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ORIGINAL ARTICLE

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The national burdens of rheumatoid arthritis and osteoarthritis in Japan: projections to the year 2010, with future changes in severity distribution

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Abstract We projected the national burdens of rheumatoid arthritis (RA) and osteoarthritis (OA) in Japan in the year 2010, together with future changes in severity distribution. The age-, sex-, and in/outpatient-specific prevalence rates of RA and OA from the 1999 National Patient Survey were multiplied by the National Census population projections for 2000 and 2010. The years lived with disability (YLD) of RA or OA in 2010 were adjusted for the projected changes in the summed measure of severity distribution (i.e., the sum products of the percentage distribution and the health-related quality of life score for three severity classes) using the corresponding regression equations. Between 2000 and 2010, the numbers of patients with RA and OA in Japan will increase by 14% (from 0.31 million to 0.36 million) and 27% (from 0.77million to 0.98 million), respectively, and accordingly, the YLD of RA and OA will increase by 3% (from 42.8 to 43.6 per 100000) and 21% (from 65.8 to 79.1 per 100000), respectively. Because of the decreasing proportion of severely affected patients, the increase in YLD may be smaller compared with the increase in the number of patients. As in other developed countries, the national burdens of RA and OA in Japan will increase between 2000 and 2010. However, any projection is likely to be an overestimate unless it considers future changes in the severity distribution associated with medical progress.

Key words Burden of disease · Epidemiology · Osteoarthritis (OA) · Projection · Rheumatoid arthritis (RA)

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Introduction

Arthritis is one of the most prevalent chronic conditions in developed countries. According to the 2001 Japanese National Life Survey, those who describe one or more of the arthritis-related symptoms, including pain, numbness, and stiffness in hands and feet, account for 9%–16% of the elderly population, and 3%–6% of the total population.[1] To improve the health-related quality of life of the population, strategies for the prevention and control of arthritis are required. Reliable information on the burden of arthritis will allow the development of more effective strategies in relation to ethnic, geographic, and socioeconomic backgrounds.

The disability-adjusted life year (DALY) is often used to quantify the burden of disease in a population.[2] A DALY is equivalent to a lost year of healthy life due to premature mortality or disability. Years lived with disability (YLD) is the disability component of DALY. It is defined in terms of incidence multiplied by duration and disability weight. According to the Global Burden of Disease methodology,[2] each disease has a single specific value of disability weight. In the particular case of arthritis, including rheumatoid arthritis (RA) and osteoarthritis (OA), there is concern about whether such a disability weight can integrate the wide range of disabilities[3] and the health-related quality of life[3–5] associated with severity classes. Moreover, the severity distribution may change with medical progress. The projected burden of disease should reflect future changes in severity distribution. In the present study, we project the national burdens of RA and OA in Japan in the year 2010, in terms of YLD, together with future changes in severity distribution.

Methods

Projections of prevalence rates

The age-, sex-, and in/outpatient-specific prevalence rates of RA (ICD-10 categories M05–M06) and OA (ICD-10 cat-

Table 1. Age-, sex-, and in/outpatient-specific prevalence rates (per 1000) of RA and OA in Japan, the 1999 National Patient Survey

