

Estimates of Annual Medical Costs of Work-related Low Back Pain in Japan

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Abstract: Little is reported regarding economic burden of work-related low back pain except for the United States. In the present study, annual medical cost of work-related low back pain in Japan was calculated based on the treatment fee per day, a total of days of treatment received for low-back pain of all causes, employment rates, and an estimated number of work-related low-back cases. The analysis indicated that, in 2011, the total annual medical cost for work-related low back pain was 82.14 billion yen, consisting of 26.48 and 55.66 billion yen for inpatients and outpatients, respectively. As well as for 2011, the costs were also estimated for 2008, 2005, and 2002. Whereas the total medical costs of work-related low back pain monotonically increased during 2002–2011, the costs for spine disorder (including spondylosis) have also increased in recent years. Work-related low back pain entails a considerable economic burden to Japanese society.

Key words: Work-related disease, Musculoskeletal disorders, Occupational low back pain, Cost of illness, Social cost, Medical cost

Introduction

Low back pain represents a significant health problem among working population. It accounts for about 62% of the whole work-related diseases (period of temporary retirement was equal to 4 days or more) in Japan in 2011¹. Worldwide, 37% of low back pain is work-related, with twofold variation across regions². For effective countermeasures, it is necessary to demonstrate the annual medical costs of work-related low back pain and its breakdown list. Nevertheless, few studies have investigated economic burden of work-related low back pain³ except for those in the United States^{4–6}, whereas that of low back pain of all causes have been reported in several countries^{7–9}. At least, no information is available for costs of work-related

low back pain in Japan except for accidental low back pain (6.02 billion yen in 1994)⁹. The study presented here was, therefore, conducted to estimate the direct medical costs of work-related low back pain in Japan. Here, the words “work-related” mean “caused by work”. Even if one’s work is affected by a low back pain caused by his/her housework, it is considered as a non-occupational low back pain. His/her productivity loss caused by his/her housework-related low back pain is not counted as costs of work-related (occupational) low back pain. Also, this paper mainly targeted annual direct medical cost, which the government and individual patients have to pay. On the other hand, indirect cost estimation is outside the scope of this paper because the direct and indirect cost method is not always the standard approach in the previous studies of work-related low back pain cost except for Leigh *et al.*⁶.

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Methods

This is a cost analysis based on the review of public statistics and literature data. The annual medical costs (medicine, laboratory tests, equipment, labor costs, etc.) for work-related low back pain in Japan was calculated by illness using the equation below based on the treatment fee per day from the Survey of Medical Care Activities in Public Health Insurance¹⁰, the annual total of days of treatment received calculated from the Patient Survey¹¹, employment rates from the Labour Force Survey¹² and an estimated number of work-related low back cases.

Annual medical costs per disease for work-related low back pain = Σ (Treatment cost per day) \times (Estimated number of daily patients receiving medical care) \times (Number of days hospitals are in service) \times (Employment rate) \times (Percentage of pain appeared during work)

The summation in the equation is over age groups. Data were searched using internet and governmental websites. The annual medical costs for work-related low back pain in Japan were estimated by diseases, using the Survey of Medical Care Activities in Public Health Insurance¹⁰ and the Patient Survey¹¹ released by the Ministry of Health, Labour and Welfare, the Labour Force Survey released by the Ministry of Internal Affairs and Communications¹², and the literature data on the percentages of low back pain appeared during work¹³. The Survey of Medical Care Activities in Public Health Insurance is compiled from the receipts for medical fees covering treatment given in May every year. The survey also includes data from the union-based health insurance, the Japan Health Insurance Association, the National Health Insurance, and the Medical Aid System for the Elderly. The Patient Survey, conducted once every three years, uses samples from medical institutions, hospitals and clinics nationwide. The survey gathers information on the gender, age and illness of both inpatients and outpatients receiving treatment on one specified day in October. Since it is conducted once every three years, the present study made estimates using 2011 data, the latest data at this time (2012). To match this data, data of the Survey of Medical Care Activities in Public Health Insurance 2011 was used. As well as for the Patient Survey, 2011 data was also used for the Labour Force Survey, which includes employment rate data by gender and age group every year. Additionally, as Takemitsu *et al.*¹³ reported that among 1,381 workers, aged between 18 and 65 yr, who visited any of over 30 Rosai Hospitals across Japan due to low back pain, the symptoms appeared

during work for 44.1% and 42.2% in men and women, respectively, these percentages were considered as low-back pain caused by work. Except for them, there is no available data at this time.

