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Epidemiology of psoriasis and palmoplantar pustulosis: a nationwide study using the Japanese national claims database

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ABSTRACT

Objective: The primary objective was to estimate the national prevalence of psoriasis and palmoplantar pustulosis (PPP) in Japan. Secondary objectives were to determine (1) whether psoriasis and PPP disease activity varies by season, and (2) whether disease severity is associated with concurrent diabetes mellitus, hyperlipidaemia and hypertension.

Settings: Patients with a psoriasis or PPP diagnosis code between April 2010 and March 2011 were identified using a Japanese national database.

Participants: 565 903 patients with psoriasis or PPP were identified. No patient was excluded.

Primary and secondary outcome measures: National prevalence was calculated using census data. We estimated the difference in the proportion of patients who used healthcare services, as a proxy for disease activity, between the hot and cold seasons and the difference in the standardised prevalence of comorbidities between severe and mild disease. The measures were estimated separately for the two broad disease categories of psoriasis and PPP but not in all patients as planned because the two disease categories had major differences.

Results: The national prevalence of psoriasis and PPP was 0.34% (95% CI 0.34% to 0.34%) and 0.12% (0.12% to 0.12%), respectively. The difference in the proportion of patients who used healthcare services in the hot compared to the cold season was −0.3% (−0.5% to −0.1%) for psoriasis and 10.0% (9.8% to 10.3%) for PPP. The difference in the standardised prevalence between severe and mild psoriasis was 3.1% (2.7% to 3.4%), 3.2% (2.8% to 3.6%) and 5.1% (4.7% to 5.6%) for concurrent diabetes mellitus, hyperlipidaemia and hypertension, respectively. No significant difference in the prevalence of comorbidity was observed for PPP.

Conclusions: The national prevalence, seasonal variation in disease activity and prevalence of comorbidities in Japanese patients with psoriasis and PPP estimated in this descriptive study may be used as basic information for future studies.

Strengths and limitations of this study

- This study estimated the national prevalence of psoriasis and palmoplantar pustulosis (PPP) using a national database covering more than 90% of the Japanese population.
- Seasonal variation in the use of healthcare services (as a proxy for disease activity), as well as psoriasis and PPP treatments and the prevalence of concurrent diabetes mellitus, hyperlipidaemia and hypertension are also examined.
- The main limitation of the current study is that psoriasis and PPP diagnosis codes have not been validated.
- Psoriasis and PPP may have been misclassified by non-specialists, thus affecting our results.

INTRODUCTION

Psoriasis is a chronic immune-mediated disease affecting 2–4% of population in the USA and Europe,[1–3] but has a lower prevalence in Asian countries according to recent epidemiological studies.[4 5] The prevalence in Asia of palmoplantar pustulosis (PPP), first described as a variant of pustular psoriasis[6] and regarded as a rare disease in the West,[7] is not known.

Databases, including claims databases, have sometimes been used to study the epidemiology of diseases including psoriasis.[1 4] A Japanese universal multi-payer healthcare system covering most citizens was set up in 1961, while the Japanese national database of health insurance claims (JNDB) was only recently established by the Ministry of Health, Labour and Welfare. Since April 2009, the JNDB has collected data for all claims in electronic format. In 2011, the JNDB was made available on a trial basis for research and other secondary purposes. In this descriptive epidemiological study, we used JNDB data to estimate the national prevalence and some

relevant epidemiological characteristics (including seasonal variation in the use of healthcare services)[8] of psoriasis and PPP in the Japanese population.

MATERIALS AND METHODS

Acquisition of claims data

All patients assigned psoriasis or PPP diagnosis codes in outpatient or inpatient claims issued in electronic format between April 2010 and March 2011 were identified. Overall, 97.9% and 99.6% of claims issued from hospitals, 76.0% and 91.2% issued from clinics and 99.9% and 99.9% issued from community pharmacies from April 2010 to March 2011 were in electronic format. In August 2010, 89.5% of claims from clinics were already in electronic format.[9] We selected all standardised domestic diagnosis codes mapped to L400–L409 of the 10th Revision of the International Statistical Classification of Diseases and Related Health Problems (ICD-10) in the master table of diagnosis codes for claims in electronic format maintained by the Medical Information System Development Center, Tokyo, Japan. Two identifiers (ID1 and ID2) are assigned to all claims for each patient. These identifiers were created for the JNDB because social security numbers or other unique identifiers are not used in the Japanese healthcare system. ID1 is generated by encrypting the combination of health card number assigned by each insurer, and the patient's date of birth and sex, while ID2 is generated by encrypting the combination of name, date of birth and sex. ID1 may be useful for identifying a patient when their family name has changed (eg, on marriage), while ID2 may be useful for identifying a patient previously insured by a different company (eg, due to job change). Data on sex and age group (in 5-year intervals of 0–4, 5–9, …, 80–84, and 85 years of age or older) were collected. We obtained the diagnosis codes of concurrent diabetes mellitus, hyperlipidaemia and hypertension, the codes of drugs used to treat these conditions, and the codes of drugs and phototherapy used to treat psoriasis and PPP. In the Japanese health insurance system, only one outpatient claim and/or one inpatient claim from one hospital or clinic are issued for any one patient each month. Similarly, only one claim from one community pharmacy is issued for any one patient each month. We obtained the dates (year and month) of claims issued for the study subjects together with the diagnosis and treatment codes. We also collected information on the specialty of the hospital or clinic department mentioned in claims, although this information is not required for reimbursement and is often not available.

The study was approved by the ethics committee of the Graduate School and Faculty of Medicine, University of Tokyo in October 2011 (no. 3586).

Statistical analysis

The prevalence of psoriasis and PPP in Japan was estimated by dividing the number of patients with a psoriasis or PPP diagnosis code by the size of the population according to the census of October 2010. The normal approximation CI of the prevalence was also estimated. A total of 21 local diagnosis codes were classified into the following eight disease subclasses: (1) plaque psoriasis ('psoriasis vulgaris' (L400), 'psoriasis' (L409), 'psoriasis vulgaris of entire body' (L400), 'psoriasis of extremities' (L400), 'psoriasis vulgaris of extremities' (L400), 'psoriasis vulgaris of lower back' (L400) and 'plaque psoriasis' (L400)); (2) scalp psoriasis ('seborrheic psoriasis' (L400) and 'psoriasis vulgaris of scalp' (L400)); (3) guttate psoriasis (L404); (4) psoriatic arthritis ('psoriatic arthritis' (L405), 'psoriatic arthritis mutilans' (L405) and 'psoriatic spondylitis' (L405)); (5) pustular psoriasis ('pustular psoriasis' (L401), 'impetigo herpetiformis' (L401), 'acrodermatitis continua' (L402), 'generalised pustular psoriasis' (L401) and 'acute generalised pustular psoriasis' (L401)); (6) erythrodermic psoriasis (L408); (7) palmoplantar pustulosis (L403); and (8) pustulotic arthro-osteitis (PAO) (L403). Patients were further broadly classified into 'patients with PPP' when they had a diagnosis code of PPP or PAO but no other diagnosis code. Otherwise, patients were classified into 'patients with psoriasis'. These two broad disease categories were used on an ad hoc basis because the number of patients with PPP was much larger than expected and the patients in the two disease categories were found to have several important differences. We used the midpoint of the 5-year interval (eg, 37 years old for age group 35–39) to calculate average age.

To estimate seasonal variation in the use of healthcare services for psoriasis and PPP, as a proxy for disease activity, we counted the number of patients in each month during the 12-month observation period for whom an outpatient or inpatient claim with psoriasis or PPP diagnosis code was issued. Patients were then divided into four groups according to the combination of two dummy variables, X and Y, where the values were assigned as follows: X=1 if the patient used healthcare services for psoriasis or PPP in the hottest season (July or August 2010), while X=0 otherwise; and Y=1 if the patient used healthcare services in the coldest season (January or February, 2011), while Y=0 otherwise. We estimated the difference (and its 95% CI) between the mean of X (the proportion of patients who used the service in the hottest season) and the mean of Y (the proportion of patients who used the service in the coldest season) and the difference was tested by the paired t test.

Treatments for psoriasis and PPP were classified as systemic therapy (adalimumab, infliximab, ustekinumab, methotrexate, ciclosporin and etretinate), phototherapy and topical therapy (topical vitamin D and topical corticosteroid). To determine the distribution of treatments for psoriasis and PPP, the number of patients receiving each treatment was counted, and the proportion of males and the average age were calculated for each treatment group. In addition, for each therapy, the

proportion of patients with psoriatic arthropathy in the broad category of psoriasis and with PAO in the broad category of PPP was calculated to determine which treatment was preferred for patients with arthropathy.

