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Prevalence of Skin and Skin-Related Diseases in the Rochester Epidemiology Project and a Comparison with Other Published Prevalence Studies

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Abstract

In Olmsted County, Minn., USA, reliable, population-based epidemiologic research studies can be performed because of a unique medical records linkage system, the Rochester Epidemiology Project (REP). Our objective was to summarize the epidemiologic data describing the prevalence of skin and skin-related diseases derived from the REP and to compare the findings with those from other studies worldwide. Retrospectively, we reviewed the results of population-based REP studies reporting the prevalence of skin and skin-related diseases over more than 4 decades and compared them to other published prevalences globally. Prevalences from the REP reported per 100,000 persons were as follows: hidradenitis suppurativa, 130.0; psoriasis, 700.0; psoriatic arthritis in 1992, 100.0, and in 2000, 160.0; Behçet disease, 5.2; scleroderma, 13.8; dermatomyositis, 21.42; systemic lupus erythematosus (SLE), from 30.5 to 122.0 suspected SLE, 32.8; combined SLE, 41.8; discoid lupus erythematosus, 27.6, and cutaneous lupus erythematosus, 70.4 and 73.2 (from 2 studies). Many of the population-based prevalences of specific skin and skin-related diseases derived from the REP are different from those estimated globally. Suggested reasons for disparity in the prevalences globally may include differences in the type of reported prevalence, study methodology, geographic areas, ethnic groups, age distribution, and socioeconomic status.

Keywords

Epidemiology; Prevalence; Skin diseases; Skin-related diseases

Introduction

Skin and skin-related diseases cause a global health burden, and the epidemiology of disease must be understood in order to plan for the allocation of health care resources. Epidemiologic data include measures of incidence and prevalence. We previously summarized the incidence (a measure of new cases in a population over a given period) of

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skin and skin-related diseases in Olmsted County, Minn., USA, from the Rochester Epidemiology Project (REP) data [1].

Prevalence is defined as the proportion of a population found to have a disease over a specified period (period prevalence) or at a specific point in time (point prevalence). The prevalence of skin and skin-related diseases may change over time and vary depending on geographic areas, age distributions, and ethnic groups.

In Olmsted County, in southeastern Minnesota, population-based epidemiologic studies can be derived from the REP, a unique records linkage research infrastructure that has existed since 1966. The REP permits access to the medical records of virtually all persons living in this geographically isolated population [2, 3]. The population of Olmsted County is relatively small (146,000 persons according to 2011 census data) and mostly white (i.e. less racially diverse than the USA as a whole).

Among patients seeking health care in Olmsted County, skin disorders are reported as the most prevalent, followed by osteoarthritis, joint disorders, and back problems [4]. Since almost half the Olmsted County population has received a diagnosis of a skin disorder, we decided to gather all available published prevalence data on skin and skin-related diseases from the REP data published over the past 4 decades. In addition, we compared the reported prevalence data from the REP with other reported prevalence data.

Methods

Over 2,100 papers have been published from the REP. All studies using the source of the REP are approved and registered in their system. In conjunction with the REP team, we abstracted a complete list of all published studies from 1966 (starting date of REP) to November 2014. We reviewed each article and identified those that described prevalences of skin and skin-related diseases. We included all REP studies that reported either a point or period prevalence of a certain skin or skin-related disease. Studies reporting lifetime prevalence were excluded. The REP studies had reported prevalences on the following skin and skin-related diseases: hidradenitis suppurativa, psoriasis, psoriatic arthritis, Behçet disease, dermatomyositis, scleroderma, systemic lupus erythematosus (SLE), suspected SLE, combined SLE, discoid lupus erythematosus, and cutaneous lupus erythematosus. The following data were abstracted from each of the REP studies: reference, disease, age of studied population, and date/period of prevalence estimate with corresponding 95% CIs, when available. If sex-specific prevalences were reported in the REP studies, these were abstracted too. All measured prevalence data were per 100,000 persons.

