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Incidence of Diseases Primarily Affecting the Skin by Age Group: Population-Based Epidemiologic Study in Olmsted County, Minnesota, and Comparison With Age-Specific Incidence Rates Worldwide

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Abstract

Understanding the effects of age on the epidemiology of diseases primarily affecting the skin is important to the practice of dermatology, both for proper allocation of resources and for optimal patient-centered care. To fully appreciate the effect that age may have on the population-based calculations of incidence of diseases primarily affecting the skin in Olmsted County, Minnesota, and worldwide, we performed a review of all relevant Rochester Epidemiology Project–published data and compared them with similar reports in the worldwide English literature. Using the Rochester Epidemiology Project, population-based epidemiologic studies have been performed to estimate the incidence of specific skin diseases over the past 50 years. In older persons (>65 y), nonmelanoma skin cancer, lentigo maligna, herpes zoster, delusional infestation, venous stasis syndrome, venous ulcer, and burning mouth syndrome were more commonly diagnosed. In those younger than 65 years, atypical nevi, psoriatic arthritis, pityriasis rosea, herpes progenitalis, genital warts, alopecia areata, hidradenitis suppurativa, infantile hemangioma, Behçet disease, and sarcoidosis (isolated cutaneous, with sarcoidosis-specific cutaneous lesions and with erythema nodosum) had a higher incidence. Many of the incidence rates by age group of diseases primarily affecting the skin derived from the Rochester Epidemiology Project were similar to those reported elsewhere.

Keywords

epidemiology; skin diseases; statistical review

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Introduction

As the world population grows and changes, so too does disease incidence (new disease over time in a population) change. For diseases that primarily affect the skin, incidence trends in the literature over time and by category may help us to coordinate the appropriate allocation of resources in clinical practice, patient-centered care, and research in dermatology. Therefore, an understanding of which skin diseases are more prominent with age is important.

For instance, it is well established in the literature that nonmelanoma skin cancers are more common in the elderly. The incidence of melanoma skin cancer, however, has increased markedly in younger age groups, especially among women (1), and the incidence of nonmelanoma skin cancer is also increasing in this younger age group. Diseases for which incidences are less commonly reported in the literature and which are perhaps less researched (although no less important for our patients and professions), such as hidradenitis suppurativa, appear to be more common in men and women in their twenties (2). The mechanisms whereby a person's age influences the function and integrity of the integumentary system have yet to be fully elucidated, but exposure to extrinsic factors such as UV radiation and tobacco, genetics, endocrine and hormonal dysregulation, and inflammation may all influence the multifaceted pathogenesis of disease in skin over time (3). For diseases such as hidradenitis suppurativa, an epidemic of obesity and weight gain may affect the age-related incidence of this disease.

The Rochester Epidemiology Project (REP) is an extensive medical records linkage system founded in 1966, whereby the medical records of almost all residents of Olmsted County, Minnesota, United States, may be used for the epidemiologic study of disease over the past 50 years (4,5). Although there are some limitations in the generalizability of data cultivated from the REP owing to a less racially and ethnically diverse population, the ability to obtain a multitude of health information from a population of approximately 150,000 people in a well-defined geographic region has been helpful.

In 2 previous publications, incidences of diseases primarily affecting the skin were reported 1) without subcategorization and 2) subsequently stratified by sex (6,7), with a comparison to reports from the world literature in 1 of the studies (7). The purpose of our study is to better understand age-specific incidence rates (IRs) of diseases that primarily affect the skin in Olmsted County and, similarly, age-specific IRs worldwide.

Materials and Methods

The highest IRs (per 100,000 person-years) by age group for diseases primarily affecting the skin were collected from all of the REP studies in Olmsted County, Minnesota, generated between 1966 and June 2016. Studies in which these data were included as a figure(s), rather than numerically defined, were excluded. Studies reporting appropriate data but with fewer than 10 patients in the analysis were also excluded from our study. The following parameters were recorded for each report fitting our inclusion criteria: source, study period, skin

disease, age, number of cases, age group, and highest IR per 100,000 person-years by age and sex, similar to previous studies (6,7).