	Age group (years)								Total
	0–14	15–24	25–34	35–44	45–54	55–64	65–74	75–	
RA									
Inpatients									
Total	0.00	0.00	0.00	0.01	0.04	0.11	0.25	0.48	0.08
Men	0.00	0.00	0.00	0.00	0.01	0.04	0.09	0.13	0.02
Women	0.00	0.00	0.00	0.01	0.06	0.19	0.39	0.67	0.13
Outpatients									
Total	0.00	0.06	0.27	0.94	2.81	5.39	6.53	5.75	2.33
Men	0.00	0.00	0.00	0.25	1.23	2.44	3.33	2.90	0.99
Women	0.00	0.12	0.55	1.64	4.39	8.19	9.26	7.29	3.62
Total									
Total	0.00	0.06	0.27	0.95	2.85	5.51	6.78	6.24	2.42
Men	0.00	0.00	0.00	0.25	1.25	2.48	3.42	3.03	1.02
Women	0.00	0.12	0.55	1.66	4.45	8.38	9.65	7.96	3.75
OA									
Inpatients									
Total	0.00	0.01	0.01	0.02	0.05	0.11	0.34	0.67	0.11
Men	0.00	0.00	0.00	0.00	0.02	0.05	0.12	0.24	0.04
Women	0.00	0.01	0.02	0.04	0.08	0.18	0.53	0.89	0.18
Outpatients									
Total	0.00	0.11	0.15	0.68	2.02	6.84	22.99	32.40	5.81
Men	0.00	0.00	0.11	0.38	0.71	3.05	10.99	19.32	2.58
Women	0.00	0.12	0.20	0.98	3.23	10.57	33.11	39.25	8.89
Total									
Total	0.00	0.12	0.16	0.70	2.07	6.96	23.33	33.07	5.91
Men	0.00	0.00	0.11	0.38	0.73	3.10	11.11	19.55	2.61
Women	0.00	0.12	0.22	1.02	3.31	10.74	33.64	40.14	9.07

RA, rheumatoid arthritis; OA, osteoarthritis
RA and OA were defined by the ICD-10 categories of M05–M06 and M15–M19, respectively

egories M15–M19) were derived from the 1999 National Patient Survey.[6] These prevalence rates are shown in Table 1. To project the number of patients with RA and OA in 2000 and 2010, these prevalence rates were multiplied by the corresponding age- and sex-specific population projections for 2000 and 2010 from the National Institute of Population and Social Security Research.[7]

Projections of changes in severity distribution

A questionnaire survey on RA and OA was conducted with the Japan Rheumatism Foundation registered rheumatologists in December 2001. Details of the survey results have been described elsewhere.[8,9] The questionnaire asked about (1) the severity distribution in 1990 and 2000, and (2) the health-related quality of life, including six items related to physical functions, seven items related to daily living activities, and three items related to social activities. The health-related quality of life was scored between 0 (best) and 16 (worst) by adding up the values of 0 (high), 0.5 (medium), or 1 (low) for each of the 16 items.[8,9] A summed measure of severity distribution was defined in terms of the percentage distribution of three severity classes (A, those who did not need hospital care; B, those who were in need of inactive hospital care; C, those who were in need of active hospital care) together with the health-related quality of life score.[8,9] For RA, the three severity classes A, B, and C were scored 2.9, 7.6, and 11.4, respectively. In 1990, these three severity classes accounted for 72.3%, 16.1%, and 11.6%, respectively, and the summed measures of severity distribution were $2.9 \times 0.723 + 7.6 \times 0.161 + 11.4 \times 0.116 = 4.643$.[8,9] For OA, the three severity classes A, B, and C were scored 1.7, 5.2, and 8.1, respectively. In 1990, these three severity classes accounted for 82.9%, 9.5%, and 7.6%, respectively, and the summed measures of severity distribution were $1.7 \times 0.829 + 5.2 \times 0.095 + 8.1 \times 0.076 = 2.519$.[8,9] The change in the summed measure of severity distribution between 1990 and 2000 was extrapolated to its projected value in 2010. Accordingly, the summed measures of severity distribution in 2000 and 2010 were estimated at 4.201 and 3.759, respectively, for RA, and at 2.398 and 2.277, respectively, for OA (see Results section).

Projections of YLD

The YLD were calculated as the sum products of the number of patients and their disability weights,[2] without using a time-discount and an age-weight. There are arguments both for and against the time-discounting and age-weighting health outcomes, so we avoided those processes. The YLD in 2010 were adjusted for the projected changes in the summed measure of severity distribution using the following regression equations: for RA, adjusted YLD = crude YLD $\times$ 4.201/3.759; for OA, adjusted YLD = crude YLD $\times$ 2.398/2.277. YLD per 100 000 were calculated as the YLD divided by the population projections at the time.