To examine whether concurrent diabetes mellitus, hyperlipidaemia and hypertension are more frequent in patients with severe psoriasis and PPP, treatment for psoriasis and PPP was used as a surrogate for psoriasis and PPP severity. Patients were subdivided into severity classes I–IV: patients receiving one or more systemic therapies (class I); patients receiving phototherapy but no systemic therapy (class II); patients receiving topical therapy only (class III); and patients receiving no treatment for psoriasis or PPP (class IV). Patients were determined to have diabetes mellitus if they had a diabetes mellitus diagnosis code in at least one claim as well as codes for antidiabetic drugs in claims issued in two or more months during the 12-month observation period. Similarly, patients were defined as having hyperlipidaemia and hypertension, respectively, if they had a related diagnosis code in at least one claim as well as codes for drug treatments (ie, lipid-lowering drugs and anti-hypertensive drugs, respectively) in claims issued in two or more months. The prevalence of diabetes mellitus, hyperlipidaemia and hypertension in each psoriasis and PPP severity class was standardised to the distribution of age and sex in the entire study population. Differences in the standardised prevalence and its 95% CI were estimated using severity class III as reference. The standard textbook[10] was used to calculate the difference in the standardised prevalence and its 95% CI (see equation (15–4) and the 'parallel formula' to equation (15–10), respectively, in reference [10]).

To determine who provided the healthcare service, we obtained the specialty of the department connected to a claim with a psoriasis or PPP diagnosis code. Patients were subdivided into the following three department subgroups: (A) 'dermatology or rheumatology patients' when the department was specified as either dermatology or rheumatology in at least one claim with a psoriasis or PPP diagnosis code; (B) 'patients of an other specialty' when the department was specified as other specialty in at least one claim but not as dermatology or rheumatology in any claim; and (C) 'patients of a department not specified' when the department was not specified in any claim. Demographic and other characteristics of patients with psoriasis and PPP examined in each of the three department subgroups are shown in the online supplementary tables.

All statistical analyses were conducted using SAS (V.9.3, SAS Institute, Cary, North Carolina, USA).

RESULTS

Prevalence of psoriasis and PPP, and demographic characteristics of patients

We identified 565 903 patients with psoriasis or PPP from a total of 681 827 ID1s and 778 767 ID2s assuming that identical ID1 and ID2 pairs represented the same patient. As the total population in the October 2010 census was 128 million, 565 903 represents a prevalence of 0.44% (95% CI 0.44% to 0.44%). The 565 903 patients were broadly classified into 429 679 patients with psoriasis (national prevalence 0.34%, 95% CI 0.34% to 0.34%) and 136 224 patients with PPP. Because 12 663 patients classified under the broad category of psoriasis also had a PPP or PAO diagnosis code, 148 887 patients (national prevalence 0.12%, 95% CI 0.12% to 0.12%) had a PPP or PAO diagnosis code. The 12 663 patients with psoriasis and PPP diagnosis codes accounted for 2.9% of the 429 679 with a psoriasis diagnosis code and 8.5% of the 148 887 with PPP or PAO code. Table 1 shows the age and sex distribution of patients with psoriasis and PPP. In patients with psoriasis, about 60% were male (male to female ratio: 1.44) and average age was 56.7 years , while in patients with PPP, about two thirds were female (male to female ratio: 0.53) and average age was 55.5 years. Figure 1 shows the national prevalence of psoriasis and PPP in males and females estimated using the census data. For both males

Table 1 Age and sex distribution of patients with psoriasis and PPP in the JNDB

	Psoriasis*			PPP		
	N			N		
Age (years)	Male	Female	Total	Male	Female	Total
0–9	3376	3177	6553	396	382	778
10–19	4430	5046	9476	689	923	1612
20–29	9800	9904	19 704	1821	3673	5494
30–39	27 915	22 251	50 166	5049	9388	14 437
40–49	34 637	21 588	56 225	7256	13 237	20 493
50–59	44 963	28 146	73 109	10 318	23 157	33 475
60–69	59 510	33 907	93 417	12 384	23 021	35 405
70–79	48 072	30 930	79 002	7070	11 559	18 629
80–	21 070	20 957	42 027	2265	3636	5901
Total	253 773	175 906	429 679	47 248	88 976	136 224

*Patients with both psoriasis and PPP diagnosis codes are classified as having psoriasis.
JNDB, Japanese national database of health insurance claims; PPP, palmoplantar pustulosis.

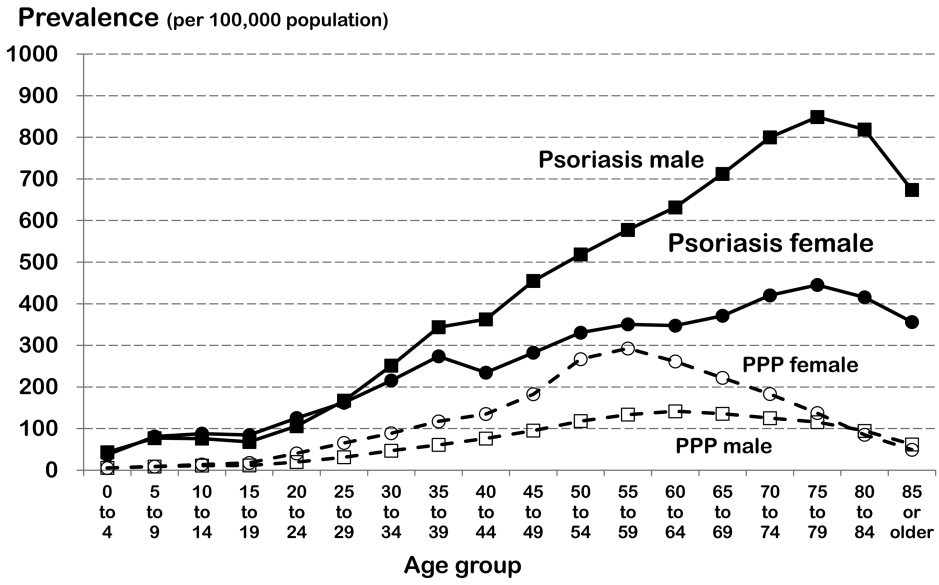

Figure 1 Prevalence of psoriasis and palmoplantar pustulosis (PPP) in the Japanese population. The prevalence of psoriasis and PPP in Japan was estimated by dividing the number of patients with a psoriasis or PPP diagnosis code by the size of the population according to the census of October 2010.

and females, the 75–79-year-old age group had the highest prevalence of psoriasis, while the 55–59-year-old age group for females and the 60–64-year-old age group for males had the highest prevalence of PPP. The demographic characteristics of patients in the three department subgroups of A (dermatology/rheumatology), B (other specialty) and C (not specified) are shown in online supplementary table S1. Of a total of 429 679 patients with psoriasis, 132 189 (30.8%), 33 763 (7.9%) and 263 727 (61.4%) were classified into subgroups A, B and C, respectively. Of a total of 136 224 patients with PPP, 24 195 (20.0%), 12 411 (9.1%) and 96 618 (70.9%) were classified into subgroups A, B and C, respectively. The male to female ratio was 1.58, 1.33 and 1.39 for psoriasis and 0.52, 0.50 and 0.54 for PPP and the average age was 58.1, 61.8 and 55.3 years for psoriasis and 57.2, 56.9 and 54.9 years for PPP in subgroups A, B and C, respectively.