We subsequently performed a search of the worldwide English-language literature describing age-specific IRs for diseases that primarily affect the skin during our study period of 1966 through June 2016 by using PubMed. If appropriate data were present but analyses were performed on 10 or fewer patients, the study was not included in our review. Some studies reported only overall IRs by age group with no subclassification by sex, and vice versa; these studies were included. Similar to a previous publication (7), we limited our world literature review to 5 publications per disease in each of 5 main categories (which were also used in previous publications [6,7]): 1) skin cancer, 2) connective tissue diseases, 3) papulosquamous diseases including psoriatic arthritis, 4) infections and infestations, and 5) other skin diseases. For each disease, we chose to limit our search to a maximum of 5 most-relevant publications.

We used the following search terms for the English-language literature via PubMed: incidence AND age-specific incidence AND basal cell carcinoma OR squamous cell carcinoma OR atypical nevi OR lentigo maligna OR cutaneous melanoma OR systemic lupus erythematosus (SLE) (definite, suspected, or combined), OR mixed connective tissue disease OR primary Sjögren syndrome OR psoriasis OR psoriatic arthritis OR pityriasis rosea OR herpes zoster OR herpes progenitalis OR condyloma acuminatum (genital warts) OR cutaneous nontuberculous mycobacterial infection OR delusional infestation OR alopecia areata OR hidradenitis suppurativa OR infantile hemangioma OR Behçet disease OR venous stasis syndrome OR burning mouth syndrome OR leukocytoclastic vasculitis OR sarcoidosis (isolated cutaneous, or systemic with sarcoidosis-specific cutaneous lesions or systemic with erythema nodosum).

We abstracted the same parameters from each of the studies meeting our criteria as outlined above and additionally included study method and geographic area. We found no comparative studies meeting our criteria for the following diseases: atypical nevi, mixed connective tissue disease, pityriasis rosea, herpes progenitalis, cutaneous nontuberculous mycobacterial infection, delusional infestation, hidradenitis suppurativa, infantile hemangioma, burning mouth syndrome, leukocytoclastic vasculitis, and sarcoidosis; either studies were not found, age-specific IRs were not reported, or age-specific IRs were presented as figures rather than numerically reported.

Results

Results from REP studies are summarized in Table 1. In general, nonmelanoma skin cancer, lentigo maligna, herpes zoster, delusional infestation, venous stasis syndrome, venous ulcer, and burning mouth syndrome were more commonly diagnosed in the elderly. In contrast, persons younger than 65 years in Olmsted County were more likely to have atypical nevi, psoriatic arthritis, pityriasis rosea, herpes progenitalis, genital warts, alopecia areata, hidradenitis suppurativa, infantile hemangioma, Behçet disease, and sarcoidosis (isolated cutaneous, with sarcoidosis-specific cutaneous lesions and with erythema nodosum).

Table 2 summarizes the literature published in English on non-REP studies. In general, nonmelanoma skin cancer was diagnosed more commonly in persons older than 70 years. Malignant melanoma and melanoma in situ were diagnosed more frequently in those older than 65 years. Herpes zoster and venous leg ulcer were also more common in the elderly. In contrast, lentigo maligna, SLE, psoriatic arthritis, pityriasis rosea, genital warts, and Behçet disease were more likely to be diagnosed in persons younger than 65 years.

Discussion

Skin Cancer

In Olmsted County, nonmelanoma skin cancer, including basal cell and squamous cell carcinoma, was more commonly diagnosed in persons older than 85 years, except in one study in which IRs were generated in a population younger than 40 years (8–10). World literature reports were similar; both nonmelanoma skin cancers were most commonly diagnosed after age 70 years (41–45).

REP studies highlighted an increased likelihood of diagnosis of cutaneous malignant melanoma in Olmsted County in persons older than 60 years, with the highest reported incidence for women occurring in the 40- to 59-year-old age group in one study (13,14). In the world literature, the highest incidence of malignant melanoma and melanoma in situ was in those aged 65 years and older (44–51). Of note, premalignant melanoma in a study in western Australia was more commonly diagnosed in men older than 80 years, whereas women were most commonly aged 40 to 49 years (57). In Olmsted County, lentigo maligna was more commonly diagnosed in those aged 70 years and older (12). Incidence reports in the world literature of lentigo maligna and lentigo maligna melanoma by age group are not as definitive; more studies outlining incidence by age may be of benefit to improve our epidemiologic knowledge of these specific skin diseases (52,55,56).