Table 2. Projected numbers of patients and prevalence rates (per 1000) for RA in Japan, 2000 and 2010

	Age group (years)								Total	(Prevalence rate)
	0–14	15–24	25–34	35–44	45–54	55–64	65–74	75–		
Year 2000										
Inpatients										
Total	0	0	0	159	774	1812	3252	4320	10316	(0.08)
Men	0	0	0	0	97	322	543	415	1376	(0.02)
Women	0	0	0	79	581	1602	2722	3889	8872	(0.14)
Outpatients										
Total	0	955	5013	14960	54396	88773	84936	51744	300777	(2.37)
Men	0	0	0	2005	11904	19618	20073	9266	62865	(1.01)
Women	0	932	5041	12948	42495	69042	64626	42311	237394	(3.67)
Total										
Total	0	955	5013	15119	55170	90750	88187	56154	311348	(2.46)
Men	0	0	0	2005	12098	19939	20616	9681	64338	(1.04)
Women	0	932	5041	13106	43076	70643	67347	46200	246345	(3.81)
Year 2010										
Inpatients										
Total	0	0	0	186	626	2037	3736	6620	13204	(0.10)
Men	0	0	0	0	78	363	627	677	1744	(0.03)
Women	0	0	0	92	471	1796	3112	5755	11226	(0.17)
Outpatients										
Total	0	762	4382	17452	43982	99812	97571	79304	343265	(2.69)
Men	0	0	0	2334	9599	22119	23187	15092	72329	(1.17)
Women	0	742	4366	15139	34457	77420	73886	62614	268624	(4.10)
Total										
Total	0	762	4382	17638	44608	102034	101307	86062	356793	(2.80)
Men	0	0	0	2334	9755	22481	23813	15768	74151	(1.20)
Women	0	742	4366	15323	34928	79216	76997	68368	279942	(4.27)

RA, rheumatoid arthritis

The age-, sex-, and in/outpatient-specific prevalence rates in Table 1 were multiplied by the corresponding age- and sex-specific population projections from the National Institute of Population and Social Security Research

Results

The projected numbers of patients with RA in Japan are shown in Table 2, together with the projected prevalence rates. In 2000, 0.31 million Japanese suffered from RA. Of these, 79% were women and 3.3% were hospitalized. By 2010, the number of patients with RA is projected to increase by 14% and reach 0.36 million. Note that this projection implies an increase in the prevalence rate (per 1000) from 2.46 in 2000 to 2.80 in 2010. The largest increase in the number of patients will be observed in the oldest age group, i.e., 75 years and older (+53%; +63% in men and +48% in women), but the age groups of 55–64 years and 65–74 years will still contain the most patients.

The projected numbers of patients with OA in Japan are shown in Table 3, together with the projected prevalence rates. In 2000, 0.77 million Japanese suffered from OA. Of these, 78% were women and 1.8% were hospitalized. By 2010, the number of patients with OA is projected to increase by 27% and reach 0.98 million. Note that this projection implies an increase in the prevalence rate (per 1000) from 6.05 in 2000 to 7.71 in 2010. The largest increase in the number of patients will be observed in the oldest age group, i.e., 75 years and older (+53%; +63% in men and +48% in women), and this age group will contain the largest number of patients.

The projected percentage distributions of the three severity classes of RA and OA in Japan are shown in Table 4. The percentage in the low-severity class (A) is projected to increase, while the percentages in the higher-severity classes (B and C) are projected to decrease: the 2010 projections indicate a 9% increase in A, a 31% decrease in B, and a 36% decrease in C for RA, and a 3% increase in A, a 27% decrease in B, and a 12% decrease in C for OA above the 2000 level. The summed measures of severity distribution (i.e., the sum products of the percentage distribution and the health-related quality of life score for the three severity classes) are estimated at 4.201 in 2000 and 3.759 in 2010 for RA, and 2.398 in 2000 and 2.277 in 2010 for OA.