Domestic diagnosis codes

The distribution of domestic diagnosis codes divided into eight diagnosis subgroups is shown in table 2. In patients under the broad category of psoriasis, the proportion of males was below 50% for guttate psoriasis, pustular psoriasis, PPP and PAO but above 70% for erythrodermic psoriasis. Patients with guttate psoriasis were younger, while patients with erythrodermic psoriasis were older, than those with other types of psoriasis. In patients under the broad category of PPP, patients with PAO included more females and were younger than patients without PAO. When patients were divided into the three department subgroups, more than half were in

Table 2 Diagnoses given in claims for patients with psoriasis and PPP in the JNDB

Diagnoses	N*	(%)	Male	(%)	Age	(SD)
Psoriasis						
Plaque psoriasis	418 705	(97.4)	248 770	(59.4)	56.7	(18.7)
Scalp psoriasis	2832	(0.7)	1682	(59.4)	57.2	(18.1)
Guttate psoriasis	2572	(0.6)	1136	(44.2)	42.4	(20.6)
Psoriatic arthritis	8360	(1.9)	4431	(53.0)	55.5	(15.1)
Pustular psoriasis	4636	(1.1)	2250	(48.5)	55.9	(19.3)
Erythrodermic psoriasis	1610	(0.4)	1176	(73.0)	60.4	(17.2)
PPP†	12 625	(2.9)	4675	(37.0)	58.3	(13.7)
PAO†	401	(0.1)	85	(21.2)	53.1	(12.1)
Total	429 679	(100)	253 773	(59.1)	56.7	(18.7)
PPP						
PPP	135 647	(99.6)	47 063	(34.7)	55.5	(15.5)
PAO	5734	(4.2)	1307	(22.8)	52.1	(12.6)
Total	136 224	(100)	47 248	(34.7)	55.5	(15.5)

*Each patient is counted once for each diagnosis, so the sums of patients with eight diagnoses for psoriasis and two diagnoses for PPP exceed the total.
†Patients with psoriasis and PPP/PAO diagnosis codes.
JNDB, Japanese national database of health insurance claims; PAO, pustulotic arthro-osteitis; PPP, palmoplantar pustulosis.

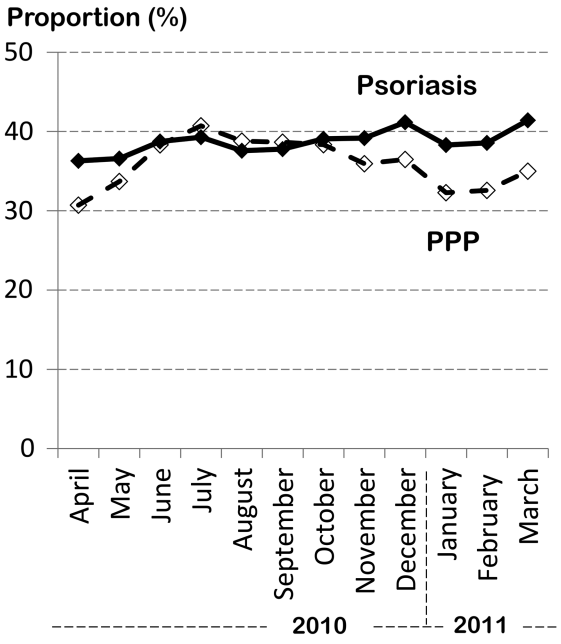

Figure 2 Use of healthcare services by patients with psoriasis and palmoplantar pustulosis (PPP). The proportion was estimated as the number of patients for whom a claim with a psoriasis or PPP diagnosis code was issued in each of the 12 months between April 2010 and March 2011 divided by the number of patients with psoriasis and PPP, respectively.

subclass A (dermatology/rheumatology) for 'pustular psoriasis' (2953/4636), 'erythrodermic psoriasis' (1045/1610) and 'psoriatic arthritis' (4530/8360) (see online supplementary table S2).

Seasonal variation in the use of healthcare services

Figure 2 shows the seasonal variation of the use of healthcare services by patients with psoriasis and PPP. On average, about 39% of patients with psoriasis and 36% of patients with PPP used healthcare services each month. In patients with psoriasis, the proportion of patients who used healthcare services in the hottest season (July or August, 2010) (52.6%) was similar to that in the coldest season (January or February, 2011) (53.0%), with a difference of only −0.3% (95% CI −0.5% to −0.1%, p=0.0004). On the other hand, in patients with PPP, the proportion of patients who used healthcare services in the hottest season (55.3%) was higher than that in the coldest season (45.3%), with a difference of 10.0% (9.8% to 10.3%, p<0.0001). As shown in online supplementary tables S3 and S4, patients with PPP, but not patients with psoriasis, used healthcare services more during the hottest season, as was observed for all three department subgroups.

Treatments for psoriasis and PPP

Treatments for psoriasis and PPP are summarised in table 3. Systemic therapies were used mainly for patients with psoriasis, but a few patients with PPP also used etretinate and other systemic therapies. Patients treated with biologics were relatively young and a high proportion had arthropathy. Of 3291 patients with psoriasis on biologic treatment, 2674 (81.1%) were in department subgroup A (dermatology/rheumatology) (see online supplementary table S5). Phototherapy was more frequently used for patients with PPP than with psoriasis, while topical vitamin D was selected more frequently for patients with psoriasis than with PPP. About 80% of patients with both psoriasis and PPP used topical corticosteroid. About 9% of patients with psoriasis and about 16% of patients with PPP received no treatment for psoriasis or PPP. Patients with psoriasis and PPP who received no treatment included more patients with arthropathy when compared receiving those with topical therapy, particularly in department subgroup B (other specialty) (see online supplementary table S5).

Psoriasis and PPP comorbidities

Table 4 shows the number of patients and standardised prevalence of concurrent diabetes mellitus, hyperlipidaemia and hypertension in severity classes I–III in patients with psoriasis and PPP. For patients with psoriasis, the standardised prevalence was higher in class I (systemic therapy) than in class III (topical therapy only) in the entire population as well as in the three department subgroups (see online supplementary table S6). Prevalence was similar between class II (phototherapy) and class III except for department subgroup A (dermatology/rheumatology), where prevalence was higher in class II than in class III. The prevalence of comorbidities was lower in class IV (no treatment) than in class III in department subgroup A (dermatology/rheumatology) but higher in class IV than in class III in the other department subgroups (see online supplementary table S6). For patients with PPP, there was no significant difference between classes I, II and III.

DISCUSSION

We determined that during the 12-month period between April 2010 and March 2011, about 0.34% of patients in the JNDB had a psoriasis diagnosis code and 0.12% had a PPP diagnosis code. About 60% of patients with psoriasis were male, while about two thirds of patients with PPP were female. The use of healthcare services was roughly constant during the 12-month observation period in patients with psoriasis, while the use of services by patients with PPP was higher in summer. The prevalence of concurrent diabetes mellitus, hyperlipidaemia and hypertension in patients with psoriasis receiving systemic therapy was higher than in those receiving topical therapy only.

The 0.34% prevalence of psoriasis demonstrated in our study was lower than the 2–4% observed in Western countries, while the male predominance in our study contrasted with the almost equal distribution of males and females in Western countries.[1–3] A low disease prevalence and a predominance of male patients with

Table 3 Treatments for psoriasis and PPP in the JNDB

	Psoriasis			Psoriatic arthritis	PPP			
	N=429 679				N=136 224			
	N* (%)	Male N (%)	Age (SD)	N (%)	N* (%)	Male N (%)	Age (SD)	PAO N (%)
Systemic therapy								
Adalimumab	1322 (0.3)	892 (67.5)	50.0 (14.0)	453 (34.3)	64 (0.05)	12 (18.8)	59.1 (12.1)	7 (10.9)
Infliximab	2141 (0.5)	1344 (62.8)	48.1 (13.9)	741 (34.6)	197 (0.1)	55 (27.9)	51.5 (13.5)	13 (6.6)
Ustekinumab	–†				–†			
Methotrexate	1680 (0.4)	1072 (63.8)	52.0 (15.5)	480 (28.6)	174 (0.1)	53 (30.5)	54.6 (13.4)	19 (10.9)
Ciclosporin	21 997 (5.1)	13 813 (62.8)	53.2 (16.2)	1604 (7.3)	251 (0.2)	98 (39.0)	52.9 (13.8)	20 (8.0)
Etretinate	15 481 (3.6)	11 025 (71.2)	60.1 (13.6)	609 (3.9)	1950 (1.4)	725 (37.2)	57.5 (11.7)	35 (1.8)
Phototherapy	21 005 (4.9)	12 370 (58.9)	54.6 (18.1)	309 (1.5)	10 408 (7.6)	3657 (35.1)	53.3 (15.0)	156 (1.5)
Topical therapy								
Topical vitamin D	256 122 (59.6)	156 050 (60.9)	53.4 (18.5)	3698 (1.4)	42 903 (31.5)	14 276 (33.3)	53.0 (14.9)	612 (1.4)
Topical corticosteroid	349 568 (81.4)	211 744 (60.6)	54.9 (18.1)	5323 (1.5)	109 692 (80.5)	37 881 (34.5)	53.4 (15.3)	3576 (3.3)
No treatment	38 224 (8.9)	19 398 (50.7)	58.6 (19.5)	1851 (4.8)	21 209 (15.6)	7527 (35.5)	54.6 (16.2)	2083 (9.8)

*Each patient is counted once for each treatment.
†Less than 10 patients had ustekinumab which was only approved in the last month of the observation period.
JNDB, Japanese national database of health insurance claims; PPP, palmoplantar pustulosis; PAO, pustulotic arthro-osteitis.

psoriasis were also found in other Asian countries: for example, the prevalence of males and females with psoriasis was 0.23% and 0.16% in Taiwan,[4] and 0.54% and 0.44% in China,[5] respectively. On the other hand, the 0.12% prevalence of PPP observed in our study was higher than the 0.01–0.05% found in Western countries, where the female predominance seen in the current study was also observed.[7 11 12] Around 20% of patients with PPP were reported to also have psoriasis,[7 13] while in our study, 8.5% of patients with a PPP or PAO diagnosis code also had psoriasis. We observed that the male-to-female ratio differed for psoriasis and PPP, and that psoriasis was more prevalent in the older age groups than PPP. The seasonal variation in the use of healthcare services by patients with PPP, as a proxy of disease activity, was not observed in patients with psoriasis. According to the proposal of the International Psoriasis Council in 2007, PPP should be considered a separate condition from psoriasis.[12 14] However, the findings in the current study indicate there is a relationship between psoriasis and PPP (eg, 8.5% of patients with psoriasis also had PPP, which is higher than the prevalence of 0.34% of psoriasis in the whole population), but there are also several differences between psoriasis and PPP, as stated in the above-mentioned proposal.