Connective Tissue Diseases

Age group does not as easily delineate trends in incidence of connective tissue diseases from the REP. This may be partly due to the different definitions used to describe a diagnosis of SLE, including *SLE*, *definite SLE*, *suspected SLE*, and *combined SLE*. In general, the highest incidences of SLE occurred in those older than 45 years in Olmsted County (15–18). Two world studies showed the highest incidence of SLE by age group to be in persons ages 16 to 19 years and 35 to 44 years, respectively, with contrasting age groups by sex and race in a study from Baltimore, Maryland (58,59). For mixed connective tissue disease, the highest incidence was reported in persons aged 60 to 69 years in Olmsted County.

Patients in Olmsted County with primary Sjögren syndrome were more likely to receive a diagnosis after age 75 years if male and between 55 and 75 years if female (19, 20). Similarly, in Taiwan, those aged 65 to 74 years were more likely to have primary Sjögren syndrome (61).

Papulosquamous Diseases

In Olmsted County, psoriasis was more commonly diagnosed in persons aged 60 to 69 years in 2 REP-derived studies, with the highest incidence occurring in men at a later age than in women, whereas for psoriatic arthritis the opposite was true; more men had a psoriatic arthritis diagnosis at an earlier age (21–24). Similar findings were noted elsewhere for psoriatic arthritis (63,64,67).

Pityriasis rosea was uniformly more common in 20- to 24-year-olds in both men and women in Olmsted County (25). In Athens, Greece, most diagnoses were made in persons aged 31 to 35 years and between the ages of 21 and 25 years and 6 and 10 years in female and male patients, respectively (68).

Skin Infections and Infestations

Herpes zoster in Olmsted County was diagnosed predominantly in those aged 80 years and older in the 2 studies in which the population comprised adults (27,28). Similarly, the incidence of herpes zoster in adults in the world literature was highest in persons older than or equal to 65, 75, and 85 years, depending on the study (69, 71–73). Herpes progenitalis in Olmsted County was most commonly diagnosed in women of childbearing age, 20 to 24 years; the same was true for genital warts (29,30). The incidence of genital warts was comparatively highest in persons of reproductive potential in Northern California, Denmark, Sweden, and Australia (74–77).

Cutaneous nontuberculous mycobacterial infection was most commonly diagnosed in those older than 60 years; delusional infestation was typically diagnosed in persons older than 80 years in Olmsted County (31,32).

Other Skin Diseases

In REP studies, alopecia areata was more commonly diagnosed in persons aged 30 to 39 years (33,34). Hidradenitis suppurativa was more commonly diagnosed in those aged 20 to 29 years (2). Behçet disease was more commonly diagnosed between the ages of 18 and 29 years in Olmsted County, with an increased age at diagnosis for men (30–39 years) (36). Similarly, a study performed in southern Sweden demonstrated Behçet disease as diagnosed most commonly in the 25- to 34-year-old age group for combined sexes (78).

In Olmsted County, venous stasis syndrome and venous ulcer were most commonly diagnosed in men and women older than 85 years (37). Results were similar worldwide, with diagnosis in men and women more commonly after age 90 years (79).

Burning mouth syndrome was most commonly diagnosed after age 80 years, leukocytoclastic vasculitis after age 60 years, and sarcoidosis after age 40 years in Olmsted County (38–40). Interestingly, men had systemic sarcoidosis with specific cutaneous lesions and with erythema nodosum earlier than women, whereas isolated cutaneous sarcoidosis was more commonly diagnosed in women at an earlier age (40).

