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ORIGINAL ARTICLE

Estimates of hip fracture incidence in Japan using the National Health Insurance Claim Database in 2012–2015

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Abstract

Summary Using the nationwide health insurance claims database, we found that the age-standardized hip fracture incidence rates in Japan indicated significant increase in males but no significant change in females during 2012–2015. The fracture risk in subjects aged 75–84 years indicated decrease in females but no change in males.

Introduction Nationwide registry data on hip fractures have not yet been established in Japan. Using the newly developed National Database of Health Insurance Claims (NDB), which covers the entire Japanese population, we investigated the incidence rates of hip fractures and the associated regional differences. We also assessed the frequency of osteoporosis prescriptions, bone turnover marker (BTM) level, and bone mineral density (BMD) measurements.

Methods The annual numbers of hip fractures, osteoporosis prescriptions, and BTM level and BMD measurements by prefecture from 2012 to 2015 were obtained from NDB data. We calculated the standardized claims-data ratio (SCR) in each prefecture.

Results The age-standardized incidence rates from 2012 to 2015 indicated no significant change in females and significant increase in males (p value for trend; 0.920, 0.002, respectively). The fracture risk decreased in females aged 75–84 years and indicated no increase in females aged 85–89 years during 2012–2015, while the fracture risk indicated no change in males aged 75–84 years and increased in males aged 85–89 years. The frequency of osteoporosis prescriptions, BTM level measurements, and BMD measurements in the general population in the corresponding period increased with statistical or marginal significance in females and males. West–east regional differences were observed in the incidence rates; the highest SCR values in the western prefectures were approximately double the lowest values in the eastern prefectures.

Conclusions The age-standardized hip fracture incidence rates indicated no significant change in females and significant increase in males in Japan from 2012 to 2015.

Keywords Health insurance claim database · Hip fracture incidence · National database · Osteoporotic prescription

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Introduction

Hip fractures increase the risk of disability and mortality [1, 2]. Moreover, the United Nations world population survey reported a rapid increase in the age of the world's population [3]. With the increasing proportion of the elderly population, the burden of hip fractures has been recognized as a serious global public health problem [4, 5]. The geographic distribution of hip fracture events varies globally, with higher rates in the Scandinavian countries and North America and lower rates in Asia and Africa [6, 7]. Although hip fracture incidence rates have decreased in the UK, North America, the Scandinavian countries, Hong Kong, and Taiwan, no such decline has been reported in Japan [8–11].

Several studies on nationwide hip fracture incidence using the national registry database or claim database have been reported in Europe [12–14]. In South Korea and Taiwan, hip fracture incidence rates have been calculated on the basis of the national health insurance database [10, 15]. However, in Japan, no such nationwide registry database for hip fractures has yet been established. Hip fracture incidence rates have been estimated from cross-sectional surveys offered to all hospitals having a department of orthopedic surgery; however, the patients' response rates have not been somewhat low, at approximately 60% [11]. East-west regional hip fracture incidence differences in Japan have been reported [11], but a precise look at the physical map would lead to renaming these as southeast-northwest differences, because of the diagonal location of Japan's islands.

The Japanese Ministry of Health, Labor and Welfare has established a digital collection of all anonymous healthcare insurance claim data known as the National Database of Health Insurance Claims (NDB) [16]. The NDB is composed of data from health insurance claims, that is, medical expense statements. The national healthcare system in Japan covers most of the medical care; thus, the NDB includes data on medical treatments such as prescription, injection, examination, and operations for both outpatients and inpatients. Computerized claim data accounted for 98% of the entire claim data in 2012 [17], making the NDB data nearly exhaustive in terms of healthcare insurance claims. We used this NDB database to calculate hip fracture incidences by prefecture in Japan as well as to investigate the frequency of osteoporosis medication use, bone turnover marker level measurements, and bone mineral density (BMD) measurements in Japan.