About 9% of patients with psoriasis and 16% of patients with PPP were receiving no treatment for psoriasis or PPP in our study. In a previous study in the UK, one third of patients with psoriasis were not using any therapy at the time of evaluation.[1] According to a survey conducted in the USA between 2003 and 2011, 49%, 24% and 9% of patients with mild, moderate and severe psoriasis were untreated and approximately about half of all patients were dissatisfied with their treatment.[15] Likewise, approximately 9% of patients with psoriasis and 16% of patients with PPP in our study were receiving no therapy for psoriasis or PPP, while some who were receiving treatment may have been dissatisfied with it. However, some patients may not been receiving psoriasis or PPP therapy because they had very mild disease. Interestingly, as shown in online supplementary table S5, the patient group not receiving psoriasis or PPP treatment included more patients with arthropathy than the group receiving topical therapy, particularly in department subgroup B (other specialty). Thus, severity class IV (no treatment) in department subgroup B might represent more severe psoriasis or PPP than severity class III (topical therapy only), while in other department subgroups, severity class IV might represent less severe psoriasis or PPP when compared to severity class III.

Many studies conducted in Western and Asian countries have reported that the prevalence and incidence of the risk factors for myocardial infarction and stroke such as diabetes mellitus, hyperlipidaemia and hypertension, are high in patients with psoriasis, particularly those with severe psoriasis.[16–19] The reasons why these risk factors are increased in patients with psoriasis have not been fully explained, but the increased risk may be due to the

Table 4 Prevalence of diabetes mellitus, hyperlipidaemia and hypertension in three severity classes of patients with psoriasis and PPP in the JNDB

	Psoriasis			PPP		
	Class I Systemic therapy* N=39 796	**Class II Phototherapy† N=18 833**	**Class III Topical therapy‡ N=332 826**	**Class I Systemic therapy* N=2588**	**Class II Phototherapy† N=10 153**	**Class III Topical therapy‡ N=102 274**
Diabetes mellitus						
N§	5271	1747	32 378	260	686	7585
Prevalence¶ (%)	12.7	9.0	9.6	9.3	7.7	8.5
Difference** (%)	3.1	−0.6	Ref	0.8	−0.8	Ref
(95% CI)	(2.7 to 3.4)	(−1.0 to −0.2)		(−0.5 to 2.1)	(−1.4 to −0.2)	
Hyperlipidaemia						
N§	8208	3125	56 561	557	1731	17 783
Prevalence¶ (%)	20.7	16.7	17.5	18.3	17.4	17.3
Difference** (%)	3.2	−0.8	Ref	1.0	0.1	Ref
(95% CI)	(2.8 to 3.6)	(−1.3 to −0.3)		(−0.6 to 2.6)	(−0.7 to 1.0)	
Hypertension						
N§	11 795	4369	78 996	576	1885	19 332
Prevalence¶ (%)	28.5	22.8	23.4	22.4	21.8	21.7
Difference** (%)	5.1	−0.6	Ref	0.6	0.04	Ref
(95% CI)	(4.7 to 5.6)	(−1.2 to −0.1)		(−1.0 to 2.3)	(−0.9 to 0.9)	

*Patients who received one or more of the systemic therapies listed in table 3.
†Patients with phototherapy but no systemic therapy.
‡Patients with topical vitamin D or topical corticosteroid only.
§Number of patients with a diagnosis code of concurrent disease (diabetes mellitus, hyperlipidaemia or hypertension) in at least in claim as well as a diagnosis code of drugs to treat the concurrent disease in claims issued in two or more months.
¶Prevalence standardised to the distribution of age and sex in the entire study population of 565 903 patients.
**Difference in prevalence compared to class III.
JNDB, Japanese national database of health insurance claims; PPP, palmoplantar pustulosis.

high prevalence of obesity and other known predisposing factors in patients with psoriasis.[20] It is also possible that some of the comorbidities are adverse reactions to ciclosporin and other systematic therapies for psoriasis.[21] In our study, an increase in comorbidity was observed in patients with severe psoriasis but not in patients with severe PPP when compared to patients receiving topical therapy only. Ciclosporin may be a major contributor to the high prevalence of the comorbidity as it was used by over half of the patients with psoriasis receiving systemic therapy but by only 10% of those with PPP receiving systematic therapy.

The main limitation of the current study is that psoriasis and PPP diagnosis codes have not been validated. Therefore, the true national prevalence may be higher or lower than that reported here. One concern is disease misclassification, particularly when the diagnosis is made by a non-specialist. However, demographic characteristics and other major findings were common to the whole population and department subgroup A (dermatology/rheumatology). This suggests that all patients identified by the claims diagnosis codes in the current study roughly represented all patients with psoriasis and PPP who used healthcare services during the observation period. Nevertheless, we could not exclude some types of misclassification. For instance, the proportion of guttate psoriasis in patients with psoriasis was around 4% in a previous study from Japan,[22] and higher than the 0.6% in the current study (table 2), which could be due to misclassification. The strength of the study is the use of the claims database covering over 90% of patients nationally.

In conclusion, the study using JNDB data collected from the entire nation revealed that the prevalence of psoriasis was lower and the prevalence of PPP was higher than in Western countries. As in previous studies, severe psoriasis was associated with a high prevalence of concurrent diabetes mellitus, hyperlipidaemia and hypertension. The prevalence and other characteristics of psoriasis and PPP estimated in the current study may provide basic information for future studies.

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Supplementary Tables

Supplementary Table S1

Age-sex distribution of patients with psoriasis and PPP subdivided by the department specified in a claim with a diagnosis code of psoriasis and PPP in Japanese National Database

	Psoriasis[a]		PPP	
Age (years old)	Male N (%)	Female N (%)	Male N (%)	Female N (%)
All patients				
0-9	3,376 (1.3)	3,177 (1.8)	396 (0.8)	382 (0.4)
10-19	4,430 (1.7)	5,046 (2.9)	689 (1.5)	923 (1.0)
20-29	9,800 (3.9)	9,904 (5.6)	1,821 (3.9)	3,673 (4.1)
30-39	27,915 (11.0)	22,251 (12.6)	5,049 (10.7)	9,388 (10.6)
40-49	34,637 (13.6)	21,588 (12.3)	7,256 (15.4)	13,237 (14.9)
50-59	44,963 (17.7)	28,146 (16.0)	10,318 (21.8)	23,157 (26.0)
60-69	59,510 (23.5)	33,907 (19.3)	12,384 (26.2)	23,021 (25.9)
70-79	48,072 (18.9)	30,930 (17.6)	7,070 (15.0)	11,559 (13.0)
80-	21,070 (8.3)	20,957 (11.9)	2,265 (4.8)	3,636 (4.1)
Total	253,773 (100)	175,906 (100)	47,248 (100)	88,976 (100)
Mean (SD)	57.1 (17.8)	56.1 (19.9)	55.7 (16.1)	55.5 (15.2)
Patients of dermatology or rheumatology (subgroup A) [b]				
0-9	810 (1.0)	814 (1.6)	36 (0.4)	88 (0.3)
10-19	1,137 (1.4)	1,278 (2.5)	70 (0.8)	110 (0.6)
20-29	2,659 (3.3)	2,561 (5.0)	247 (2.7)	578 (3.2)
30-39	7,677 (9.5)	5,582 (10.9)	828 (8.9)	1,567 (8.8)
40-49	9,831 (12.1)	5,978 (11.7)	1,247 (13.4)	2,464 (13.8)
50-59	13,674 (16.9)	8,607 (16.8)	1,946 (20.9)	4,777 (26.7)
60-69	20,802 (25.7)	11,290 (22.0)	2,851 (30.6)	5,226 (29.2)
70-79	17,355 (21.4)	9,840 (19.2)	1,638 (17.6)	2,493 (13.9)
80-	6,975 (8.6)	5,319 (10.4)	442 (4.8)	623 (3.5)
Total	80,920 (100)	51,269 (100)	9,305 (100)	17,890 (100)
Mean (SD)	58.8 (17.1)	57.1 (19.0)	58.1 (14.8)	56.8 (14.1)