For comparison, we also reviewed the English-language literature to identify additional studies reporting overall prevalences using the electronic database PubMed. We searched PubMed for prevalence studies within the same period as the REP studies (1966 to November 2014). The following search terms were used on PubMed: hidradenitis suppurativa OR psoriasis OR psoriatic arthritis OR Behçet disease OR dermatomyositis OR scleroderma OR systemic lupus erythematosus (SLE) OR suspected SLE OR combined SLE OR discoid lupus erythematosus OR cutaneous lupus erythematosus AND prevalence. To

complete the literature seach, reference lists of relevant articles were reviewed to identify possible additional studies not retrieved by the electronic search on PubMed. Only original articles were included. However, if multiple non-REP studies on prevalence were available, a maximum of 4 references for each skin and skin-related disease were included for comparison. We could not identify any non-REP prevalence studies that met our inclusion criteria on suspected SLE, combined SLE, discoid lupus erythematosus, or cutaneous lupus erythematosus. For each included non-REP study, we abstracted the following data: reference, geographic area, study methodology, age of studied population, and date/period of prevalence estimate with corresponding 95% CIs, when available. Measured prevalence data were per 100,000 persons. In a limited number of the included non-REP studies, sex-specific prevalences were reported, and these were also abstracted.

Results

A total of 11 REP studies met the study inclusion criteria. The majority of the REP data were reported as point prevalence and were as follows (prevalences are expressed per 100,000 persons): hidradenitis suppurativa (HS), 130.0; psoriasis, 700.0; psoriatic arthritis in 1992, 100.0, and in 2000, 160.0; Behçet disease (BD), 5.2; scleroderma, 13.8; dermatomyositis (DM), 21.42; systemic lupus erythematosus (SLE) in 1968, 48.0; SLE in 1980, 40.0; SLE in 1993, 122.0; SLE in 2006, 30.5; suspected SLE, 32.8; combined SLE, 41.8; discoid lupus erythematosus, 27.6; and cutaneous lupus erythematosus, 70.4 and 73.2 (prevalences were reported from 2 studies). Table 1 summarizes the abstracted data for each REP study [5–15].

Table 2 summarizes data abstracted from each of the included non-REP studies [16–43]. The prevalences of HS in Denmark and France were significantly higher than in Olmsted County [5, 16, 17]. The prevalence of HS in South Wales was similar to the prevalence in Olmsted County [5, 18]. The prevalences of psoriasis in Europe were higher than the prevalence reported for Olmsted County [6, 21–23]. For psoriatic arthritis, the prevalences were reported to be lower in the Czech Republic [24] and Northwest Greece [25] compared to Olmsted County [6] but much higher both in Norway [26] and Italy [27]. The prevalence of BD was significantly higher in Turkey [31] compared to Olmsted County [8], other European countries and Taiwan [28–30]. The prevalence of DM in central Greece [35] was relatively high compared to the prevalences in the USA, Australia, and Argentina [9, 32–34]. The prevalences of scleroderma in Detroit, Mich., USA [36], areas of Canada [37, 38], and South Australia [39] were higher than the prevalence reported in Olmsted County [10]. The prevalence of SLE varied considerably over the years in Olmsted County, but was similar to other white populations in Europe and the USA [10–13, 40–42].

Discussion

Skin and skin-related diseases accounted for a high percentage of all medical visits both in Olmsted County [4] and around the world [44]. The REP has been used to study the prevalence of certain specific skin diseases. For these specific skin diseases, we found the highest prevalences among patients with HS, psoriasis, and psoriatic arthritis, whereas the SLE and its subtypes, scleroderma, and DM were rare.

Estimates of prevalence are critically dependent on the study methodology used. All REP studies were based on population-based cohorts where the diagnosis of a disease had been confirmed by a physician. We compared these data to studies from other population-based cohorts in which data were drawn from other hospital registries, general practice, or established registries such as insurance data. Other prevalence studies were based on data gathered from self-reported patients and/or questionnaires. We noted that registry data mostly provided the lowest estimates of prevalences, particularly when compared to studies in which estimated data were based on self-reported patients.

As expected, the prevalence of skin and skin-related diseases varied between Olmsted County and other countries, states, or areas, suggesting a role for environmental and/or genetic factors in the pathogenesis. For example, the prevalence of BD was higher in Turkey [31] compared to Olmsted County [8], other European countries [28, 29], and Taiwan [30]. The prevalence of HS in South Wales did vary between areas, with the highest prevalence in an urban practice compared to a practice in an industrial valley [18]. Between Italian regions, a 2.8-times higher prevalence of psoriasis was reported in the central regions compared to Sardinia and the Southern region (Calabria, Apulia, and Basilicata), also suggesting a possible association with sunlight exposure and weather [23]. Between two areas in the Czech Republic, the highest prevalence was reported in the district of Cheb (a rural area) compared to the City of Ceske Budejovice (an urban area) [24]. In southwestern Ontario, Canada, the prevalences of scleroderma also varied between the areas of Windsor, Sarnia, and Woodstock. Interestingly, it was noted that scleroderma patients in these areas were more likely to drink alcohol [38]. In southern Australia, a lower prevalence of DM was reported [33] compared to other countries as well as Olmsted County [9, 32, 34, 35]. This study found a possible association between DM and a higher socioeconomic status [33].