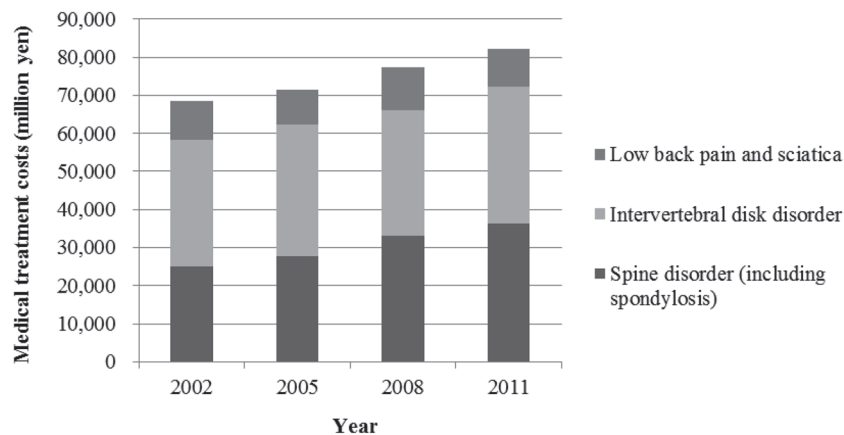
Range of the analysis was set at 20 to 64 yr old, because (1) the Survey of Medical Care Activities in Public Health Insurance¹⁰ did not gather data by age, (2) the percentage of pain appeared during work described above was based on the survey on subjects with ages between 18 and 65 yr¹³, and (3) the data published in the Patient Survey¹¹ is collated in groups of 5 yr of age.

The disease classification used in the estimates was middle classification of the Ministry of Health, Labour and Welfare in the Patient Survey¹¹. This contained the number of patients for more detailed illness classifications, but the present study used the middle classifications because the public data in the Survey of Medical Care Activities in Public Health Insurance¹⁰ only included up to the middle classification. According to ICD-10 codes¹⁴, M45–M49 [spine disorder (including spondylosis)], M50–M51 (intervertebral disk disorder) and M54.3–M54.5 (low back pain and sciatica) were studied in the present study as the common diseases with low back pain.

The detailed procedure of estimation was as follows. First, to calculate the treatment cost per day, the total medical fee points were multiplied by 10 Japanese yen and divided by the number of actual days for treatment by disease classification in the Survey of Medical Care Activities in Public Health Insurance¹⁰. Second, the estimated number of patients, who were receiving treatment at hospitals and clinics on the survey day, was figured out from the Patient Survey (by inpatients and outpatients, by males and females)¹¹. Third, employment rates in Japan by gender and age group were extracted from the Labour Force Survey¹². Forth, the number of days for treatment was estimated as follows: The number of inpatients was assumed to be the number of patients that were hospitalized at the day the Patient Survey was conducted throughout the year, so the number of days for treatment was set to 365 days. However, this did not mean that the same patient was hospitalized all year; it was assumed that the number of patients on a daily basis did not change with patients being released and others being admitted. About the number of outpatients, we also assumed that almost the same number of outpatients received treatment daily. When taking into consideration the medical institution holidays, the estimated total number of outpatients in the Patient Survey were adjusted to 313 days (= 365 \times 6/7). This adjustment factor is used for the estimation of the

Table 1. Estimated medical treatment costs of work-related low back pain in Japan in 2011 (million yen)

Middle classification of illness	Men		Women		Total
	Inpatient	Outpatient	Inpatient	Outpatient	
Spine disorder (including spondylosis)	10,675	12,929	3,380	9,444	36,428
Intervertebral disk disorder	9,203	13,634	3,219	9,857	35,912
Low back pain and sciatica	0	5,422	0	4,376	9,798
Total	19,878	31,985	6,599	23,677	82,138

**Fig. 1. Trend of total medical cost of work-related low back pain in Japan.**

total number of patients in the Patient Survey¹¹). As well as for 2011, medical costs of work-related low back pain were also estimated for 2008, 2005, and 2002 based on the same assumptions and methods.