Supplementary Table S1 -- continued

	Psoriasis[a]		PPP	
Age (years old)	Male N (%)	Female N (%)	Male N (%)	Female N (%)
Patients of department other than dermatology or rheumatology (subgroup B) [c]				
0-9	288 (1.5)	232 (1.6)	53 (1.3)	30 (0.4)
10-19	210 (1.1)	225 (1.6)	56 (1.3)	61 (0.7)
20-29	418 (2.2)	476 (3.3)	110 (2.6)	265 (3.2)
30-39	1,304 (6.8)	1,098 (7.6)	384 (9.2)	818 (9.9)
40-49	1,889 (9.8)	1,380 (9.5)	600 (14.4)	1,091 (13.2)
50-59	3,058 (15.9)	2,091 (14.4)	891 (21.4)	2,137 (25.9)
60-69	4,797 (24.9)	3,091 (21.3)	1,165 (28.0)	2,238 (27.1)
70-79	4,825 (25.1)	3,283 (22.6)	669 (16.1)	1,169 (14.2)
80-	2,460 (12.8)	2,638 (18.2)	226 (5.4)	448 (5.4)
Total	19,249 (100)	14,514 (100)	4,154 (100)	8,257 (100)
Mean (SD)	61.7 (17.2)	61.9 (18.9)	56.8 (16.1)	56.9 (15.0)
Patients of department not specified (subgroup C) [d]				
0-9	2,278 (1.5)	2,131 (1.9)	307 (0.9)	300 (0.5)
10-19	3,083 (2.0)	3,543 (3.2)	563 (1.7)	752 (1.2)
20-29	6,723 (4.4)	6,867 (6.2)	1,464 (4.3)	2,830 (4.5)
30-39	18,934 (12.3)	15,571 (14.1)	3,837 (11.4)	7,003 (11.1)
40-49	22,917 (14.9)	14,230 (12.9)	5,409 (16.0)	9,682 (15.4)
50-59	28,231 (18.4)	17,448 (15.8)	7,481 (22.1)	16,243 (25.9)
60-69	33,911 (22.1)	19,526 (17.7)	8,368 (24.8)	15,557 (24.8)
70-79	25,892 (16.9)	17,807 (16.2)	4,763 (14.1)	7,897 (12.6)
80-	11,635 (7.6)	13,000 (11.8)	1,597 (4.7)	2,565 (4.1)
Total	153,604 (100)	110,123 (100)	33,789 (100)	62,829 (100)
Mean (SD)	55.6 (18.0)	54.9 (20.3)	54.9 (16.4)	54.9 (15.4)

Supplementary Table S1 -- continued

a Patients with both of diagnosis codes of psoriasis and PPP are classified as those with psoriasis.
b Patients with at least one claim with diagnosis code of psoriasis or PPP where the department was specified as dermatology or rheumatology during the 12-month observation period.
c Patients with a diagnosis code of psoriasis or PPP where the department was specified as that other specialty but not as dermatology or rheumatology.
d Patients with a diagnosis code of psoriasis or PPP where the department was not specified.
PPP, palmoplantar pustulosis.

Supplementary Table S2

Diagnosis codes of psoriasis and PPP classified by the department specified in a claim in Japanese National Database

	Department Specified				Not specified [e]	All patients
	Derma [a]	Rheuma [b]	Derma/ rheuma [c]	Other specialty [d]		
	N [f] (%)	N [f] (%)	N [f] (%)	N [f] (%)	N [f] (%)	N [f] (%)
Psoriasis	130,953 (100)	2,301 (100)	132,189 (100)	33,763 (100)	263,727 (100)	429,679 (100)
Plaque psoriasis	127,170 (97.1)	1,602 (69.6)	127,822 (96.7)	30,808 (96.5)	260,075 (98.6)	418,705 (97.4)
Psoriasis vulgaris	103,573 (79.1)	1,161 (50.5)	104,002 (78.7)	20,202 (59.8)	214,621 (81.4)	338,825 (78.9)
Psoriasis	20,972 (16.0)	528 (22.9)	21,231 (16.1)	11,159 (33.1)	44,821 (17.0)	77,302 (18.0)
Psoriasis vulgaris of entire body	7,262 (5.5)	66 (2.9)	7,267 (5.5)	579 (1.7)	2,030 (0.8)	9,876 (2.3)
Psoriasis of extremities	387 (0.3)	---[g]	390 (0.3)	99 (0.3)	411 (0.2)	900 (0.2)
Psoriasis vulgaris of extremities	3,210 (2.5)	24 (1.0)	3,214 (2.4)	371 (1.1)	2,417 (0.9)	6,002 (1.4)
Psoriasis vulgaris of lower back	144 (0.1)	---[g]	144 (0.1)	38 (0.1)	74 (0.03)	256 (0.1)
Plaque psoriasis	70 (0.1)	---[g]	70 (0.1)	11 (0.03)	33 (0.01)	114 (0.03)

Supplementary Table S2 ---continued

	Department					All patients
	Specified				Not specified [e]	
	Derma [a]	Rheuma [b]	Derma/ rheuma [c]	Other specialty [d]		
	N [f] (%)	N [f] (%)	N [f] (%)	N [f] (%)	N [f] (%)	N [f] (%)
Scalp psoriasis	1,177 (0.9)	--- [g]	1,180 (0.9)	257 (0.8)	1,395 (0.5)	2,832 (0.7)
Seborrheic psoriasis [h]	123 (0.1)	--- [g]	123 (0.1)	118 (0.3)	350 (0.1)	591 (0.1)
Psoriasis vulgaris of scalp	1,055 (0.8)	--- [g]	1,058 (0.8)	140 (0.4)	1,046 (0.4)	2,244 (0.5)
Guttate psoriasis	1,241 (0.9)	--- [g]	1,242 (0.9)	137 (0.4)	1,193 (0.5)	2,572 (0.6)
Psoriatic arthritis	3,774 (2.9)	1,210 (52.6)	4,530 (3.4)	2,128 (6.3)	1,702 (0.6)	8,360 (1.9)
Psoriatic arthritis	3,686 (2.8)	960 (41.7)	4,206 (3.2)	1,529 (4.5)	1,410 (0.5)	7,145 (1.7)
Psoriatic arthritis mutilans [i]	63 (0.05)	244 (10.6)	292 (0.2)	575 (1.7)	272 (0.1)	1,139 (0.3)
Psoriatic spondylitis	82 (0.1)	24 (1.0)	93 (0.1)	45 (0.1)	25 (0.01)	163 (0.04)
Pustular psoriasis	2,941 (2.2)	67 (2.9)	2,953 (2.2)	409 (1.2)	1,274 (0.5)	4,636 (1.1)
Pustular psoriasis	2,595 (2.0)	62 (2.7)	2,606 (2.0)	238 (0.7)	822 (0.3)	3,666 (0.9)
Impetigo herpetiformis [j]	128 (0.1)	--- [g]	128 (0.1)	160 (0.5)	255 (0.1)	543 (0.1)

Supplementary Table S2 ---continued

	Department					All patients
	Specified				Not specified [e]	
	Derma [a]	Rheuma [b]	Derma/ rheuma [c]	Other specialty [d]		
	N [f] (%)	N [f] (%)	N [f] (%)	N [f] (%)	N [f] (%)	N [f] (%)
Acrodermatitis continua	242 (0.2)	--- [g]	243 (0.2)	12 (0.04)	199 (0.1)	454 (0.1)
Generalized pustular psoriasis	28 (0.02)	--- [g]	28 (0.02)	--- [g]	--- [g]	32 (0.01)
Acute generalized pustular Psoriasis	--- [g]	--- [g]	--- [g]	--- [g]	--- [g]	--- [g]
Erythrodermic psoriasis	1,045 (0.8)	35 (1.5)	1,057 (0.8)	223 (0.7)	330 (0.1)	1610 (0.4)
PPP	6,170 (4.7)	82 (3.6)	6,194 (4.7)	811 (2.4)	5,620 (2.1)	12,625 (2.9)
PAO [k]	173 (0.1)	21 (0.9)	180 (0.1)	73 (0.2)	146 (0.1)	401 (0.1)
PPP	26,928 (100)	435 (100)	27,195 (100)	12,411 (100)	96,618 (100)	136,224 (100)
PPP	26.880 (99.8)	394 (90.6)	27,109 (99.7)	11,979 (96.5)	96,559 (99.9)	135,647 (99.6)
PAO [l]	689 (2.6)	112 (25.7)	762 (2.8)	3,268 (26.3)	1,704 (1.8)	5,734 (4.2)