Most of the skin and skin-related diseases studied in Olmsted County were more common in females compared to males (fig. 2) [5, 7–11, 13, 14]. Similar differences were reported elsewhere (fig. 3) [19, 24–26, 29, 30, 34, 36, 37, 40–43], showing that differences in skin layers, physiology, and sex hormones also affect the pathogenesis.

The population of Olmsted County is a predominantly white US population. Other prevalence studies have demonstrated that certain skin diseases are more prevalent in black populations. For example, in the Detroit Tri-County Area in the USA, the black population had a higher prevalence of scleroderma when compared with the white population [36]. In southeastern Michigan, USA, the prevalence of SLE was highest among the black female population, followed by the white, Hispanic, and Asian/pacific Islander female populations [40]. Similar differences between ethnic groups were found for SLE prevalences in Birmingham, UK, with the highest prevalence reported among Afro-Caribbean females followed by Asian and white females, irrespective of place of birth (fig. 4) [36, 40, 43]. For BD, when looking at people living in metropolitan areas in Paris, France, the prevalence was highest among people of North African origin, followed by Asian (incl. Turkish), noncontinental French, sub-Saharan African, and European nationality [29], irrespective of place of birth. Also shown were disease susceptibility differences among ethnic groups. On the other hand, the prevalence of psoriasis was found to be more common among the white population compared to African-Americans in the USA [20].

In summary, the results of the above prevalence studies were determined by many factors, such as type of prevalence, study methodology, geographic areas, ethnic group, age distribution and socioeconomic status.

Limitation

In addition, there are various possible issues when comparing prevalence data: (1) the definition of the prevalence – the prevalence data were either reported as a point prevalence or period prevalence; (2) different study methodologies – data were either drawn from a population-based source such as hospital, general practice, or established registers such as insurance data or from self-reported patients and/or questionnaires; (3) different dates/years of prevalences – the prevalences were reported from a number of different dates and years; (4) geographical areas – the reported prevalence comes from different countries or areas; (5) different ethnic groups – the prevalences may reflect a certain ethnic group (e.g. black or white population) more accurately and may not represent the entire population of a country; (6) different categorization of a skin and skin-related disease – certain studies have used the International Classification of Diseases categories or other classification criteria to determine if the patient had the disease, while others were not confirmed by a physician, but by the patients; (7) age groups – the reported prevalences may represent a certain age group (e.g. adults only or children only) and therefore not represent the overall prevalence in the entire population across all ages.

Conclusion

Skin and skin-related diseases are an important public health concern. Describing public health issues from an epidemiologic perspective can increase an understanding of the potential impact and provide a basis for developing and prioritizing public health programs. The prevalence of skin and skin-related disease varies from study to study, and many factors contribute to these differences.