Results

For 2011, the total annual medical cost for work-related low back pain was estimated at 82.14 billion yen, consisting of 26.48 and 55.66 billion yen for inpatients and outpatients, respectively (Table 1). Looking at the costs by illness (ICD-10 codes), costs were 36.43 billion yen for spine disorder (including spondylosis) (M45–M49), 35.91 billion yen for intervertebral disk disorder (M50–M51), and 9.80 billion yen for low back pain and sciatica (M54.3–M54.5). Medical costs were 1.7-fold higher in men than in women. In particular, costs for inpatients were threefold higher in men than in women.

Figure 1 shows the total medical costs of work-related low back pain for each year. Annual total medical cost has monotonically increased throughout 2002–2011. Also, a monotonic increase of medical costs for spine disorder (including spondylosis) was found. The mean and SD of the annual total medical costs for those four years (2002, 2005, 2008, and 2011) were 74.9 billion and 6.09 billion

yen, respectively. Whereas the estimated number of daily patients receiving medical care has not increased (data not shown), treatment costs per day have increased as shown in Fig. 2 and 3.

Discussion

It was found in the present study that medical costs of work-related low back pain in Japan were 82.14 billion yen in 2011. As the medical cost of low back pain of all causes across all ages in Japan in 2011 was estimated at 836.5 billion yen, medical costs for work-related low back pain accounted for 9.8% of the entire medical costs of low back pain in Japan. Whereas the economic impact of overall occupational healthcare cost is minimal, the medical cost for work-related low back pain (particularly spine disorder) is on the increase. The increases of treatment cost per day are main driving force of increase in annual medical costs for work-related low back pain. The gender difference may partly reflect the lower employment rate of women.

Table 2 shows the annual costs for work-related low back pain in Japan and other countries. The medical cost for work-related low back pain per capita in Japan in 2011 was 643 yen. In addition, according to a personal

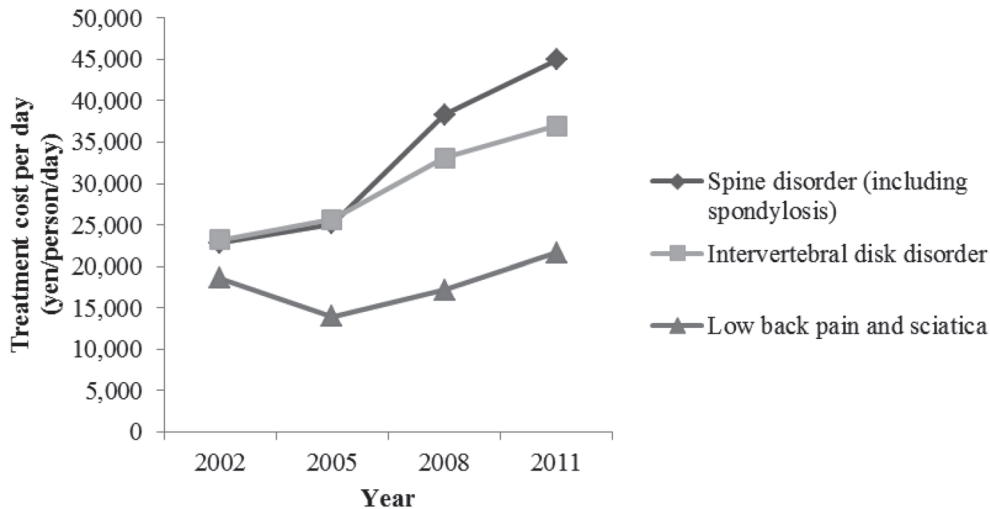


Fig. 2. Trend of treatment cost per day for inpatients in Japan.