The projected YLD of RA and OA in Japan are shown in Table 5. After adjusting for the projected changes in severity distribution, the YLD of RA are projected to increase by 3%, from 52174.6 (42.8 per 100000) in 2000 to 55550.1 (43.6 per 100000) in 2010; this projected increase in YLD is smaller than the projected increase in the number of patients (14%). On the other hand, the YLD of OA are projected to increase by 21%, from 83351.5 (65.8 per 100000) in 2000 to 100817.4 (79.1 per 100000) in 2010; this projected increase in YLD is slightly smaller than the projected increase in the number of patients (27%). In a comparison between the crude and adjusted YLD, the adjusted values are 11% lower than the crude values for RA, and 5% lower for OA.

Table 3. Projected numbers of patients and prevalence rates (per 1000) for OA in Japan, 2000 and 2010

	Age group (years)								Total	(Prevalence rate)
	0–14	15–24	25–34	35–44	45–54	55–64	65–74	75–		
Year 2000										
Inpatients										
Total	0	159	186	318	968	1812	4422	6029	13894	(0.11)
Men	0	0	0	0	194	402	723	767	2086	(0.03)
Women	0	78	183	316	774	1517	3699	5166	11733	(0.18)
Outpatients										
Total	0	1750	2785	10822	39103	112655	299031	291568	757714	(5.94)
Men	0	0	1034	3048	6871	24522	66248	61727	163450	(2.64)
Women	0	932	1833	7737	31266	89105	231075	227807	589755	(9.00)
Total										
Total	0	1909	2971	11141	40071	114631	303453	297597	771773	(6.05)
Men	0	0	1034	3048	7065	24924	66971	62462	165504	(2.67)
Women	0	932	2016	8053	32041	90538	234774	232973	601326	(9.17)
Year 2010										
Inpatients										
Total	0	127	162	371	783	2037	5080	9241	17801	(0.14)
Men	0	0	0	0	156	453	836	1249	2694	(0.04)
Women	0	62	159	369	628	1702	4229	7644	14792	(0.23)
Outpatients										
Total	0	1397	2434	12625	31617	126663	343517	446861	965114	(7.57)
Men	0	0	912	3547	5541	27648	76523	100541	214712	(3.47)
Women	0	742	1588	9046	25352	99918	264185	337118	737950	(11.26)
Total										
Total	0	1524	2597	12996	32400	128885	348597	456101	983100	(7.71)
Men	0	0	912	3547	5697	28102	77359	101738	217354	(3.51)
Women	0	742	1747	9416	25980	101525	268414	344762	752586	(11.48)

OA, osteoarthritis

The age-, sex-, and in/outpatient-specific prevalence rates in Table 1 were multiplied by the corresponding age- and sex-specific population projections from the National Institute of Population and Social Security Research

Table 4. Projected percentage distributions of three severity classes for RA and OA in Japan, 1990–2010. The 2001questionnaire survey with the Japan Rheumatism Foundation registered rheumatologists

Severity class	QOL[a]	Year		
		1990	2000	2010
RA				
A	2.9	72.3	79.2	86.1
B	7.6	16.1	12.3	8.5
C	11.4	11.6	8.5	5.4
OA				
A	1.7	82.9	85.7	88.5
B	5.2	9.5	7.5	5.5
C	8.1	7.6	6.8	6.0

RA, rheumatoid arthritis; OA, osteoarthritis

The three severity classes were defined as A (those who did not need hospital care), B (those who were in need of inactive hospital care), and C (those who were in need of active hospital care)

The change in the severity distribution between 1990 and 2000 was extrapolated to its projected value in 2010

[a] Health-related quality of life scored between 0 (best) and 16 (worst)

Discussion

This is the first study to measure the national burdens of RA and OA in Japan by YLD, and to show their projections to 2010 together with future changes in severity distribution. A YLD is equivalent to a lost year of healthy life due to disability.[2] The YLD projected in the present study indicate how much the Japanese are, or will be, deprived of their health-related quality of life by RA and OA.