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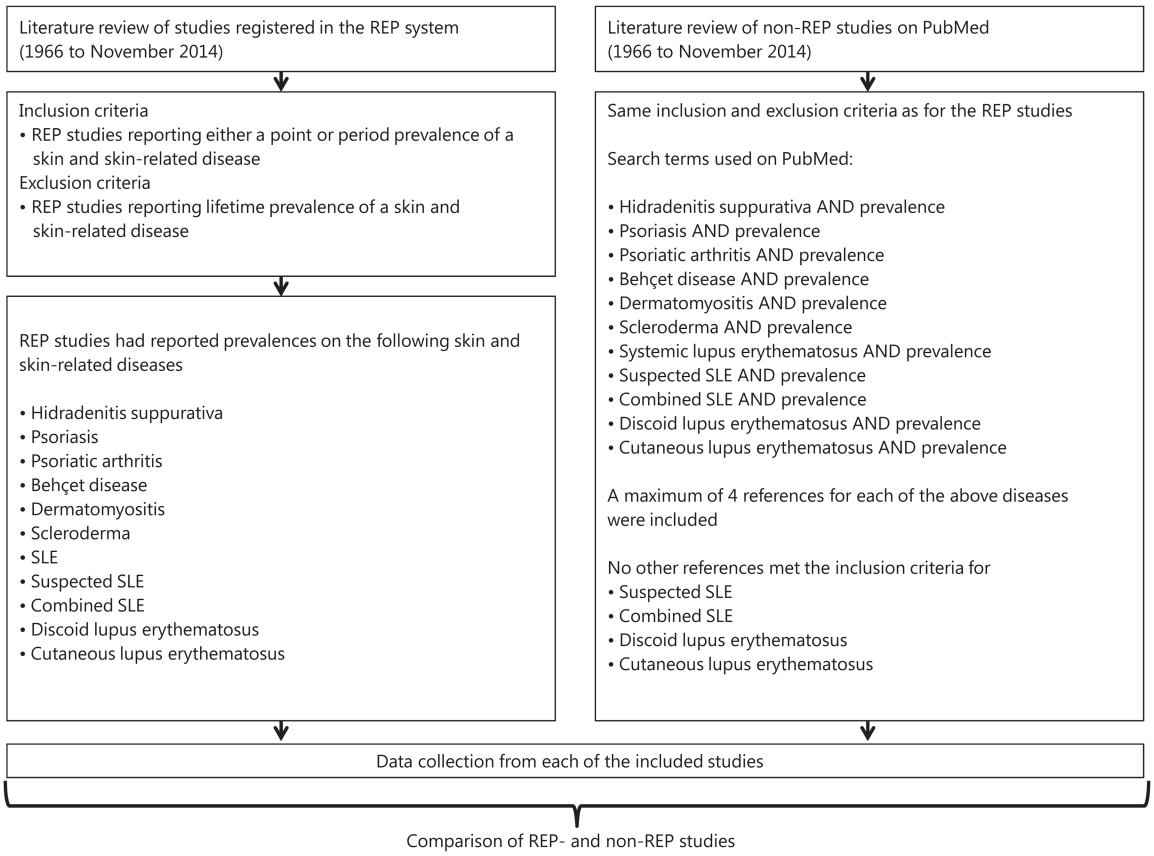

Fig. 1.
Flowchart. SLE = Systemic lupus erythematosus.