Materials and methods

Data sources

We obtained data from the Nationwide Health Insurance Claims database of the Department of Health of the Ministry of Health, Labor and Welfare, Japan. We requested aggregated data in the tabular form from the NDB and then used the data tallied as crosstab data for each year from 2012 to 2015 for the analysis. These tables were cross-tabulated based on prefecture, sex, and 5-year age range to obtain medical practitioners' receipts for health insurance claims for individuals aged ≥ 40 years. These tables included the numbers of patients who experienced hip fractures, those who were prescribed medications for osteoporosis, those who had bone turnover marker level measurements performed, and those who had BMD measurements of the lumbar spine performed using dual-energy X-ray absorptiometry (DXA). The reason to obtain only BMD measurements at the lumbar spine as BMD measurement data was as follows. First, Japanese guidelines for prevention and treatment of osteoporosis stated that measurement of BMD at the lumbar spine and/or proximal femur by DXA was recommended as bone assessment [18]. Second, in Japan, National Health Insurance point for BMD measurement at the proximal femur can be charged only when the aforementioned measurement was performed at the same day when the BMD at the lumbar spine was measured. Therefore, under medical treatment covered by health insurance in Japan, BMD measurement at the proximal femur was performed almost always accompanied by BMD measurement at the lumbar spine. In addition, we used the crosstab data of the aforementioned patients who underwent measurements during the same year in which each patient suffered a hip fracture.

The Ethics Committee of the Kindai University Faculty of Medicine approved the study protocol. We included only crosstab data provided by the Ministry of Health, Labor and Welfare Insurance Bureau. These data were completely anonymous; thus, informed consent was not required.

Ascertaining the incidence of hip fractures

We defined patients who suffered hip fracture events as patients who received both hip fracture and hip operation codes in the same year in the present study (Online Resource 1). The Ministry of Health, Labor and Welfare Insurance Bureau evaluated patients with both hip fracture and operation codes during the same year as those with a single hip fracture event during that year (even if they experienced several hip fracture events in the same year).

Population data in Japan

To obtain the data from the Japanese population, we used census data from 2015, and the expected data for 2012–2014 obtained using the following formula:

$$N \text{ in } k = N \text{ in } 2010 + (N \text{ in } 2015 - N \text{ in } 2010) \times (k - 2010)/5$$

[N in k, age-specific population in the year k].

N in 2010 and 2015 were obtained via census data from the corresponding years. [19, 20].

Statistical analysis

We calculated the rates of age-standardized hip fracture incidence, osteoporosis prescriptions, bone turnover marker level measurements, and BMD measurements using census data from 2010 as a reference. We also used the 2010 world population data [21] to obtain comparable values for age-standardized hip fracture incidence rates from other countries. The trend analyses in the age-band specific fracture rates were performed using Poisson regression analysis with the year 2012–2015 as a dependent variable, the natural log of the number of age-band specific population as the offset variable, and the fracture number in each year as the independent variable. Further, we applied Bonferroni correction for the trend analysis on the age-band specific fracture. For this, we assessed each individual hypothesis at a significance level of 0.00192; this significance level was obtained by dividing 0.05 by 26, which is the number of hypotheses regarding the trends of male and female age-band specific fracture rates during 2012–2015. The trend analyses in the age-standardized fracture rates were also performed using Poisson regression analysis with a natural log of 1000,000 as the offset variable and the expected fracture number per 1000,000 as the independent variable. The annual change in age-standardized rates of osteoporosis prescriptions, bone turnover marker level measurements, and BMD measurements were calculated as follows. First, we estimated the changes in aforementioned rates per year by conducting linear regression analysis, in which the rate was used as the independent variable and the year 2012–2015 was used as the dependent variable. Then, we divided the regression coefficient value by the mean rate for each year from 2012 to 2015. Then, using the below mentioned formula, we calculated the standardized claim-data ratio (SCR) to describe the rates in each prefecture in Japan as follows:

$$\begin{aligned}\mathrm{SCR} = {} & 100 \times \text{the number of events in each prefecture} \\ & /\textstyle\sum(\text{5-year age range-specific population in each prefecture} \\ & \times \text{the event rate in each 5-year age range-specific population in Japan})\end{aligned}$$

Results

Hip fracture incidence rates of hip fractures are presented in Table 1. The fracture risk according to the 5-year age bands increased by approximately 1.5–2 times in males and females aged ≥ 70 years (Table 1). In males, four age bands had a significant increase (65–69, 85–89, 90–94, and 95–99 years) with the remainder showing no change. For females, three age bands had a significant increase (65–69, 90–94, and 95–99 years) and two with a significant decrease (75–79 and 80–84 years) with the remainder showing no change. Regarding the sex difference about the trend of incidence rates of the 5-year age bands, the fracture risk in subjects aged 75–84 years did not change significantly in males and decreased in females in the 2011–2015 study period, and the fracture risk in subjects aged 85–89 years increased in males and indicated no significant increase in females (Table 1).