Supplementary Table S2 -- continued

a Patients with at least one claim with a diagnosis code of psoriasis or PPP where the department was specified as dermatology during the 12-month observation period.
b Patients with at least one claim where the department was specified as rheumatology.
c Patients with at least one claim where the department was specified as dermatology or rheumatology (department subgroup A).
d Patients with any claim where the department was specified as other specialty but not dermatology or rheumatology (department subgroup B).
e Patients with claims where the department was not specified (department subgroup C).
f One patient is counted once for each code and for subclass of diagnosis and therefore sum of lower categories may exceed a total of upper category.
g Less than 10 patients were found.
h "Internal medicine" was specified for 68 (58%) of 118 patients with "Seborrheic psoriasis" in the department of other specialty.
i "Orthopedics" was specified for 470 (82%) of 575 patients with "Psoriatic arthritis mutilans" in the department of other specialty.
j "Internal medicine" was specified for 61 (38%) of 160 patients with "Impetigo herpetiformis" in the department of other specialty.
k "Internal medicine" was specified for 54 (74%) of 73 patients with "PAO" in the department of other specialty under the broad disease category of psoriasis.
l "Internal medicine" was specified for 2978 (91%) of 3268 patients with "PAO" in the department of other specialty under the broad disease category of PPP.
PPP, palmoplantar pustulosis; PAO, pustulotic arthro-osteitis.

Supplementary Table S3

Use of healthcare service in each of 12 months during the study period in patients with psoriasis and PPP subdivided by the department in a claim with diagnosis code of psoriasis and PPP in Japanese National Database

	All		Dermatology or rheumatology (subgroup A)		Other specialty (subgroup B)		Department not specified (subgroup C)	
Year and Month	N [b]	%	N [b]	%	N [b]	%	N [b]	%
Patients with Psoriasis								
2010 April	155,927	36.3	57,385	43.4	15,271	45.2	83,271	31.6
2010 May	157,238	36.6	57,029	43.1	14,884	44.1	85,325	32.4
2010 June	166,483	38.7	59,989	45.4	15,409	45.6	91,085	34.5
2010 July	168,831	39.3	60,186	45.5	15,495	45.9	93,150	35.3
2010 August	161,494	37.6	59,172	44.8	14,974	44.4	87,348	33.1
2010 September	162,322	37.8	59,257	44.8	15,182	45.0	87,883	33.3
2010 October	167,886	39.1	59,960	45.4	15,148	44.9	92,778	35.2
2010 November	168,288	39.2	60,074	45.4	15,295	45.3	92,919	35.2
2010 December	176,910	41.2	62,093	47.0	15,562	46.1	99,255	37.6
2011 January	164,580	38.3	59,920	45.3	15,067	44.6	89,593	34.0
2011 February	165,743	38.6	58,425	44.2	14,937	44.2	92,381	35.0
2011 March	177,900	41.4	62,591	47.3	15,968	47.3	99,341	37.7
Total	429,679	100.0	132,189	100.0	33,763	100.0	263,727	100.0

Supplementary Table S3 -- continued

Year and Month	All		Dermatology or rheumatology (subgroup A)		Other specialty (subgroup B)		Department not specified (subgroup C)	
	N [b]	%	N [b]	%	N [b]	%	N [b]	%
Patients with PPP								
2010 April	41,825	30.7	9,388	34.5	4,747	38.2	27,690	28.7
2010 May	45,888	33.7	9,912	36.4	4,523	36.4	31,453	32.6
2010 June	52,193	38.3	11,172	41.1	5,045	40.6	35,976	37.2
2010 July	55,463	40.7	11,508	42.3	5,126	41.3	38,829	10.2
2010 August	52,850	38.8	11,329	41.7	4,903	39.5	36,618	37.9
2010 September	52,649	38.6	11,375	41.8	5,065	40.8	36,209	37.5
2010 October	52,229	38.3	11,193	41.2	4,988	40.2	36,048	37.3
2010 November	48,962	35.9	10,464	38.5	4,753	38.3	33,745	34.9
2010 December	49,679	36.5	10,606	39.0	4,757	38.3	34,316	35.5
2011 January	43,971	32.3	9,801	36.0	4,432	35.7	29,738	30.8
2011 February	44,373	32.6	9,603	35.3	4,461	35.9	30,309	31.4
2011 March	47,678	35.0	10,289	37.8	4,716	38.0	32,673	33.8
Total	136,224	100.0	27,195	100.0	12,411	100.0	96,618	100.0

a Patients with at least one claim with diagnosis code of psoriasis or PPP where the department was specified as either dermatology or rheumatology ("Dermatology or rheumatology") or other specialty but not dermatology or rheumatology ("Other specialty") during the 12-month observation period.

b Number of patients with a claim with a diagnosis code of psoriasis or PPP.

PPP, palmoplantar pustulosis.

Supplementary Table S4

Seasonal variation of use of healthcare service in patients with a diagnosis code of psoriasis and PPP in Japanese National Database

Use of health-care service					
2010 July or August	2011 January or February	Psoriasis N [a]	%	PPP N [a]	%
All patients					
Yes	Yes	147,254	34.3	41,153	30.2
Yes	No	78,956	18.4	34,229	25.1
No	Yes	80,384	18.7	20,548	15.1
No	No	123,085	28.6	40,294	29.6
Total		429,679	100.0	136,224	100.0
Difference (95% CI) [b]		-0.33% (-0.51 to -0.15%)		10.0% (9.8 to 10.3%)	
P value [c]		0.0004		<0.0001	
Patients of dermatology or rheumatology (subgroup A) [d]					
Yes	Yes	58,962	44.6	9,905	36.4
Yes	No	22,384	16.9	6,267	23.0
No	Yes	22,328	16.9	4,164	15.3
No	No	28,515	21.6	6,859	25.2
Total		132,189	100.0	27,195	100.0
Difference (95% CI) [b]		0.04% (-0.27 to 0.36%)		7.7% (7.1 to 8.4%)	
P value [c]		0.79		<0.0001	
Patients of department of other specialty (subgroup B) [e]					
Yes	Yes	14,223	42.1	4,596	37.0
Yes	No	5,714	16.9	2,615	21.1
No	Yes	5,497	16.3	1,790	14.4
No	No	8,329	24.7	3,410	27.5
Total		33,763	100.0	12,411	100.0
Difference (95% CI) [b]		0.64% (0.03 to 1.25%)		6.6% (5.7 to 7.6%)	
P value [c]		0.04		<0.0001	

Supplementary Table S4 --- continued

Use of health-care service					
2010 July or August	2011 January or February	Psoriasis N [a]	%	PPP N [a]	%
Patients of department not specified (subgroup C) [f]					
Yes	Yes	74,069	32.7	26,652	27.6
Yes	No	50,858	19.9	25,347	26.2
No	Yes	52,559	19.3	14,594	15.1
No	No	86,241	28.0	30,025	31.1
Total		263,727	100.0	96,618	100.0
Difference (95% CI) [b]		-0.64% (-0.88 to -0.40%)		11.1% (10.8 to 11.5%)	
P value [b]		<0.0001		<0.0001	

a Number of patients with a claim with a diagnosis code of psoriasis or PPP.

b Difference between the proportion of patients who used the healthcare service in the hottest season (July or August 2010) and the proportion of patients who used the service in the coldest season (January or February of 2011).

c The result of paired t-test is shown.

d Patients with at least one claim with diagnosis code of psoriasis or PPP where the department was specified as dermatology or rheumatology during the 12-month observation period.

e Patients with a diagnosis code of psoriasis or PPP where the department was specified as other specialty but not as dermatology or rheumatology.

f Patients with a diagnosis code of psoriasis or PPP where the department was not specified.

PPP, palmoplantar pustulosis.