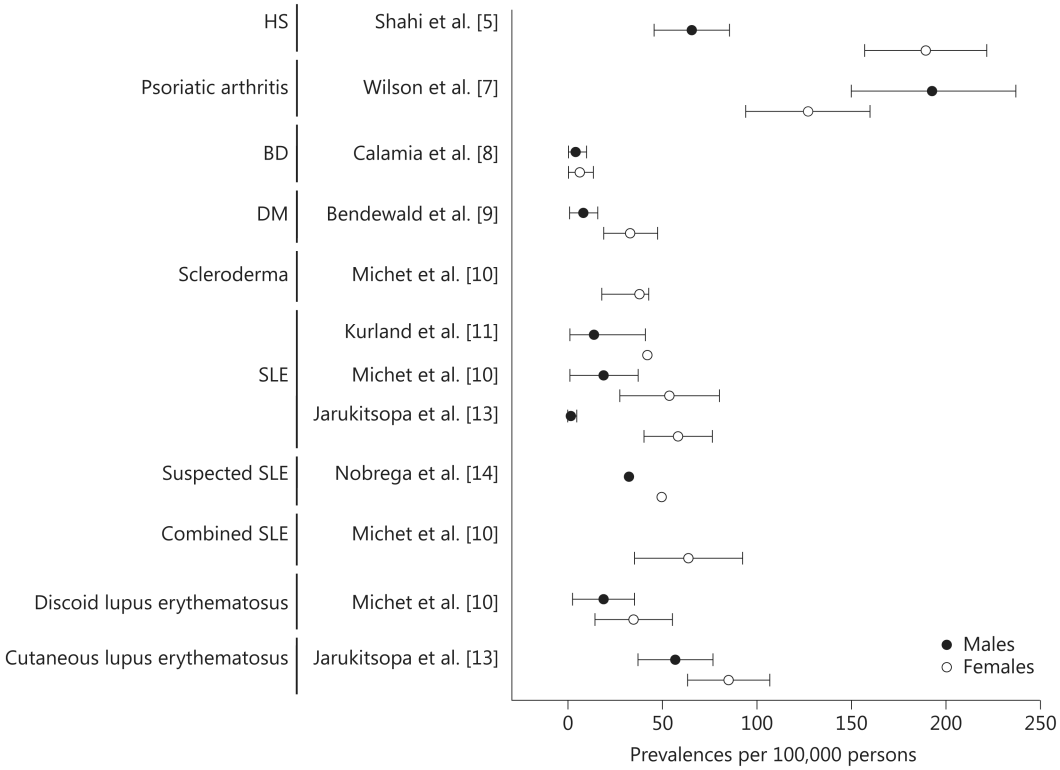

Fig. 2.

Sex-specific prevalences of skin and skin-related diseases in Olmsted County, Minn., USA.

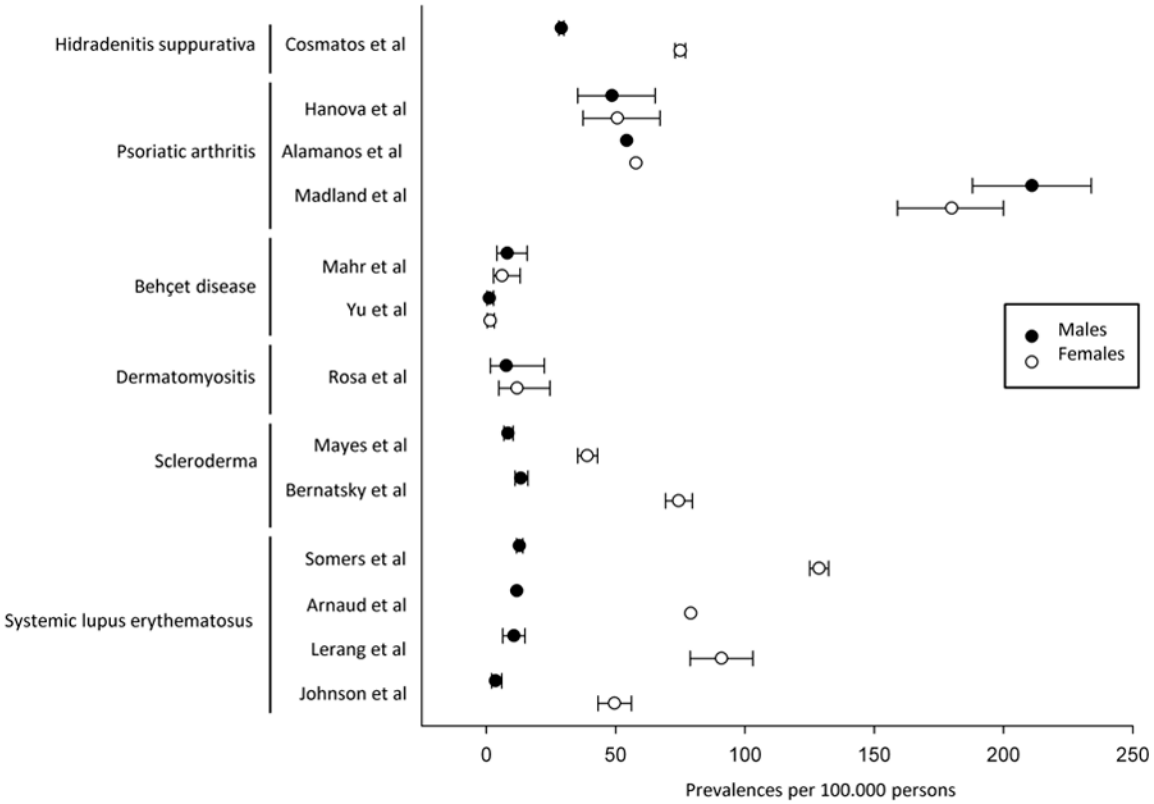

Fig. 3.
Sex-specific prevalences of skin and skin-related diseases globally.