Study Strengths and Limitations

We recognize several strengths and limitations of our study. The REP is extremely useful for obtaining standardized data in a population over time. We believe that this compilation of data in comparison with international studies is helpful for recognition of skin disease in the elderly across the globe, with consideration toward allocation of future resources. The specific limitations regarding the use of REP studies are further outlined in a previous publication (6). We recognize that our method of article selection and search criteria may introduce bias into our review and may not provide a wholly comprehensive picture of the age-related incidence of certain diseases. Also, whereas choosing 5 articles may be suitable for frequently occurring diseases, further investigation and reporting of IRs in rarer diseases would be valuable. We also recognize the difficulty in comparing REP studies with studies from the world literature, specifically because of differences in study design, population characteristics, age groups, and eligibility criteria reported in each study. Also, reporting IRs as standardized or crude rates may or may not affect how data compare between REP and world literature studies. Meta-analyses and meta-regression analyses were not performed because of scarcity of data pertaining to age-related incidences for certain diseases. Future studies and analyses may contribute to a more comprehensive appreciation of age-related incidence rates regarding this topic, as well as provide information about bias across studies. Future studies may also evaluate the effects of obesity and weight gain on the incidence of diseases primarily affecting the skin, which is outside the scope of the current review. We do also recognize that the extent of this review, as well as the time period used for the collection of data, is large, which reflects the large amounts of data available for comparison through the REP. Using a study period of 1966 through June 2016 is a limitation of our study in that more recent trends in IRs may not be as accurately portrayed. We included the dates of relevant studies and note that for some diseases a stricter time period would have excluded studies for rarer diseases. In addition, our use of the REP is a limitation in that certain diseases common in the elderly, such as actinic keratosis and chronic actinic dermatitis, were not included in our review.

Conclusion

We describe several reports of diseases primarily affecting the skin subcategorized by age group, particularly examining data accumulated by the REP from 1966 to the present and gathering comparative data within the world literature. Our results indicate that several of these skin diseases may have increased incidences within certain age group categories. Despite differences in study methodologies and designs, we found similarities in skin diseases by age group between the REP and world literature studies. Nonmelanoma skin cancers, herpes zoster, and venous ulcer were found to be of highest incidence in the elderly, whereas psoriatic arthritis, pityriasis rosea, genital warts, and Behçet disease were less likely to be diagnosed in the elderly. We believe that further subcategorization of diseases that primarily affect the skin encourages appropriate use of resources in our field and advancement in the knowledge of dermatologic disease for research, optimal patient-centered care, and population health initiatives. We also believe that highlighting those diseases for which incidence subcategorization by age is scarce indicates that further study in these areas may be undertaken.

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Abbreviations

IR	incidence rate
REP	Rochester Epidemiology Project
SLE	systemic lupus erythematosus

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Table 1

Studies Reporting Age-Specific Incidence of Diseases Primarily Affecting the Skin in Olmsted County, Minnesota, USA

Source	Study Period	Skin Disease	Age, y	N	Highest Incidence Rate Per 100,000 Person-Years by Age and Sex					
					Age Group, y	Both Sexes	Age Group, y	Female	Age Group, y	Male
Skin Cancer										
Chuang et al (8)	1976–1984	BCC	All	657	85	950.2	85	927.8	75–84	1,043.4
Christenson et al (9)	1976–2003	BCC	40	417	36–39	93	36–39	99.6	36–39	86.1
Christenson et al (9)	1976–2003	SCC	40	68	36–39	17.4	36–39	12.5	36–39	22.6
Chuang et al (8)	1976–1984	SCC	All	169	85	446.3	85	371.1	85	706.5
Gray et al (10)	1984–1992	SCC	All	511	85	874	85	758.4	85	1,286
Adajti et al (11)	2000–2005	Atypical nevi	All	631	30–39	143.1	30–39	155.5	30–39	130.4
Mirzoyev et al (12)	1970–2007	Lentigo maligna	18	145	70–79	28.5	80	12.6	70–79	51.9
Popescu et al (13)	1950–1985	CMM	All	107	70	23.5	70	16.8	70	37.3
Resseguie et al (14)	1950–1974	CMM	All	42	60	8.8	40–59	8	60	15.5
Connective Tissue Disease										
Kurland et al (15) ^a	1951–1967	SLE	All	29	45–64	9.2	65	13.6	45–64	12.4
Michet et al (16)	1950–1979	Definite SLE	All	258	65	4.8	25–44	6.3	65	4.5
Michet et al (16)	1950–1979	Suspected SLE	All	21	65	4.8	65	7.5	N/A	N/A
Nobrega et al (17)	1950–1959	Combined SLE	All	8	45–54	5.1	55	7.5	45–54	5.8
Nobrega et al (17)	1960–1965	Combined SLE	All	17	45–54	15.6	55	14.5	45–54	34.8
Ungprasert et al (18)	1985–2014	Mixed connective tissue disease	18	50	60–69	3	60–69	4.3	60–69	1.6
Pillemer et al (19) ^b	1976–1992	Primary Sjögren syndrome	All	53	All	3.2	55–64	22.7	75	8.7
Nannini et al (20)	1976–2005	Primary Sjögren syndrome	18	105	65–74	12.7	65–74	21.8	75	7.5
Papulosquamous Disease Including Psoriatic Arthritis										
Icen et al (21)	1970–2000	Psoriasis	18	1,633	60–69	94.2	50–59	90.7	60–69	115.3
Bell et al (22) ^c	1980–1983	Psoriasis	All	132	60–69	112.6	60–69	126.5	70	130.6
Wilson et al (23)	1969–1999	Psoriatic arthritis	18	147	50–59	9.6	50–59	10.5	30–39	12.2
Shbeeb et al (24)	1982–1991	Psoriatic arthritis	20	66	20	6.59	40–59	13.38	20–39	10.8
Chuang et al (25)	1969–1978	Pityriasis rosea	All	939	20–24	454	20–24	523.2	20–24	305
Infections and Infestations										
Guess et al (26)	1960–1981	Herpes zoster	<20	173	15–19	63	15–19	58	15–19	71