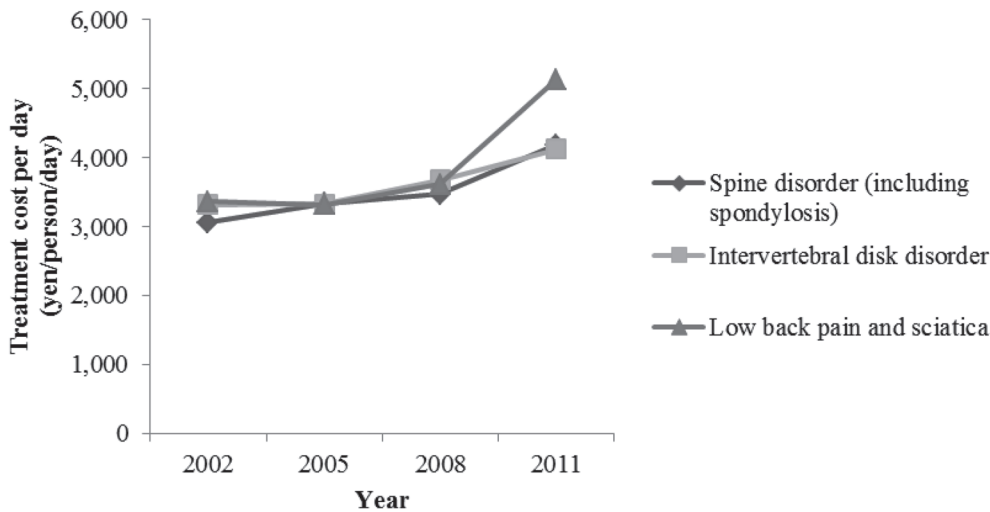


Fig. 3. Trend of treatment cost per day for outpatients in Japan.

communication with the Ministry of Health, Labour and Welfare, the Industrial Accident Compensation Insurance paid 3.38 billion yen in Japan in FY 2011 for work-related low back pain compensation (41.1% for compensation for absence from work and 57.7% for disability compensation). Therefore, annual total cost (medical and indemnity costs) for work-related low back pain in Japan in 2011 per capita was 669 yen. The economic burden (medical costs and compensation plus indemnity costs) of work-related back pain in Quebec in 1981 has been estimated to be 173 million Canadian dollars in the past study³). Accordingly, the total cost of work-related back pain per capita in Quebec in 1981 was 2,399 yen (when 1 Canadian dollar = 89.27 Japanese yen). This is 3.6-fold higher than that in Japan in 2011. The cause could be attributed to high

compensation costs in Quebec in 1981 (86% of total costs) and low compensation costs in Japan in 2011 (4% of total costs). In contrast, the medical cost for work-related low back pain in 1981 Quebec per capita (335 yen) was about half of that in Japan in 2011. In the United States, Webster and Snook^{4, 5} estimated medical plus indemnity costs of compensable low back pain in 1986 and 1989 to be 11.1 billion and 11.4 billion US dollars, respectively. These are equal to 4,076 and 4,073 yen per capita (when 1 US dollar = 88.18 Japanese yen), respectively. The corresponding medical costs per capita were 1,284 and 1,320 yen, respectively. These were about twofold higher than that in Japan in 2011. Additionally, on the basis of the estimate in 1986 by Webster and Snook⁴) (\$11.1 billion) and various additional assumptions (e.g. medical and wage inflation

Table 2. Annual costs for work-related (low) back pain in Japan and other countries

Country (region) Year	Japan ^a 2011	Quebec ³⁾ 1981	U.S. ⁴⁾ 1986	U.S. ⁵⁾ 1989	U.S. ^{6),b} 1992
Cost for work-related (low) back pain [million Canadian dollars] ^c	–	173	–	–	–
Cost for work-related (low) back pain [billion US dollars] ^c	–	–	11.1	11.4	49.2
Cost for work-related (low) back pain [million yen] ^{c, d}	85,519	15,444	978,798	1,005,252	4,338,456
Population [thousand persons] ^e	127,799	6,438	240,133	246,819	256,514
Cost for work-related (low) back pain per capita [yen] ^c	669	2,399	4,076	4,073	16,913
Medical cost for work-related (low) back pain per capita [yen]	643	335 ^f	1,284	1,320	(Unknown)