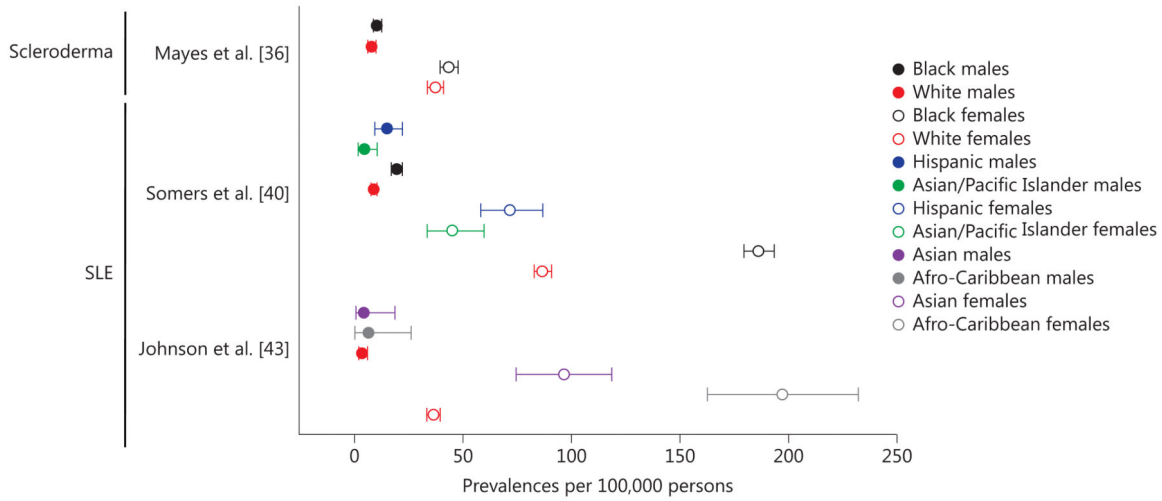

Fig. 4.

Sex-specific prevalences of skin and skin-related diseases by ethnic groups.

Table 1

Studies of prevalence rate of skin and skin-related disease using the REP, Olmsted County, Minn., USA

Reference	Disease	Age, years	Date/period of prevalence estimate	Prevalence
Shahi et al. [5]	HS	All	Jan 1, 2009	127.8 (108.9–146.8)
Shbeeb et al. [6]	Psoriasis	≥18	Jan 1, 1992	700.0 (650.0–750.0)
Shbeeb et al. [6]	Psoriatic arthritis	≥18	Jan 1, 1992	101.0 (80.0–120.0)
Wilson et al. [7]	Psoriatic arthritis	All	Jan 1, 2000	158.0 (132.0–185.0)
Calamia et al. [8]	BD	≥18	2000	5.2 (0.64–9.84)
Bendewald et al. [9]	DM	All	Jan 1, 2007	21.42 (13.07–29.77)
Michet et al. [10]	Scleroderma	All	Jan 1, 1980	13.8 (4.2–23.4)
Kurland et al. [11]	SLE	All	Jan 1, 1968	48.0
Michet et al. [10]	SLE	All	Jan 1, 1980	40.0 (23.5–57.5)
Uramoto et al. [12]	SLE	All	Jan 1, 1993	122.0 (97.0–147.0)
Jarukitsopa et al. [13]	SLE	All	Jan 1, 2006	30.5 (21.1–39.9)
Michet et al. [10]	Suspected SLE	All	Jan 1, 1980	32.8 (18.1–47.5)
Nobrega et al. [14]	Combined SLE	All	Jan 1, 1966	41.8
Michet et al. [10]	Discoid lupus erythematosus	All	Jan 1, 1980	27.6 (14.1–41.1)
Durosaro et al. [15]	CLE	All	Jan 1, 2006	73.2 (58.3–88.2)
Jarukitsopa et al. [13]	CLE	All	Jan 1, 2006	70.4 (55.9–84.8)

CLE = Cutaneous lupus erythematosus. Figures in parentheses indicate 95% confidence intervals. Prevalence estimate: the prevalence is a point prevalence if it was reported for a specific point in time (i.e. a specific day and year), but the prevalence is a period prevalence if it was reported for a specified period (e.g. months or years). In Nobrega et al. [14], combined SLE is defined as classic SLE (positive LE cell test and ≥3 major systemic manifestations of LE) plus rheumatoid arthritis with LE (previous rheumatoid arthritis with positive LE cell test and ≥3 major systemic manifestations of LE). As for Durosaro et al. [15] and Jarukitsopa et al. [13], both studies reported the point prevalence of cutaneous lupus erythematosus for the Olmsted County population in January 2006. Differences in these prevalences are due to differences in the methodology used in defining the denominator and in adjusting the population. Moreover, these prevalence estimates for cutaneous lupus erythematosus are underestimates since they were derived from incident cases in Olmsted County from 1965 to 2002.