We project that between 2000 and 2010, the numbers of patients with RA and OA in Japan will increase by 14% (from 0.31 million to 0.36 million) and 27% (from 0.77million to 0.98 million), respectively, and accordingly, the YLD of RA and OA will increase by 3% (from 42.8 to 43.6 per 100000) and 21% (from 65.8 to 79.1 per 100000), respectively. Because of the decreasing proportion of severely affected patients, the increase in YLD may be smaller compared with the increase in the number of patients.

The Global Burden of Disease methodology[2] provides a way to link information on disease occurrence to information on health outcomes, including premature death and disability. It has been used to assess the global burden of disease and injury,[10] to assess global health trends,[11] and to set global priorities for health research.[12] However, there are arguments for and against the disability weights used in YLD calculations. Is the single specific value of a disability weight adequate to describe the health state of all patients with the disease? Is the value suitable for every nation on every health level? It is known that patients with RA and OA show wide range of disabilities[3] and health-related quality of life,[3–5] which are associated with their severity classes. For local circumstances, the Dutch study[13] and the Australian study[14] estimated the disability weights for some severity classes of RA and OA. The YLD projected in the

Table 5. Projected YLD of RA and OA in Japan, 2000 and 2010

	Year			
	2000	2010		
		Crude (*C*)	Adjusted[a] (*A*)	Δ(*A*−*C*)
RA				
YLD				
Total	54174.6	62082.0	55550.1	−6531.9
Men	11194.8	12902.3	11544.8	−1357.5
Women	42864.0	48709.9	43585.0	−5124.9
YLD per 100000				
Total	42.8	48.7	43.6	−5.1
Men	18.1	20.8	18.6	−2.2
Women	66.2	74.3	66.5	−7.8
OA				
YLD				
Total	83351.5	106174.8	100817.4	−5357.4
Men	17874.4	23474.2	22289.8	−1184.4
Women	64943.2	81279.3	77178.0	−4101.3
YLD per 100000				
Total	65.8	83.3	79.1	−4.2
Men	28.8	37.9	36.0	−1.9
Women	100.3	124.0	117.8	−6.2

RA, rheumatoid arthritis; OA, osteoarthritis; YLD, years lived with disability
YLD were calculated as the sum products of the number of patients and their disability weights, without using a time-discount and an age-weight
YLD per 100000 were calculated as the YLD divided by the population projections at the time
[a] adjusted for projected changes in severity distribution (see Methods)

present study are derived from the disability weights estimated in the Global Burden of Disease Study,[2] but were adjusted for the percentage distribution and-health-related quality of life for three severity classes of RA and OA in Japan. Because of expected future changes in severity distribution, our projections are likely to be approximate. In a comparison between the crude and adjusted YLD, the adjusted values are 11% lower than the crude values for RA, and 5% lower for OA. This result indicates that any projection is likely to be an overestimate unless it considers future changes in severity distribution.[2]

Our projections are subject to several limitations. First, primary prevalence rates were derived from the National Patient Survey, which has been conducted annually by nationwide random sampling in hospitals. Because of the omission of untreated patients, the projected number of patients and the prevalence rates may be underestimated. However, a previous population survey showed similar prevalence rates of RA (2.5 per 1000 men and 3.0 per 1000 women).[15] We can find no comparable population-level data on prevalence rates for OA. Only elderly populations in rural communities have been studied, and different case definitions were used,[16–18] but otherwise the former study was similar.[19] Second, information on severity distribution and health-related quality of life was collected from a questionnaire survey answered by rheumatologists. However, we have confirmed the validity of the survey results.[8,9] Finally, the change in severity distribution between 1990 and 2000 was extrapolated to its projected value in 2010. Research to improve the prevention and treatment of arthritis, and measures to promote cost-effective prevention and treatment, may result in an even greater decrease in the proportions of severely affected patients. If, contrary to our expectation, the decrease in the proportions of severely affected patients is small, the YLD in 2010 will be close to the crude values given in Table 5.

As in other developed countries, the national burdens of RA and OA in Japan are expected to increase between 2000 and 2010. However, any projection is likely to be an overestimate unless it considers future changes in severity distribution associated with medical progress. Further studies may be required to project the overall burden of arthritis among both treated and untreated patients in Japan.

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