Source	Study Period	Skin Disease	Age, y	N	Highest Incidence Rate Per 100,000 Person-Years by Age and Sex					
					Age Group, y	Both Sexes	Age Group, y	Female	Age Group, y	Male
Yawn et al (27)	1996–2001	Herpes zoster	22	1,669	80	1,140	80	910	80	1,070
Kawai et al (28) ^d	2000–2007	Herpes zoster	All	8,017	80	1,070	All	3.44	All	2.61
Chuang et al (29)	1965–1979	Herpes proiesitalis	All	392	20–24	197	20–24	210	20–24	170
Chuang et al (30)	1950–1978	Condyloma acuminatum	All	746	20–24	298	20–24	322	20–24	247
Wentworth et al (31)	1980–2009	Cutaneous nontuberculous mycobacterial infection	All	40	60	2.2	N/A	N/A	N/A	N/A
Bailey et al (32)	1976–2010	Delusional infestation	All	64	80	10	80	7.2	80	16.2
Other Skin Diseases										
Safavi et al (33)	1975–1989	Alopecia areata	All	292	30–39	29.3	50–59	31.4	30–39	31.3
Mirzoyev et al (34)	1990–2009	Alopecia areata	All	530	30–39	30.1	20–29, 40–49	27.1	30–39	37.2
Vazquez et al (2)	1968–2008	Hidradenitis suppurativa	All	268	20–29	13.3	20–29	18.4	20–29	7.4
Anderson et al (35) ^e	1976–2010	Infantile hemangioma	3	999	3	1,640	60–89 days	7.910	60–89 days	3,410
Calamia et al (36)	1960–2005	Behçet disease	18	13	18–29	0.75	18–29	1.14	30–39	0.59
Heit et al (37)	1966–1990	Venous stasis syndrome	15	1,131	85	349.7	85	364.8	85	306.3
Heit et al (37)	1966–1990	Venous ulcer	15	263	85	124.9	85	134.7	85	96.7
Kohorst et al (38)	2000–2010	Burning mouth syndrome	All	169	80–89	48.1	70–79	70.3	70–79	18.4
Arora et al (39)	1996–2010	Leukocytoclastic vasculitis	All	84	60–69	9.7	60–69	9.3	70	10.9
Ungprasert et al (40)	1976–2013	Isolated cutaneous sarcoidosis	18	26	40–49	1.5	40–49	2.3	60–69	1.4
Ungprasert et al (40)	1976–2013	Systemic sarcoidosis with sarcoidosis-specific cutaneous lesions	18	36	40–49	2	50–59	3.4	40–49	1.7
Ungprasert et al (40)	1976–2013	Systemic sarcoidosis with erythema nodosum	18	26	40–49	1.5	40–49	2	30–39	1.1

Abbreviations: BCC, basal cell carcinoma; CMM, cutaneous malignant melanoma; N/A, not available; SCC, squamous cell carcinoma; SLE, systemic lupus erythematosus.

Adapted from Andersen and Davis (6,7). Used with permission.

^aStandardized to the 1960 census.

^bHole punched in the manuscript copy, but data were not obscured.

^cStandardized to the 1980 Rochester census.

^dHighest incidence rate for both sexes was originally reported as cases/1,000 person-years and has been adjusted to cases/100,000 person-years.

^eIncidence rates were originally reported as cases/100 person-years and have been adjusted to cases/100,000 person-years.