Frequency of hip fractures, osteoporosis prescriptions, bone turnover marker level measurements, and BMD measurements from 2012 to 2015

The age-standardized rates of hip fractures, osteoporosis prescriptions, bone turnover marker level measurements, and BMD measurements are presented in Fig. 1. During 2012 and 2015, hip fracture rates indicated no change among females but a slight increase among males, as shown in Table 1 and Fig. 1a (p values for trend in females and males were p = 0.993 and p = 0.009, respectively). Regarding BMD measurements during 2012 and 2015, a clear increase can be seen in Fig. 1d (the annual percentage change in females and males with p value for trend was 13.8% with p = 0.002 and 14.8% with p = 0.004, respectively). In addition, some osteoporosis prescription increases are evident in Fig. 1b (the annual percentage change in females and males with p value for trend was 2.2% with p = 0.004 and 3.5% with p = 0.051), as well as increases in bone turnover marker level measurements in Fig. 1c (the annual percentage change in females and males with p value for trend was 7.5% with p = 0.013 and 7.8% with p = 0.010). Females/males ratios of the rates were 3.41 (95% CI, 3.36–3.46) for hip fractures (Fig. 1a), 7.13 (95% CI, 7.11–7.15) for osteoporosis prescriptions (Fig. 1b), 7.15 (95% CI, 7.10–7.20) for bone turnover marker level measurements (Fig. 1c), and 5.43 (95% CI, 5.40–5.46) for BMD measurements (Fig. 1d) in 2015.

Distributions of hip fractures, osteoporosis prescriptions, bone turnover marker level measurements, and BMD measurements among the general population in each prefecture

The hip fracture SCRs in the western areas appeared to be higher than those in the eastern areas (Fig. 2). In males, the highest SCR was 144.3 in the Okinawa prefecture located in the west and the lowest SCR was 62.5 in the Akita prefecture located in the east (highest/lowest SCR ratios, 2.31 [95% CI, 2.19–2.43]). In females, the highest SCR value was 121.4 in the Hyogo prefecture located in

Table 1 Number of incidence and incidence of hip fracture, 2012–2015

	2012	2013	2014	2015	*p* value for trend
Male					
Number of incidence	27,802	29,264	30,982	31,761	
Incidence per 100,000, age					
40–44	4.1	5.0	4.5	4.3	0.868
45–49	6.2	6.2	7.2	7.0	0.056
50–54	8.7	9.3	9.9	10.3	0.015
55–59	14.6	14.2	14.7	15.3	0.342
60–64	25.9	25.1	25.3	24.2	0.143
65–69	38.6	38.4	40.8	45.2	< 0.001*
70–74	79.7	82.7	84.8	75.7	0.127
75–79	176.4	177.0	176.2	166.0	0.004
80–84	365.9	362.1	371.5	366.4	0.578
85–89	626.9	656.6	679.6	698.0	< 0.001*
90–94	856.7	908.4	998.0	1160.4	< 0.001*
95–99	1050.4	1064.9	1233.3	1740.3	< 0.001*
≥ 100	2083.6	1804.4	1726.1	1956.3	0.579
All ages (crude)	80.4	83.8	87.9	89.2	
Age-standardized incidence rates (per 100,000)					
All ages ≥ 40 years old	39.8	40.5	41.8	41.9	0.009
All ages ≥ 50 years old	62.4	63.2	65.2	65.4	0.002
Female					
Number of incidence	109,776	112,794	117,160	120,085	
Incidence per 100,000, age					
40–44	3.3	3.2	2.5	2.7	0.036
45–49	4.7	5.4	5.4	4.9	0.710
50–54	11.7	11.7	12.6	13.6	0.007
55–59	23.5	24.9	24.5	24.0	0.705
60–64	47.9	47.6	47.6	46.9	0.502
65–69	71.0	71.6	79.8	83.9	< 0.001*
70–74	162.0	164.3	170.4	158.1	0.483
75–79	404.7	390.0	380.2	362.2	< 0.001*
80–84	880.3	873.1	864.0	851.1	< 0.001*
85–89	1603.8	1607.3	1616.9	1580.2	0.112
90–94	2290.3	2291.9	2359.1	2466.0	< 0.001*
95–99	2272.9	2264.8	2435.2	2961.7	< 0.001*
≥ 100	2207.3	2379.3	2452.7	2471.0	0.007
All ages (crude)	280.9	286.1	294.5	299.0	
Age-standardized incidence (per 100,000)					
All ages ≥ 40 years old	118.8	118.5	119.5	118.5	0.993
All ages ≥ 50 years old	185.4	184.7	186.5	185.0	0.920

p value for trend analysis about fracture rates in 2012–2015 was obtained using Poisson regression analysis. Bonferroni correction was applied for the trend analysis regarding the age-band specific fracture

