N* (%)	25,707 (49.04)	24,881 (49.38)	826 (40.75)	<0.0001
History of disabling back pain among family members and/or significant others, *N* (%)	36,465 (69.26)	34,745 (68.65)	1,720 (84.36)	<0.0001
Cause of low back pain, *N* (%)				
Indeterminate	14,012 (26.61)	13,620 (26.91)	392 (19.23)	reference
Occupational	12,383 (23.52)	11,727 (23.17)	656 (32.17)	<0.0001
Daily life	16,002 (30.39)	15,536 (30.70)	466 (22.85)	0.55
Traffic injury	578 (1.10)	508 (1.00)	70 (3.43)	<0.0001
Sports injury	4,620 (8.77)	4,450 (8.79)	170 (8.34)	0.002
Disease	503 (0.96)	435 (0.86)	68 (3.33)	<0.0001
Other	4,552 (8.65)	4,335 (8.57)	217 (10.64)	<0.0001
Compensated work injury, *N* (%)	588 (1.12)	429 (0.85)	159 (7.80)	<0.0001
Radiating pain, *N* (%)	11,131 (21.14)	9,714 (19.19)	1,417 (69.49)	<0.0001
Surgery, *N* (%)	777 (1.48)	343 (0.68)	434 (21.28)	<0.0001
Consultation[a] and advice[b], *N* (%)				
No consultation	19,938 (37.87)	19,901 (39.32)	37 (1.81)	<0.0001
Consultation, no advice to rest	14,192 (26.96)	13,900 (27.46)	292 (14.32)	reference
Consultation, advice to rest	18,520 (35.18)	16,810 (33.21)	1,710 (83.86)	<0.0001

LBP low back pain, *SD* standard deviation

[a] Back pain consultation in a clinic, hospital, or alternative medicine

[b] Advice to rest on consultation for back pain

compared to other variables. History of disabling back pain among family members and/or significant others was also associated with chronic disabling back pain. Along with genetic factors, the illness behaviors of family members and/or significant others may have affected the illness behaviors of the respondents [18]. The cause of the most severe LBP and history of compensated occupational back pain were associated with chronic disabling back pain. Studies have reported an association between compensable back injury and extended disability time [19]. Additionally, one study reported an association between an elevated level of pain-related fear and sudden onset of LBP in chronic back pain patients [20]. In the current study, occupational LBP and traffic injury had higher odds of chronic disabling back pain compared to LBP without a particular cause, and fear-avoidance may have played a role. Education could be related to social class or work status, which could also be associated with work demand, control, and support. This may be one possible reason why education was associated with chronic disabling back pain in the current study. LBP with radiating pain led higher disability and chronicity compared to LBP without radiating pain, which is consistent with the systematic review [15]. Low back surgery was associated with chronic disabling back pain, which is reasonable, as surgery could be the result of long-term disability.

Back pain consultation and advice to rest was associated with chronic disabling LBP in the present study. In recent guidelines for management of non-specific acute LBP, continuing normal daily activity is recommended and bed rest is discouraged [21]. In chronic back pain, educating patients that pain is a common condition and self-manageable along with gradual exposure to activities helps reduce pain-related fear, which is an important factor in chronic LBP [22]. The present study supports these guidelines. However, these guidelines and pain-related fear appear not to be well known among Japanese health practitioners and indeed, over 35 % of respondents had been advised to rest. Dissemination of modern guidelines on management of non-specific LBP to health practitioners is needed.

This study has some limitations. Because this was a cross-sectional study, inferences cannot be drawn about

Table 6 Multiple regression of associations between chronic disabling back pain and individual characteristics ($N = 52,650$)

	aOR	95 % CI	*P* value
Age	1.02	(1.02–1.03)	<0.0001
Female	1.19	(1.06–1.33)	0.002
Ever smoked	1.17	(1.05–1.30)	0.005
No college	1.21	(1.09–1.34)	0.0003
History of disabling back pain among family members and/or significant others	1.46	(1.27–1.67)	<0.0001
Cause			
Indeterminate	1.00		
Occupational	1.34	(1.16–1.55)	<0.0001
Daily life	0.85	(0.73–0.99)	0.03
Traffic injury	2.81	(2.07–3.81)	<0.0001
Sports injury	0.99	(0.81–1.22)	0.92
Disease	1.99	(1.43–2.76)	<0.0001
Other	1.68	(1.39–2.04)	<0.0001
Compensated work injury	2.42	(1.92–3.05)	<0.0001
Radiating pain	4.94	(4.45–5.48)	<0.0001
Surgery	10.69	(9.02–12.68)	<0.0001
Consultation[a] and advice[b]			
No consultation	0.17	(0.12–0.23)	<0.0001
Consultation, no advice to rest	1.00		
Consultation, advice to rest	3.84	(3.36–4.40)	<0.0001

aOR adjusted odds ratio

[a] Back pain consultation in a clinic, hospital or alternative medicine

[b] Advice to rest on consultation for back pain

causality. We asked respondents about their lifetime experiences with LBP and some respondents may have had several LBP episodes. Therefore chronic disabling back pain, back pain consultation, and compensated LBP might not have occurred during the same back pain episode. Possible biases in an internet-based survey need to be addressed. First, regarding the type of questionnaire, a previous study reported that a web-based questionnaire had adequate reliability compared with the paper and pencil version even for older rural women [23]. Second, issues of selection bias and representativeness of the results are significant in internet-based surveys. Because the samples in the present study were selected from among internet research volunteers who may differ even from general internet users, caution is needed when interpreting this study. Compared to the general population, the internet survey company volunteers from whom our sample was drawn were over-representative of people living in large cities. In addition, the respondents were over-representative of those who had completed university or graduate-level education, and this tendency was especially strong in older respondents [24]. Nevertheless, 4 week and lifetime prevalence in the present study are within the range of those from previous studies in other industrialized countries, supporting the validity of this study [6–13]. However, the LBP prevalence may have been underestimated, since the prevalence of LBP was lower in people with at least a university-level education than in others in the present study. Some studies have also used self-administered internet-based surveys to assess LBP in a general population. In an Australian study, the authors used a method similar to the present study [25]. Potential participants were randomly selected from a permission-based online consumer panel; however, non-users were effectively excluded from the invitation. The authors stated that the point prevalence of LBP was similar to a previously published study using traditional methods. In a study conducted in the US, the authors used a nationally representative web-enabled panel of households that were recruited using random-digit dialing and address-based sampling [26]. If recruited households did not have internet access, free internet access was provided. The authors concluded that the prevalence of chronic pain was similar to that in a previous study using a representative sample. The methods used in this US study maintain the representativeness of the study while utilizing the cost-effectiveness of internet-based surveys for data collection. Such an improved internet-based survey method could be used for future studies.

Conclusion

LBP is common in Japan and its prevalence is similar to those in other industrialized countries. Several factors were associated with experiencing chronic disabling back pain during a lifetime. Back pain patients with disability should be focused on and dissemination of guidelines on management of non-specific LBP to health practitioners is needed.

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Conflict of interest None.

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