Table 2
Studies on the Age-Specific Incidence of Diseases Primarily Affecting the Skin in the PubMed English-Language Literature

Source	Study Period	Skin Disease	Method	Location	Age, y	N	Highest Incidence Rate Per 100,000 Person-Years by Age and Sex				
							Age Group, y	Both Sexes	Female	Male	
de Vries et al (41)	1998–2000	BCC	Review of incident data using the Eindhoven Cancer Registry	Southeast Netherlands	All	23,511	N/A	N/A	70	340	533
Bielska et al (42)	2006–2007	BCC	Review of diagnosed cases registered by dermatologists in Barcelona's Nord county	Spanish Mediterranean	All	936	80–84	2,197	80–84	1,523	3,910
Celic et al (43)	2003–2005	BCC	Data collection by questionnaire designed by Croatia committee of dermatology and venerology of ministry of health and social welfare	Croatia	All	7,244	N/A	N/A	80	326.8	652.3
Sella et al (44)	2006–2011	BCC	Data collected from MHS, with histology and laboratory confirmation	Israel	All	16,079	80	999	All	158	225
Hoey et al (45)	1993–2002	BCC	Data collected from NICR in the province, with pathology confirmed	Northern Ireland	All	14,442	N/A	N/A	70	405	579
Sella et al (44)	2006–2011	SCC	Data collected from MHS, with histology and laboratory confirmation	Israel	All	4,767	80	612	All	41	78
Hoey et al (45)	1992–2002	SCC	Data collected from NICR in the province, with pathology confirmed	Northern Ireland	All	6,401	N/A	N/A	70	209	401
Staples et al (46)	2002	SCC	Face-to-face interviews conducted by market research company	Australia	All	286	70	2,972	70	2,146	3,979
Karagas et al (47)	1979–1980	SCC	Physicians and pathology laboratory in New Hampshire and bordering regions; reported cases during time period	New Hampshire, Vermont	All	160	N/A	N/A	75	84.3	331.1
Karagas et al (47)	1993–1994	SCC	Physicians and pathology laboratory in New Hampshire and bordering regions; reported cases during time period	New Hampshire	All	779	N/A	N/A	75	361	1,239
Sella et al (44)	2006–2011	Invasive melanoma	Data collected from MHS, with histology and laboratory confirmation	Israel	All	1,264	70–79 and 80	64	All	16	19
Hoey et al (45)	1993–2002	MM	Data collected from NICR in the province, with pathology confirmed	Northern Ireland	All	1,866	N/A	N/A	70	35	35
Howlett et al (48) ^a	1998–2002	MM	New cases were registered with Nova Scotia Cancer Registry	Nova Scotia	All	925	N/A	N/A	65	44.9	80
Cossu et al (49)	1992–2011	MM	Epi data obtained from local tumor registry of the Italian association for tumor registries	North Sardinia, Italy	All	532	N/A	N/A	75–79	10.7	20.4