*The *p* value is smaller than the significance level of 0.00192 obtained by dividing 0.05 by 26. Age-standardized rates were estimated using population obtained from 2010 World Population Prospects from United Nations in each 5-year age group [20]

the west and the lowest was 65.0 in the Akita prefecture located in the east (highest/lowest SCR ratios, 1.87 [95% CI, 1.81–1.93]). We observed a similar distribution in hip fractures from 2012 to 2014, although the east–west regional differences might show a tendency to decrease from 2012 to 2015 (Fig. 2, Online Resource 2).

Fig. 1 Age-standardized rate during 2012–2015 of **a** hip fracture incidence, **b** osteoporosis prescriptions, **c** bone turnover marker level measurements, and **d** BMD measurements at the lumbar spine using dual-energy X-ray absorptiometry. BMD: bone mineral density. Age-standardized rates were estimated across 5-year age interval groups of individuals aged ≥ 40 years using data obtained from the 2010 census of Japan [18]

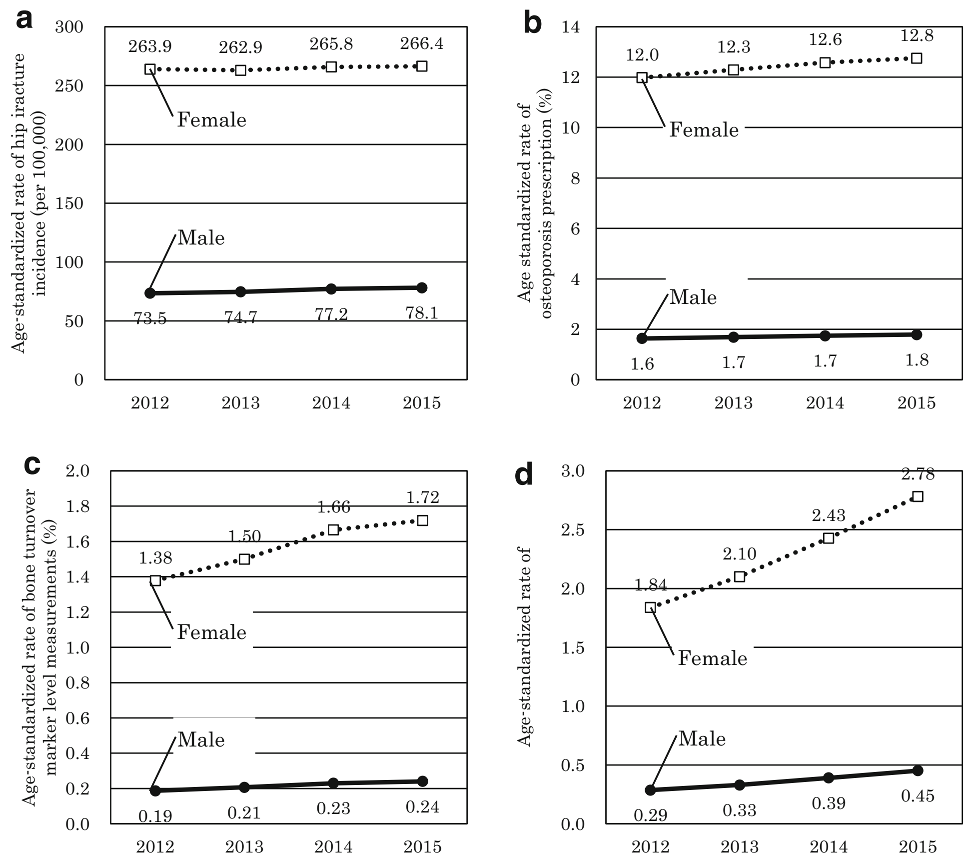

Figure 3 shows the SCR distribution of prescriptions, bone turnover marker level measurements, and BMD measurements among the general population in 2015. There were tendencies toward higher SCRs in the western areas among males and higher SCRs in Tohoku in the eastern areas among females, in terms of the distribution of prescriptions from 2012 to 2015 (Fig. 3a, Online Resource 3). We observed higher SCRs for the distribution of bone turnover marker level measurements located in the eastern areas of Tohoku and Hokkaido for both males and females from 2012 to 2015 (Fig. 3b, Online Resource 3). There was a tendency toward higher SCRs in the eastern areas of Hokkaido regarding the distribution of BMD measurements among males and females (Fig. 3c, Online Resource 3).