Supplementary Table S5

Treatments for psoriasis and PPP subdivided by the department specified in a claim with a diagnosis code of psoriasis and PPP in Japanese National Database

	Psoriasis				PPP			
		Male		Psoriatic arthritis		Male		PAO
	N [a] (%)	N (%)	Age (SD)	N (%)	N [a] (%)	N (%)	Age (SD)	N (%)
All patients								
	N=429,679				N=136,224			
Systemic therapy								
Biologics	3,291 (0.8)	2,132 (64.8)	48.9 (14.1)	1,111 (33.8)	253 (0.2)	65 (25.7)	53.2 (13.6)	20 (7.9)
Methotrexate	1,680 (0.4)	1,072 (63.8)	52.0 (15.5)	480 (28.6)	174 (0.1)	53 (30.5)	54.6 (13.4)	19 (10.9)
Ciclosporin	21,997 (5.1)	13,813 (62.8)	53.2 (16.2)	1,604 (7.3)	251 (0.2)	98 (39.0)	52.9 (13.8)	20 (8.0)
Etretinate	15,481 (3.6)	11,025 (71.2)	60.1 (13.6)	609 (3.9)	1,950 (1.4)	725 (37.2)	57.5 (11.7)	35 (1.8)
Phototherapy	21,005 (4.9)	12,370 (58.9)	54.6 (18.1)	309 (1.5)	10,408 (7.6)	3,657 (35.1)	53.3 (15.0)	156 (1.5)
Topical therapy								
Topical vitamin D	256,122 (59.6)	156,050 (60.9)	53.4 (18.5)	3,698 (1.4)	42,903 (31.5)	14,276 (33.3)	53.0 (14.9)	612 (1.4)
Topical corticosteroid	349,568 (81.4)	211,744 (60.6)	54.9 (18.1)	5,323 (1.5)	109,692 (80.5)	37,881 (34.5)	53.4 (15.3)	3,576 (3.3)
No treatment	38,224 (8.9)	19,393 (50.7)	58.6 (19.5)	1,851 (4.8)	21,209 (15.6)	7,527 (35.5)	54.6 (16.2)	2,083 (9.8)

Supplementary Table S5 --- continued

	Psoriasis				PPP			
		Male		Psoriatic arthritis		Male		PAO
	N [a] (%)	N (%)	Age (SD)	N (%)	N [a] (%)	N (%)	Age (SD)	N (%)
Patients of dermatology or rheumatology (subgroup A) [b]								
	N=132,189				N=27,195			
Systemic therapy								
Biologics	2,674 (2.0)	1,827 (68.3)	48.4 (13.8)	895 (33.5)	112 (0.4)	28 (25.0)	54.5 (11.9)	--[c]
Methotrexate	681 (0.5)	436 (64.0)	51.1 (15.6)	280 (41.1)	67 (0.2)	14 (20.9)	51.8 (13.0)	13 (19.4)
Ciclosporin	12,330 (9.3)	7,917 (64.2)	52.8 (15.8)	1,023 (8.3)	109 (0.4)	37 (33.9)	54.4 (11.9)	--[c]
Etretinate	9,010 (6.8)	6,387 (70.9)	60.6 (13.5)	501 (5.6)	744 (2.7)	271 (36.4)	57.4 (10.7)	26 (3.5)
Phototherapy	5,465 (4.1)	3,352 (61.3)	56.4 (16.9)	181 (3.3)	1,529 (5.6)	498 (32.6)	53.9 (14.2)	43 (2.8)
Topical therapy								
Topical vitamin D	86,201 (65.2)	54,802 (63.6)	55.9 (17.7)	2,736 (3.2)	11,194 (41.2)	3,737 (33.4)	54.9 (14.0)	365 (3.3)
Topical corticosteroid	112,813 (85.3)	70,655 (62.6)	56.8 (17.3)	3,580 (3.2)	23,415 (86.1)	8,006 (34.2)	55.3 (14.3)	623 (2.7)
No treatment	7,621 (5.8)	3,809 (50.0)	54.8 (19.7)	448 (5.9)	2,732 (10.0)	941 (34.4)	55.3 (14.5)	114 (4.2)

Supplementary Table S5 --- continued

	Psoriasis				PPP			
		Male		Psoriatic arthritis		Male		PAO
	N [a] (%)	N (%)	Age (SD)	N (%)	N [a] (%)	N (%)	Age (SD)	N (%)
Patients of department other specialty (subgroup B) [d]								
		N=33,763				N=12,411		
Systemic therapy								
Biologics	294 (0.9)	163 (55.4)	49.5 (15.0)	155 (52.7)	51 (0.4)	12 (23.5)	51.9 (11.8)	11 (21.6)
Methotrexate	265 (0.8)	146 (55.1)	50.3 (16.3)	133 (50.2)	38 (0.3)	15 (39.5)	56.7 (11.9)	--[c]
Ciclosporin	2,474 (7.3)	1,247 (50.4)	57.5 (16.0)	350 (14.1)	38 (0.3)	13 (34.2)	54.1 (16.2)	10 (26.3)
Etretinate	650 (1.9)	462 (71.1)	63.3 (13.5)	27 (4.2)	72 (0.6)	21 (29.2)	57.1 (11.8)	--[c]
Phototherapy	689 (2.0)	415 (60.2)	61.0 (16.7)	36 (5.2)	386 (3.1)	135 (35.0)	54.1 (14.8)	74 (19.2)
Topical therapy								
Topical vitamin D	11,608 (34.4)	7,379 (63.6)	58.6 (17.3)	391 (3.4)	1,832 (14.8)	579 (31.6)	54.3 (14.7)	153 (8.4)
Topical corticosteroid	19,804 (58.7)	12,008 (60.6)	59.1 (18.4)	869 (4.4)	7,037 (56.7)	2,304 (32.7)	54.1 (15.7)	1,858 (26.4)
No treatment	9,906 (29.3)	5,121 (51.7)	62.1 (17.0)	921 (9.3)	5,005 (40.3)	1,735 (34.7)	55.9 (14.9)	1,391 (27.8)

Supplementary Table S5 --- continued

	Psoriasis				PPP			
		Male		Psoriatic arthritis		Male		PAO
	N [a] (%)	N (%)	Age (SD)	N (%)	N [a] (%)	N (%)	Age (SD)	N (%)
Patients of department not specified (subgroup C) [e]								
		N=263,727				N=96,618		
Systemic therapy								
Biologics	323 (0.1)	142 (44.0)	52.5 (15.0)	61 (18.9)	90 (0.1)	25 (27.8)	52.3 (16.3)	--[c]
Methotrexate	734 (0.3)	490 (66.8)	53.5 (15.0)	67 (9.1)	69 (0.1)	24 (34.8)	56.2 (14.3)	--[c]
Ciclosporin	7,193 (2.7)	4,649 (64.6)	52.4 (16.7)	231 (3.2)	104 (0.1)	48 (46.2)	50.8 (14.5)	--[c]
Etretinate	5,821 (2.2)	4,176 (71.7)	59.0 (13.6)	81 (1.4)	1,134 (1.2)	433 (38.2)	57.6 (12.4)	--[c]
Phototherapy	14,851 (5.6)	8,603 (57.9)	53.6 (18.5)	92 (0.6)	8,493 (8.8)	3,024 (35.6)	53.1 (15.1)	39 (0.5)
Topical therapy								
Topical vitamin D	158,313 (60.0)	93,869 (59.3)	51.6 (18.8)	571 (0.4)	29,877 (30.9)	9,960 (33.3)	52.2 (15.1)	94 (0.3)
Topical corticosteroid	216,951 (82.3)	129,081 (59.5)	53.5 (18.3)	874 (0.4)	79,240 (82.0)	27,571 (34.8)	52.8 (15.4)	1,095 (1.4)
No treatment	20,697 (7.8)	10,463 (50.6)	58.3 (20.3)	482 (2.3)	13,472 (13.9)	4,851 (36.0)	53.9 (16.9)	578 (4.3)

Supplementary Table S5 -- continued

a One patient is counted once for each treatment.

b Patients with at least one claim with a diagnosis code of psoriasis or PPP where the department was specified as dermatology or rheumatology during the 12-month observation period.

c Less than 10 patients had the treatment.

d Patients with a diagnosis code of psoriasis or PPP where the department was specified as other specialty but not as dermatology or rheumatology.

e Patients with a diagnosis code of psoriasis or PPP where the department was not specified.

PPP, palmoplantar pustulosis; PAO, pustulotic arthro-osteitis.