Source	Study Period	Skin Disease	Method	Location	Age, y	N	Highest Incidence Rate Per 100,000 Person-Years by Age and Sex					
							Age Group, y	Both Sexes	Age Group, y	Female	Age Group, y	Male
Hoelberg et al (50)	2012	MM	NORDCAN database used to collect cancer incidence in Nordic countries	Denmark	All	2,046	N/A	0–69	803	0–69	665	
Sella et al (44)	2006–2011	MIS	Data collected from MHS, with histology and laboratory confirmation	Israel	All	714	40	All	8	All	12	
Weinstock et al (51) ^b	2002–2009	MIS	Cross-sectional study of Medicare part B claims for beneficiaries 65 y	USA	65	N/A	75.2	>65	37.7	>65	100.7	
Wang et al (52) ^c	1992–2011	MIS	Data collected from SEER database	USA	All	49,313	22.72	All	5.77	All	7.95	
Helvind et al (53)	2008–2012	MIS	Data from the Danish Melanoma Group Database	Denmark	All	1,615	N/A	>60	1.96	>60	2.6	
Iannacone et al (54) ^d	1982–2010	MIS	Data collected from the Queensland cancer registry	Queensland, Australia	15–24	192	9.2	20–24	9.8	20–24	8.6	
Wang et al (52) ^c	1992–2011	Lentigo maligna melanoma	Data collected from SEER database	USA	All	49,313	7.69	All	0.77	All	2.21	
Newell et al (55) ^e	1973–1981	Lentigo maligna	Data collected from SEER database	USA	>30	1,107	N/A	>30	0.6	>30	0.8	
Greveling (56) ^f	1989–2013	Primary lentigo maligna	Data collected using the Netherlands Cancer Registry and PALGA: Dutch Pathology registry	Netherlands	All	10,545	3.84 (2013)	All	4.16 (2013)	All	3.57 (2013)	
Greveling (56) ^f	1989–2013	Lentigo maligna melanoma	Data collected using the Netherlands Cancer Registry and PALGA: Dutch Pathology registry	Netherlands	All	2,989	1.19 (2013)	All	1.18 (2013)	All	1.25 (2013)	
Holman et al (57)	1975–1976	Pre-MM	Hospital records of Western Australia residents using a computerized hospital morbidity reporting system; histopathology records used to confirm incident cases	Western Australia	All	120	N/A	40–49	16.3	80	22.1	
Lerang et al (58)	1999–2008	SLE	Data collected from the national population register	Norway	>16	116	4.6	N/A	N/A	N/A	N/A	
Hochberg (59)	1970–1977	SLE	Medical record review from 19, 14, and 5 hospitals in Baltimore, within Baltimore city limits, and in Baltimore county, respectively	Baltimore, Maryland	All	302	7.69	45–54 white	7.23 white	35–44 white	1.21 white	
Hochberg (59)	1970–1977	SLE	Medical record review from 19, 14, and 5 hospitals in Baltimore, within Baltimore city limits, and in Baltimore county, respectively	Baltimore, Maryland	All	302	7.69	25–34 black	21.57 black	55–64 black	5.06 black	
See et al (60)	2005–2009	SLE	Data collected from the Taiwan NHIRD	Taiwan	All	358	7.2	All	12.8	All	1.5	

Source	Study Period	Skin Disease	Method	Location	Age, y	N	Highest Incidence Rate Per 100,000 Person-Years by Age and Sex					
							Age Group, y	Both Sexes	Age Group, y	Female	Age Group, y	Male
Weng et al (61)	2005–2007	Primary Sjögren syndrome	Data collected using the incidence of reported disease through the Bureau of National Health Insurance of Taiwan	Taiwan	>15	3,352	65–74	13.5	55–64	23.4	65–74	4
See et al (60)	2005–2009	Primary Sjögren syndrome	Data collected from the Taiwan NHIRD	Taiwan	All	583	All	11.8	All	20.1	All	3.3
Papulosquamous Disease Including PA												
Huerta et al (62)	1996–1997	Psoriasis	Data collected using the United Kingdom General Practice Research Database	United Kingdom	All	3,994	50–59	16.7	50–59	17.2	70–79	22.4
Kaupainen-Seppänen (63)	1990	PA	Nationwide sickness insurance database in Finland	Finland	>16	65	45–54	11.8	45–54	9	45–54	10
Soriano et al (64)	2000–2006	PA	Data collected from the Hospital Italiano Medical Care Program	Buenos Aires, Argentina	>18	35	45–64	11.6	45–64	7.7	45–64	18.1
Soderlin et al (65) ^g	1999–2000	PA	Prospective population-based annual incidence study. General practitioners in participating centers referred patients to the rheumatology department in Vaxjo	Southern Sweden	>16	151	>16	1.1	>16	1.2	>16	0.5
Savolainen et al (66)	2000	PA	Survey study of patients with at least 1 peripheral joint with synovitis or signs of inflammation at a visit	Finland	All	199	Adults	23	N/A	N/A	N/A	N/A
Alamanos et al (67)	1982–1991	PA	Patients referred to rheumatology clinics in Ioannina University Hospital and Ioannina General Hospital	Northwest Greece	All	221	All (45–64)	1.96	All (45–64)	2.18	All (45–64)	1.74
Alamanos et al (67)	1992–2001	PA	Patients referred to rheumatology clinics in Ioannina University Hospital and Ioannina General Hospital	Northwest Greece	All	221	All	3.76	All	3.8	All	3.73
Kyriakis et al (68)	1995–2002	Pityriasis rosea	Hospital-based cross-sectional study	Athens, Greece	All	479	31–35	17.5	21–25	20.2	6–10	16
Infections and Infestations												
Brisson et al (69)	1991–2000	Herpes zoster	Data collected from the Royal College of General Practitioners Weekly Returns Service	England and Wales	All	224,818	65	932	N/A	N/A	N/A	N/A
Civen et al (70) ^h	2007–2010	Herpes zoster	Surveillance site for varicella and zoster with reports by schools and healthcare providers every 2 wk using a standard questionnaire	Antelope Valley, CA	0–19	229	10–19	78.2	N/A	N/A	N/A	N/A
Esteban-Vassallo et al (71)	2005–2012	Herpes zoster	Cross-sectional study from the Madrid Regional Public Health System, electronic records in primary care	Madrid, Spain	All	211,650	75 (2012)	1,127.74 (2012)	65–74 (2011)	1,190.07 (2011)	75 (2012)	1,021.94 (2012)