Distribution of hip fracture, osteoporosis prescriptions, bone turnover marker level measurements, and BMD measurements among patients with hip fractures in each prefecture

Regarding the distribution of osteoporosis prescriptions among patients with hip fractures, we found relatively high SCRs in the eastern areas in females (Fig. 4a), in which tendency was also recognized in 2012–2014 (data not shown). The tendencies for the distributions of osteoporosis prescriptions varied in males by year in 2015 (Fig. 4a) and in 2012–2014 (data not shown). No clear tendencies for SCR distributions in terms of bone turnover marker level or BMD measurements were observed in 2015 (Fig. 4b, c) or in 2012–2014 (data not shown).

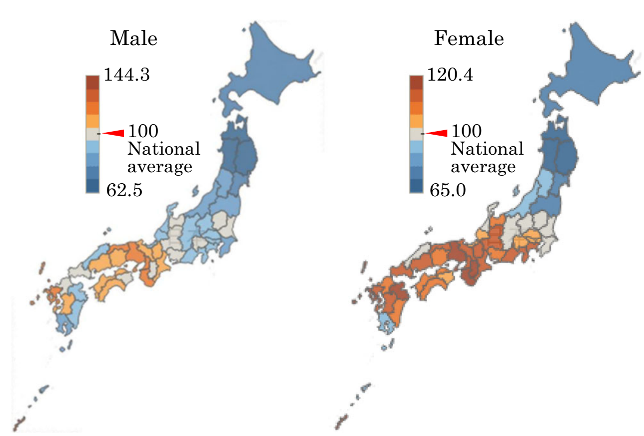

Fig. 2 Standardized claim data ratio of hip fracture incidence by prefecture in 2015

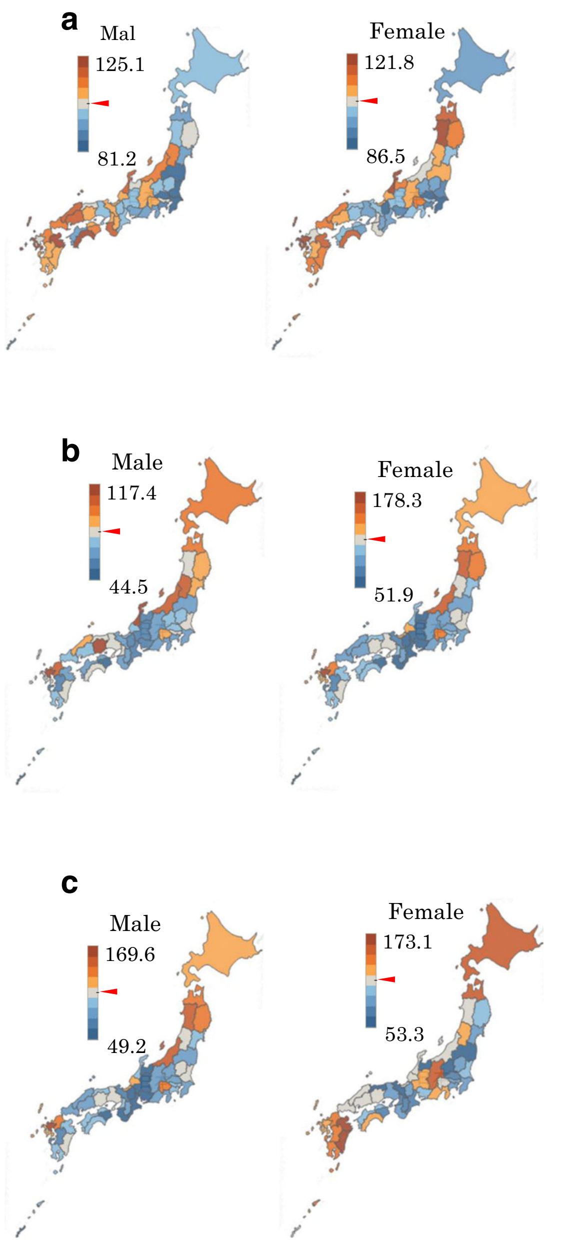

Fig. 3 Standardized claim data ratio of **a** osteoporosis prescriptions, **b** bone turnover marker level measurements, and **c** bone mineral density measurements at the lumbar spine using dual-energy X-ray absorptiometry in the general population by prefecture in 2015. Arrow indicated National average of 100