Table 2

Prevalence of skin and skin-related diseases globally

Disease	Reference	Geographic location	Study methodology	Ages of persons in population, years	Date of prevalence estimate	Prevalence per 100,000	95% CI
HS	Jemec et al. [16]	Denmark	Random sample (n = 793) was invited for a general health examination by a standard letter; 599 persons (75.5%) responded and were examined	≥15–69	1992	1,000.0	400.0–2,200.0
			Consecutive series of patients at a sexually transmitted diseases clinic; 507 patients were examined	All	Two 6-month periods (1992–1995)	4,100.0	3,000.0–6,000.0
	Revuz et al. [17]	France	Survey was mailed to a representative sample of the French population (n = 10,000) and was returned by 68.9% (6,887 of 10,000)	≥15	2002	970.0	790.0–1,250.0
	Harrison et al. [18]	South Wales	Retrospective analysis of all registered patients at 2 general practices; practice A (n = 5,652) was an industrial valley community and practice B (n = 6,919) an urban practice	All	Not reported	Practice A: 140.0 Practice B: 190.0	
	Cosmatos et al. [19]	USA	Retrospective analysis of a large health insurance claims database (n = 7,929)	All	2007	53.0	51.0–54.0
Psoriasis	Gelfand et al. [20]	USA	Random sample (n = 27,220) was asked standard demographic questions; if a physician-confirmed diagnosis of psoriasis was reported, additional questions were asked	All	Not reported	Whites: 2,500.0 African-Americans: 1,300.0	2,200.0–2,700.0 700.0–1,800.0
	Nevitt and Hutchinson [21]	Leicester, UK	Letter with a short description of psoriasis was sent to 5,395 patients in a general medical practice; patients replying positively were invited for an examination	All	Not reported	1,480.0	1,200.0–1,800.0
	Augustin et al. [22]	Germany	Retrospective analysis of data from a database of about 1.3 million nonselected persons enlisted in a German statutory health insurance organization covering all regions in Germany	All <18	2005	2,530.0 710.0	2,500.0–2,560.0

Disease	Reference	Geographic location	Study methodology	Ages of persons in population, years	Date of prevalence estimate	Prevalence per 100,000	95% CI
	Saraceno et al. [23]	Italy	Survey was mailed to a representative sample of the Italian population (n = 3,500 families)	All	Feb 2006	2,900.0	
Psoriatic arthritis	Hanova et al. [24]	Czech Republic: City of Ceske Budejovice (urban) and district of Cheb (rural)	Retrospective analysis of a population-based cohort identified from 2 regions (total n = 154,374); diagnosis was confirmed by rheumatologists or dermatologists	≥16	Mar 1, 2002	City of Ceske Budejovice: 36.7 District of Cheb: 63.0	25.6–50.9 47.6–81.8
	Alamanos et al. [25]	Northwest Greece	Retrospective analysis of records for inpatients and outpatients referred to rheumatology clinics (private and hospitals) in an area with 500,000 inhabitants	≥16	Dec 31, 2001	57.0	50.0–63.0
	Madland et al. [26]	Bergen, Norway	Retrospective analysis of data from rheumatology centers and 2 private rheumatologists in a county with 442,000 inhabitants	≥20	Jan 1, 2003	195.0	180.0–210.0
	Salaffi et al. [27]	Italy	Questionnaires were sent to a random sample of 3,664 patients selected from the practice lists of 16 general practitioners	≥18	2004	420.0	310.0–610.0
BD	Salvarani et al. [28]	Reggio Emilia, Northern Italy	Retrospective analysis of a population-based cohort; data were derived from multiple sources	≥18	Jan 1, 2005	3.8	2.0–5.8
	Mahr et al. [29]	Paris metropolitan area, France	Questionnaire was mailed to community-based general physicians, rheumatologists, dermatologists, and ophthalmologists, and asked whether they were aware of any patients with BD (metropolitan area is home for 1,094,412 adults of whom 26% are of non-European ancestry)	≥15	2003	All ethnic groups: 7.1 European: 2.4 North African: 34.6 Asian (incl. Turkish): 17.5 Sub-Saharan African: 5.1 Noncontinental French: 6.2	3.5–14.4 0.6–7.2 24.4–47.5 10.7–27.2 2.2–11. 2.8–13.1
	Yu et al. [30]	Taiwan	Retrospective analysis of a population-based cohort; cases registered with Taiwan National Health Insurance (comprising 1,000,000 beneficiaries)	All	2000	1.4	0.4–2.3
	Azizlerli et al. [31]	Istanbul, Turkey	A 2-stage study: identified people with recurrent oral ulcers by visiting homes	≥12	Not reported	420.0	3,40.0–510.0
DM	Furst et al. [32]	USA	Retrospective analysis of medical records in a large managed-care	≥18	Jan 1, 2008	5.9	5.3–6.5