Source	Study Period	Skin Disease	Method	Location	Age, y	N	Highest Incidence Rate Per 100,000 Person-Years by Age and Sex					
							Age Group, y	Both Sexes	Age Group, y	Female	Age Group, y	Male
Hillebrand et al (72)	2005–2009	Herpes zoster	Retrospective cohort study of health insurance members	Germany	All	215,959	85	9.4	All	8.3	All	5.5
Mullooly et al (73)	1997–2002	Herpes zoster	Incidence rates from Kaiser Permanente Health Plan	USA	All	369	All	215	80	1,194.30	All	1,256.70
Camenga et al (74) ⁱ	2000–2005	Genital warts	Enrollees of Northern California Kaiser Permanente	USA	11–29	181,264	20–24	470	20–24	630	20–24	270
Bollerup et al (75)	2008	Genital warts	Data collected from Danish National Patient Registry + prescription medications for genital warts	Denmark	All	117,792	N/A	N/A	18–19	1,808	22–25	1,828
Bollerup et al (75)	2013	Genital warts	Data collected from Danish National Patient Registry + prescription medications for genital warts	Denmark	All	117,792	N/A	N/A	22–25	774	22–25	1,247
Persson et al (76) ^j	1989–1990	Genital warts	Data collected from all clinics treating STDs in Borås	Sweden	10–60	440	20–24	1,200	15–19	1,400	25–29	640
Pirotta et al (77) ^j	2000–2006	Genital warts	Cross-sectional database collection with Bettering the Evaluation of Care and Health database	Australia	All	64,600	All	168	20–24	861	25–29	740
Other Skin Diseases												
See et al (60)	2005–2009	Behçet disease	Data collected from the Taiwan NHIRD	Taiwan	All	42	All	0.9	All	1.1	All	0.6
Mohammad et al (78)	1997–2010	Behçet disease	Study among 3 health care districts in Sweden using a clinical registry	Southern Sweden	15	20	25–34	0.5	15	0.1	15	0.3
Margolis et al (79) ^k	1988–1996	Venous leg ulcer	Data collected from the general practice research database for Philadelphia and Baltimore	Northeast USA	65–95	65	N/A	N/A	91–95	0.02	91–95	0.03

Abbreviations: BCC, basal cell carcinoma; Epi, epidemiology; MHS, Maccabi Health Care Services; MIS, melanoma in situ; MM, malignant melanoma; N/A, not available; NHIRD, National Health Insurance Research Dataset; NICR, Northern Ireland population-based cancer registry; PA, psoriatic arthritis; SCC, squamous cell carcinoma; SEER, Surveillance, Epidemiology, and End Results Program; SLE, systemic lupus erythematosus; STDs, sexually transmitted diseases.

^aBased on 1991 standard population.

^bRate/100,000 Medicare beneficiaries.

^cAge-standardized using the US 2000 census population.

^dData based on the 1970 US male or female population.

^eEuropean standardized rate.

^fAge-standardized to the 2000 World Standard Population.

I_g Incidence was originally reported as cases per million (2003 Taiwan population) and has been adjusted to cases/100,000 person-years.

I_q Data were originally reported as cases per million and has been adjusted to cases/100,000 person-years.

I_j Based on US census data.

I_k Rates were originally reported as cases per 1,000 person-years and have been adjusted to cases/100,000 person-years.

I_l Rates were originally reported as cases per 100 person-years and have been adjusted to cases/100,000 person-years.

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