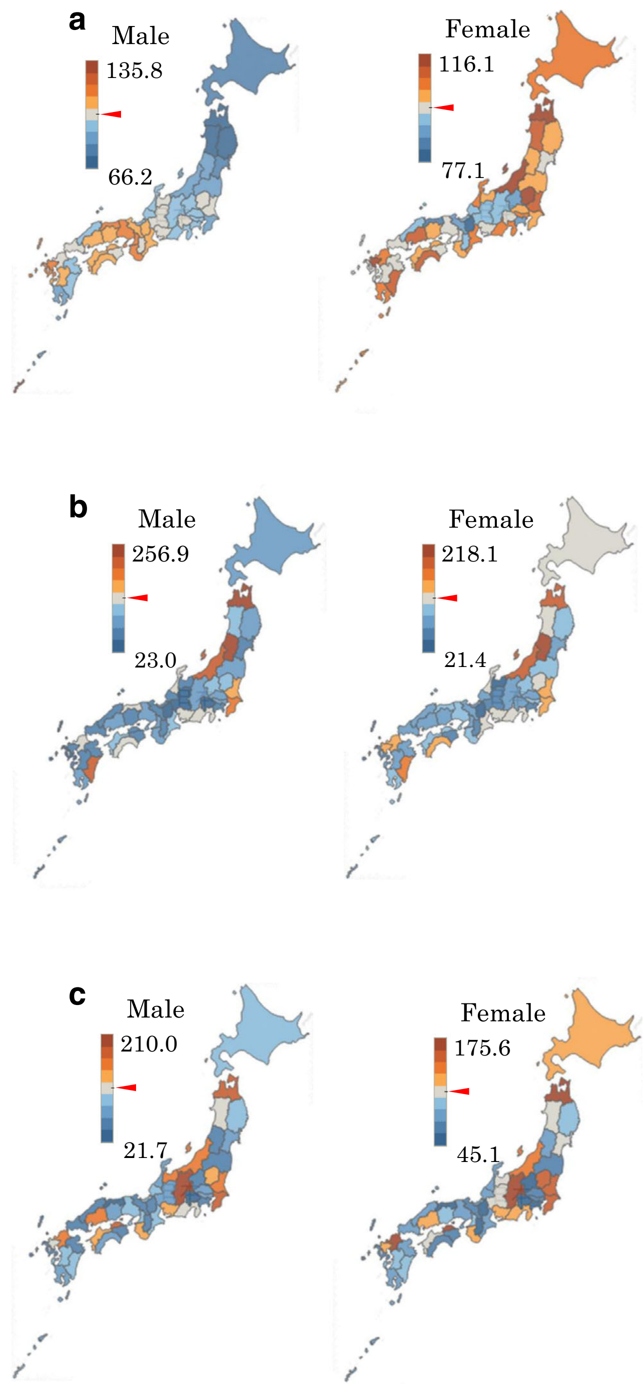

Fig. 4 Standardized claim data ratio of **a** osteoporosis prescriptions, **b** bone turnover marker level measurements, and **c** bone mineral density measurements at the lumbar spine using X-ray absorptiometry in patients with hip fracture by prefecture in 2015. Arrow indicated National average of 100

Discussion

To the best of our knowledge, this is the first exhaustive study on hip fractures conducted using the national health insurance receipt data from the National Database in Japan. The expected age-standardized hip fracture rates from 2012 to 2015 indicated no statistically significant change in females and significant increase in males. Regional differences in hip fracture rates in Japan were also found. The frequency of osteoporosis prescriptions, bone turnover marker level measurements, and BMD measurements in the general population in the corresponding period increased with statistical significance or marginal significance in females and males.