^aThe present study (82,138 and 3,381 million yen for medical and indemnity costs, respectively). ^bEstimated on the basis of the estimates in 1981 by Webster and Snook⁴⁾ (\$11.1 billion) and various additional assumptions. ^cIncluding medical and indemnity costs. ^dFollowing conversion rates were used: 1 Canadian dollar = 89.27 Japanese yen; 1 US dollar = 88.18 Japanese yen. ^eData from the Japan Ministry of Internal Affairs and Communications for Japan (<http://www.stat.go.jp/data/jinsui/2011np/pdf/gaiyou.pdf#page=1>), the City Population website for Quebec (<http://www.citypopulation.de/Canada-Quebec.html>), and the World Bank for the United States (https://www.google.co.jp/public-data/explore?ds=d5bnccppjof8f9_&met_y=sp_pop_totl&idim=country:USA&dl=ja&hl=ja&q=%E7%B1%B3%E5%9B%BD%E4%BA%B A%E5%8F%A3). ^fCalculated using the mean medical cost of one case (about \$650) and the mean total cost per worker (\$4,650).

of 35% from 1986 to 1992, and occurrence of additional administrative costs and other related costs), Leigh *et al.*⁶⁾ also estimated the costs for work-related low back pain in the United States in 1992 to be \$49.2 billion. This is equal to 16,913 yen per capita (when 1 US dollar = 88.18 Japanese yen). The related costs might have largely contributed to it.

When feasible, suppression of increase of treatment fee per day is effective to slow down the growth of medical cost for work-related low back pain in Japan. Prevention of the development of spine disorder including spondylosis in workplace might also be effective to some extent. Although small when compared internationally, medical cost for work-related back pain in Japan is on the constant increase and requires close monitoring.

Several potential limitations of the study also warrant mention. First, because Fukushima Prefecture and Ishinomaki and Kesenuma medical districts in Miyagi Prefecture, the disaster areas of the Great East Japan Earthquake, had been excluded from the Patient Survey 2011 data, the medical costs for work-related low back pain in Japan in 2011 were underestimated to some extent. Second, although we considered the low back pain with the symptoms appeared during work as work-related low back pain, this assumption may have caused some underestimation because some symptoms of work-related low back pain might also have appeared after work. In a related matter, although the actual incidence rate of low back pain might vary by working status, we multiplied entire medical cost by employment rate. However, one of our aims is to know the contribution of work-related low back pain to the entire low back pain costs. It is informative for formulating effective countermeasures of reducing health-care

costs by preventing diseases. To begin with, we have to multiply entire medical cost by employment rate because the denominator of the percentage of pain appeared during work is the number of “workers” who visited the Rosai Hospitals due to low back pain. If its denominator were the number of general inhabitants who visited the hospitals due to low back pain, we would not use employment rate. Third, because work-related low back pain might also have caused noncompensable productivity loss (presenteeism and absenteeism), further estimates of such indirect costs are issues in the future. Additionally, if workers had a severe low back pain because of their work and they quit their job and retire, the treatment cost they have to pay after they quit job and the labour earning they had to give up (indirect cost) are also economic burden which might not fully be reflected in the present study (but partly considered as compensation costs). Additional estimates of these long-term costs are also issues in the future. Forth, the middle classification of illness might not always be consistent with patient’s condition of low back pain and might have caused some uncertainty. For example, some patients with another disease might also have low back pain. Fifth, because the figures in the Patient Survey were rounded to the nearest 0.1 thousand, this might have caused some other uncertainties. Moreover, our use of adjustment factor of 6/7 for the estimation of total number of outpatients might have caused some overestimation because hospitals may not always provide services on national holidays. We cannot provide standard errors of the estimates or some kind of confidence interval because we only used public statistics and literature data. Finally, although the treatment cost data in the Survey of Medical Care Activities in Public Health Insurance did not include data from the

Industrial Accident Compensation Insurance, it was paid to only 1.3% of worker patients with low back pain according to a survey in Japan¹⁵). Therefore, its influence to our estimates would have been minimized.

In conclusion, the present study demonstrated that work-related low back pain entails a considerable economic burden to Japan society.

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