Supplementary Table S6

Prevalence of diabetes mellitus, hyperlipidemia and hypertension in severity classes I to IV of patients with psoriasis and PPP subdivided by the department specified in the claim in Japanese National Database

	All patients		Patients of dermatol or rheumatol [a] (subgroup A)		Patients of other department [b] (subgroup B)		Patients of department not specified [c] (subgroup C)	
	Psoriasis	PPP	Psoriasis	PPP	Psoriasis	PPP	Psoriasis	PPP
Severity Class I (systemic therapy)								
Total N	39,796	2,588	22,641	1,009	3,520	194	13,635	1,385
Diabetes mellitus								
N [d]	5,271	260	3,121	111	747	21	1,403	128
Prevalence [e] (%)	12.7	9.3	13.2	11.2	19.4	10.9	9.5	7.7
Difference [f] (%)	3.1	0.8	2.1	1.2	5.8	-0.6	1.4	0.3
(95%CI)	(2.7,3.4)	(-0.5,2.1)	(1.6,2.5)	(-1.4,3.9)	(4.5,7.1)	(-5.8,4.6)	(0.9,1.9)	(-1.1,1.8)
Hyperlipidemia								
N [d]	8,208	557	4,725	239	1,003	32	2,480	286
Prevalence [e] (%)	20.7	18.3	21.1	20.2	25.1	15.3	17.6	16.6
Difference [f] (%)	3.2	1.0	2.5	2.0	6.2	-2.7	1.5	0.4
(95%CI)	(2.8,3.6)	(-0.6,2.6)	(1.9,3.1)	(-0.9,5.0)	(4.8,7.7)	(-8.2,2.8)	(0.8,2.1)	(-1.5,2.4)
Hypertension								
N [d]	11,795	576	7,150	230	1,235	38	3,410	308
Prevalence [e] (%)	28.5	22.4	30.5	22.7	30.8	18.9	23.2	21.6
Difference [f] (%)	5.1	0.6	5.9	0.0	3.4	-5.7	1.5	1.1
(95%CI)	(4.7,5.6)	(-1.0,2.3)	(5.3,6.6)	(-3.0,3.0)	(1.9,4.9)	(-11.9,0.5)	(0.8,2.2)	(-1.0,3.2)

Supplementary Table S6 -- continued

	All patients		Patients of dermatol or rheumatol [a] (subgroup A)		Patients of other department [b] (subgroup B)		Patients of department not specified [c] (subgroup C)	
	Psoriasis	PPP	Psoriasis	PPP	Psoriasis	PPP	Psoriasis	PPP
Severity Class II (phototherapy without systemic therapy)								
Total N	18,833	10,153	4,332	1,452	614	379	13,887	8,322
Diabetes mellitus								
N [d]	1,747	686	496	98	89	29	1,162	559
Prevalence [e] (%)	9.0	7.7	13.2	11.2	12.0	9.6	8.0	7.2
Difference [f] (%)	-0.6	-0.8	2.1	1.2	-1.6	-1.8	-0.1	-0.2
(95%CI)	(-1.0,-0.2)	(-1.4,-0.2)	(1.6,2.5)	(-1.4,3.9)	(-4.1,0.8)	(-4.9,1.3)	(-0.6,0.3)	(-0.9,0.5)
Hyperlipidemia								
N [d]	3,125	1,731	811	268	131	71	2,183	1,392
Prevalence [e] (%)	16.7	17.4	21.1	20.2	17.8	16.9	15.5	16.5
Difference [f] (%)	-0.8	0.1	2.5	2.0	-1.0	-1.1	-0.6	0.3
(95%CI)	(-1.3,-0.3)	(-0.7,1.0)	(1.9,3.1)	(-0.9,5.0)	(-3.9,1.9)	(-5.0,2.8)	(-1.2,0.0)	(-0.6,1.2)
Hypertension								
N [d]	4,369	1,885	1,169	281	196	93	3,004	1,511
Prevalence [e] (%)	22.8	21.8	30.5	22.7	23.7	23.6	21.3	20.7
Difference [f] (%)	-0.6	0.0	5.9	0.0	-3.8	-1.0	-0.5	0.3
(95%CI)	(-1.2,-0.1)	(-0.9,0.9)	(5.3,6.6)	(-3.0,3.0)	(-6.6,-0.9)	(-5.2,3.2)	(-1.1,0.2)	(-0.7,1.2)

Supplementary Table 6 -- continued

	All patients		Patients of dermatol or rheumatol [a] (subgroup A)		Patients of other department [b] (subgroup B)		Patients of department not specified [c] (subgroup C)	
	Psoriasis	PPP	Psoriasis	PPP	Psoriasis	PPP	Psoriasis	PPP
Severity Class III (topical therapy only)								
Total N	332,826	102,274	97,595	22,002	19,723	6,833	215,508	73,439
Diabetes mellitus								
N [d]	32,378	7,583	11,886	2,141	2,985	725	17,507	4,717
Prevalence [e] (%)	9.6	8.5	11.1	10.0	13.6	11.5	8.2	7.4
Difference [f] (%)	ref	ref	ref	ref	ref	ref	ref	ref
Hyperlipidemia								
N [d]	56,561	17,783	19,006	4,434	4,206	1,315	33,289	12,034
Prevalence [e] (%)	17.5	17.3	18.6	18.2	18.9	18.0	16.1	16.2
Difference [f] (%)	ref	ref	ref	ref	ref	ref	ref	ref
Hypertension								
N [d]	78,996	19,322	26,307	4,781	6,484	1,548	46,205	12,993
Prevalence [e] (%)	23.4	21.7	24.5	22.7	27.4	24.6	21.7	20.4
Difference [f] (%)	ref	ref	ref	ref	ref	ref	ref	ref

Supplementary Table S6 -- continued

	All patients		Patients of dermatol or rheumatol [a] (subgroup A)		Patients of other department [b] (subgroup B)		Patients of department not specified [c] (subgroup C)	
	Psoriasis	PPP	Psoriasis	PPP	Psoriasis	PPP	Psoriasis	PPP
Severity Class IV (No treatment)								
Total N	38,224	21,209	7,621	2,732	9,906	5,005	20,697	13,472
Diabetes mellitus								
N [d]	4,669	2,061	808	261	1,676	622	2,185	1,178
Prevalence [e] (%)	11.5	10.4	10.6	10.1	15.1	13.0	9.6	9.1
Difference [f] (%)	1.9	2.0	-0.6	0.1	1.5	1.5	1.4	1.7
(95%CI)	(1.6,2.2)	(1.5,2.4)	(-1.3,0.1)	(-1.2,1.5)	(0.6,2.4)	(0.2,2.8)	(1.0,1.8)	(1.2,2.3)
Hyperlipidemia								
N [d]	7,771	4,283	1,318	536	2,340	1,087	4,113	2,660
Prevalence [e] (%)	18.9	18.6	16.7	17.7	19.8	18.6	18.0	17.7
Difference [f] (%)	1.4	1.4	-2.0	-0.4	1.0	0.6	1.9	1.5
(95%CI)	(1.0,1.8)	(0.8,2.0)	(-2.8,-1.1)	(-2.0,1.1)	(0.1,1.9)	(-0.9,2.1)	(1.4,2.4)	(0.8,2.2)
Hypertension								
N [d]	11,061	4,786	1,675	572	3,547	1,293	5,839	2,921
Prevalence [e] (%)	25.5	23.9	21.2	21.8	28.6	25.6	24.0	22.4
Difference [f] (%)	2.1	2.1	-3.4	-0.9	1.2	1.0	2.3	2.0
(95%CI)	(1.7,2.6)	(1.5,2.8)	(-4.3,-2.5)	(-2.6,0.9)	(0.2,2.2)	(-0.6,2.5)	(1.7,2.8)	(1.2,2.8)

Supplementary Table S6 -- continued

a Patients with at least one claim with a diagnosis code of psoriasis or PPP where the department was specified as dermatology or rheumatology during the 12-month observation period.
b Patients with a diagnosis code of psoriasis or PPP where the department was specified as other specialty but not as dermatology or rheumatology.
c Patients with diagnosis code of psoriasis or PPP where the department was not specified.
d Number of patients with a diagnosis code of the concurrent disease (diabetes mellitus, hyperlipidemia or hypertension) at least in one claim as well as a drug to treat the concurrent disease in the claims issued in 2 or more different months.
e Prevalence was standardized to the distribution of age and sex in the entire study population of 565,903 subjects as in Table 4 in the text.
f Difference of the standardized prevalence between the severity classes I, II and IV and the severity class III (topical treatment only) in each department subgroup.
PPP, palmoplantar pustulosis; CI, confidence interval.