A major advantage of the present study was the use of the Nationwide Health Insurance Claims database of the Department of Health of the Ministry of Health, Labor and

Welfare, Japan. Given that nearly all claim data (98%) had been entered into the database in Japan in 2012 [17], the findings obtained from the NDB have significant external validity regarding insurance-covered healthcare services provided in Japan. In addition, the study conducted by the Japanese Orthopedic Association in 2016, wherein questionnaires were mailed to 2647 medical orthopedic institutions (response rate, 70%), indicated that 94.8% of 9370 patients with hip fractures (mean age, 82 years) underwent surgery. Thus, it would be expected that we could collect data on almost all hip fractures in Japan for the present study.

Our findings corroborate with those of a previous study conducted using nationwide hospital- and clinic-based surveys [11]. However, the number of hip fracture events (137,600 in 2012, according to our findings) was approximately 20% less than that reported by Orimo et al., which was 175,700 in 2012 [11]. A possible reason for this difference is that we may have missed the recurrence of a hip fracture if it occurred in the same year as the first hip fracture event, because multiple fracture events in the same year were considered one single event. In contrast, Orimo et al. obtained data via mail questionnaires sent to approximately 4165 medical institutions among the 7201 medical institutions in 2012 [11]; the response rate was 63% [11], which might have led to an overestimation of hip fracture incidences because nationwide incidences were estimated based on the assumption that patients with hip fracture were equally likely to be seen at institutions that did or did not respond to the questionnaires. Our findings indicate no significant change in females and slight increase in males regarding hip fracture incidence, and a clear increase in DXA measurements in 2012–2015. We cannot conclude whether the increase in DXA measurements affected the stability trend of hip fracture incidences, as ours was an ecological study. A future study using data merged with personal levels obtained by NDB could address this issue.

The age-standardized hip fracture rates (per 100,000) in males and females aged ≥ 50 years in Japan in 2012 were in the ranges of 62.4–93.9 and 185.4–259.1, respectively. The lower values were obtained in the present study and the higher values were obtained in the study conducted by Orimo et al. [11] using the 2010 world population [21] as reference. The age-standardized hip fracture rate per 100,000 in Japan in 2012 was lower than that in Taiwan in 2012 (201.6 in males and 358.2 in females) [10], and that in South Korea in 2001 and 2004 (176 in males and 268 in females) [7, 22] where the age-standardized rates increased from 2005 to 2008 [23].

Since 2007, there has been a tendency in the annual changes in age-standardized incidence rates in Japan to indicate no change; the data are as follows 0.1% in men and − 0.4% in women during 2007–2012 according to Orimo et al. [11]. We found an increase in age-standardized incidence rates among males, and no similar trend for females. The fracture risks by 5-year age band increased approximately by 1.5–2 times in males and females aged 70 years or older. The fracture risk decreased in females aged 75–84 years and no significant increase in females aged 85–89 years during 2012–2015, and no similar trend for males. The percent of expected fractures in subjects aged 75–84 years were 52% for males and 53% for females, respectively, in the expected fracture numbers in subjects aged ≥ 75 years in 2015, using 2010 World Population from UN as a reference population [21]. Those aged 85–89 years included 27% of males and 28% of females in 2015. We speculate that these sex-based differences are not attributable to life expectancy extension over the 2012–2015 period, as the extension in that period is almost the same in males and females (0.25 and 0.24 years, respectively) [24]. One possible reason for the lack of significant increases in fracture risk in females aged 75–89 years may be because of their frequent use of bisphosphonates, as has been recognized for females in Australia [25] and Norway [26].

The present study and the previous report [11] have indicated higher rates of hip fractures in western areas than in eastern areas of Japan. The highest SCRs in the western prefectures were two times higher than those in the eastern prefectures for both males and females. The prefecture with the lowest hip fracture SCRs in 2015 was the Akita prefecture located in the west, with a life expectancy positioned in the lowest 10th percentile in Japan [24]. Thus, the risk of cancer and heart diseases which affect as competing risks in Japan [24] may cause lower hip fracture SCR values in Akita. On the other hand, the 2015 hip fracture SCR values in males and females in Nagano prefecture (who possess one of the highest life expectancies in Japan) were 93, 96, nearly identical to the national average (100). The 2015 fracture SCR values in males and females in Osaka located in the west were 118, 113, higher than National average. Among these individuals, life expectancy was 10th from the bottom of the 47 prefectures in Japan [24]. Thus, the life expectancy distribution in prefectures would not completely explain the fracture SCR distribution.