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Disease	Reference	Geographic location	Study methodology	Ages of persons in population, years	Date of prevalence estimate	Prevalence per 100,000	95% CI
			database (35 million insured members)				
	Tan et al. [33]	South Australia	All muscle biopsy reports from the Neuropathology Laboratory, Hanson Institute, were reviewed; patient medical records were reviewed for clinical correlation	All	1980–2009	1.97	
	Rosa et al. [34]	Buenos Aires, Argentina	Cases registered with the Hospital Italiano Medical Care Program (n = 140,000 members)	All	Jun 1, 2009	10.22	4.9–18.8
	Anagnostopoulos et al. [35]	Central Greece	Mailed questionnaire was followed by confirmation with clinical examination and tests of persons with a positive reply (n = 3,528)	Adults (ages not specified)	Apr 2007 to Jun 2008	58.0	50.0–180.0
Scleroderma	Mayes et al. [36]	Detroit, Mich., USA	Retrospective analysis of the population of the Detroit Tri-County Area; data were derived from multiple sources	≥18	1989–1991	All ethnic groups: 24.2 White: 22.5 Black: 31.5	21.3–27.4 19.7–25.6 28.2–35.2
	Bernatsky et al [37]	Quebec, Canada	Retrospective analysis of Quebec physician billing and hospitalization databases (covering 7.5 million people)	All	2003	44.3	41.1–47.6
	Thompson and Pope [38]	Windsor, Woodstock, Sarnia, Ont., Canada	Case-control study of patients with scleroderma and 2 age- and sex-matched controls from the same rheumatologist's practice; a questionnaire was mailed to both groups	All	Not reported	Windsor: 7.1 Woodstock: 28.0 Sarnia: 9.6	3.4–10.8 9.7–46.4 2.5–16.8
	Roberts-Thomson et al. [39]	South Australia	Analysis of the database of the South Australian Scleroderma Register	All	1993–2002	21.4	20.2–22.6
SLE	Somers et al. [40]	Southeastern Michigan, USA	Analysis of multiple case-finding sources in Wayne and Washtenaw counties (population 2.4 million)	All	2002–2004	All ethnic groups: 72.8 Black: 111.6 White: 47.5 Asian/Pacific Islander: 4.4 Hispanic: 42.1	70.8–74.8 107.7–115. 45.5–49.7 1.4–10.4 35.0–50.2
	Arnaud et al. [41]	France	Cases from the French national administrative databases (86% of the French population)	All <19	2010	47.0 3.75	46.5–47.6
	Lerang et al. [42]	Oslo, Norway	Cases from 5 hospitals (population of 580,000, of whom 20% are immigrants of non-European origin)	≥16	Jan 1, 2008	Ethnic Norwegian population: 52.8 European descent immigrant: 35.5	45.2–58.4 17.6–53.5 38.0–81.5 75.4–538.7

Disease	Reference	Geographic location	Study methodology	Ages of persons in population, years	Date of prevalence estimate	Prevalence per 100,000	95% CI
						Asian population: 59.7 In foreign country adopted population: 307.0	
	Johnson et al. [43]	Birmingham, UK	Attending physicians (n = 204) were contacted twice by mail with requests about their SLE patients (population a broad ethnic mix)	≥18	Jan 1, 1992	All ethnic groups: 27.7 Afro-Caribbean: 111.8 Asian: 46.7 Caucasian: 20.	24.2–31.2 80.8–142.8 31.5–61.9 17.5–24.0

Prevalence estimate: the prevalence is a point prevalence if it was reported for a specific point in time (i.e. a specific day and year), but it is a period prevalence if it was reported for a specified period (e.g. months or years).