The one potential factor related to regional differences in hip fracture distributions is food and nutrient intake. It is reported that greater milk intake is associated with higher bone density and higher bone microarchitecture index in males in Japan [27], where average dietary calcium intake, 530 mg/day, is lower than that in western countries as reported by International Osteoporosis Foundation in 2017 [28]. However, according to a survey conducted by the Statistics Bureau in Japan [29], expenditures on milk and dairy products per household in the prefectures were not related with SCRs of hip fractures ($r = -0.126$; $p = 0.398$ in males, $r = -0.068$; $p = 0.651$ in females). In contrast, expenditures for natto per household in the western areas appeared to be lower than those in the eastern areas of Japan [29]. Higher expenditures for natto were significantly related to lower hip fracture SCRs

(Spearman's correlation coefficient [r] = − 0.737; $p < 0.001$ in males, $r = -0.712$; $p < 0.001$ in females, Online Resource 4). Habitual natto intake, which contains high vitamin K, may prevent loss of bone mineral density, according to a cross-sectional study of Japanese elderly males [30] and a longitudinal study of Japanese females [31]. A meta-analysis of observational studies indicated that higher intake of dietary vitamin K was associated with decreased fracture risk [32]. However, we admitted that this is only our speculation as based on an ecological study, and we should clarify the relation between natto intake and fracture risks in an individual level longitudinal study.

In our analysis, we observed evident increases in BMD and bone turnover marker levels and some increases in osteoporosis prescription from 2012 to 2015. On the other hand, the incidence rates of hip fracture indicated no significant decrease in females and males. A lack of significant decreased trends of fracture in Japan could possibly be attributed to the low prescription rates for osteoporosis and low rate of therapy adherence [33]. Approximately 70% of the patients with hip fractures have never been diagnosed with osteoporosis [34]. In addition, less than 20% of patients with hip fractures were prescribed osteoporosis medication at discharge as reported by the multiple hospital-based surveys in 2006–2007 in Japan [34]. In addition, Central DXA (spine or hip) was used in 14% and quantitative ultrasound was used in 43% of the 18,422 institutions in 2011 in Japan [35]. While Central DXA was available in 70% of university hospitals and in 30% of general hospitals, it was available only in 6% of clinics in 2006 in Japan [36]. Thus, we believe that the use of DXA in our study reflects the use by university and general hospitals for measurement of bone mass, which suggests the absence of an association between fracture incidences and the DXA measurements in the present findings.

This study has some limitations. First, in terms of the national health insurance claim data, the location of the medical institution which the patient consulted was collected as the location data. Therefore, there could have been a misclassification of the patient's residential prefecture. However, this limitation is probably not sufficient to influence our findings. Second, we do not know whether the osteoporosis prescriptions were provided and if the bone turnover marker level and BMD measurements were performed before or after the occurrence of hip fracture. The number of times of prescription, the type of medication prescribed, and the number of measurements performed were unknown. Third, only the receipt code for BMD measurements at the lumbar spine by DXA was tabulated as the quantitative bone measurement. In municipalities in Japan, quantitative bone ultrasound and not DXA is the most commonly used osteoporosis screening method [37]. We recognize that the bone mass measurement rate in the present findings is not a representative of the bone mass measurement rate in Japan. Finally, the present study is an ecological study and could not demonstrate any causal relationships, including the relationships between the incidence of hip fractures and measurement of bone turnover marker levels, osteoporosis prescription, or the measurements of bone turnover marker levels and BMD. Thus, we should conduct the study with NDB data merged by personal levels in the future.

Conclusions

The findings from the national health receipt data from the National Database show that the incidence of hip fractures from 2012 to 2015 indicated no significant change in females and significant increase in males in Japan. The Regional differences in the hip fracture incidence, consisting of higher rates in the western areas than in the eastern areas, were observed. Regarding the frequency of osteoporosis prescriptions, bone turnover marker level measurements, and BMD measurements, they tended to increase in the general population from 2012 to 2015.

Compliance with ethical standards

The Ethics Committee of the Kindai University Faculty of Medicine approved the study protocol. We included only crosstab data provided by the Ministry of Health, Labor and Welfare Insurance Bureau. These data were completely anonymous; thus, informed consent was not required.

Conflict of interest None.

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