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The Epidemiology of Skin and Skin-Related Diseases: A Review of Population-Based Studies Performed by Using the Rochester Epidemiology Project

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Abstract

In Olmsted County, Minnesota, population-based epidemiologic research studies are possible because of a unique medical records linkage system, the Rochester Epidemiology Project (REP), which has been in place for almost half a century. We present a summary of epidemiologic data describing the incidence of skin diseases derived from the REP. Since 1966, more than 2000 articles have been published by the REP team. Each published article was reviewed by both authors in conjunction with the REP team to select all articles that described the incidence of skin and selected skin-related diseases. Collectively, these reports suggested that the incidence of most of the studied skin diseases has increased over the decades.

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Epidemiologic data are vital to understanding the implications of human disease. An understanding of the incidence of specific diseases is fundamental to decision making regarding allocation of resources for clinical care and research, for example. Population-based studies are the criterion standard for the study of epidemiology and yield the most accurate and generalizable estimates of incidence. Unfortunately, there are few population-based cohorts worldwide in which it is possible to study the epidemiology of disease.

In Olmsted County, Minnesota, long-term, population-based, epidemiologic research studies are possible because of a unique medical records linkage system, the Rochester Epidemiology Project (REP). The REP is a research infrastructure system that has captured health care information on virtually all residents of Olmsted County starting in 1966.[1] Details about the REP's history are described elsewhere.[2-4]

Population-based studies describing the epidemiology of skin diseases are relatively lacking. The REP has been a resource for population-based studies on the incidence of skin diseases studied over the decades and provides generalizable data on the epidemiology of the studied skin diseases. It is therefore important for dermatologists and other specialists to be aware of these data.

Because these epidemiologic data have been published in different journals over several decades, many are not aware that these data are available. The objectives of this study were to gather available epidemiologic data describing skin and skin-related diseases derived from the REP and to standardize presentation of the data, if needed, so that the reported findings can be easily compared. These data will be a rich resource to those studying many aspects of skin disease.

PATIENTS AND METHODS

More than 2000 articles have been published by the REP team.[4] In conjunction with the REP team, we reviewed each article to select all articles that described the incidence of skin and selected skin-related diseases such as systemic lupus erythematosus (SLE) and psoriatic arthritis. We agreed on the articles to be included in this review. Thus, all published population-based studies on the incidence of skin and skin-related diseases that had been performed by using the REP from 1966 (the date the REP started) to January 2013 were included in this review. Articles that reported only cumulative incidence rates (lifetime risk) as well as those that reported studies involving 10 or fewer cases were excluded.

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We abstracted the following information from the published studies: time period reported in the study, population characteristics, total number of cases included in the study, and number of cases by sex and age group. If the number of cases by sex and age group were not reported in the publication, then the counts were obtained from the archived data.

For each study, age- and sex-adjusted incidence rates were estimated by dividing the number of cases by sex and age group by the Olmsted County (or the city of Rochester) population assumed to be at risk. The Olmsted County (or the city of Rochester) population was obtained from decennial census data, with linear interpolation for intercensal years. The 95% CIs were calculated on the basis of the assumption that the number of cases by age and sex group followed a Poisson distribution. For consistency, all rates were standardized to the 2000 US white population. If the number of cases by sex and age group were not available, then the counts were obtained from the archived data reported in the Table.

RESULTS

A total of 34 articles met the study inclusion criteria. The incidence rates of skin and skin-related diseases for final reporting were grouped as follows: (1) skin cancer; (2) connective tissue diseases; (3) papulosquamous diseases, including psoriasis (including psoriatic arthritis); (4) infections and infestations; and (5) other skin diseases (ie, those skin diseases not categorized in the preceding groups). The Table summarizes the abstracted data from each of the articles, along with the age- and sex-adjusted incidence rates (standardized to the 2000 US white population).[5-38] The risk of developing certain skin diseases such as nonmelanoma skin cancer, psoriasis, pityriasis rosea, herpes zoster, condyloma acuminatum, and lower extremity cellulitis was found to be relatively high in Olmsted County.

DISCUSSION

We present a summary of population-based data describing the incidence of skin and skin-related diseases in Olmsted County. Despite some limitations (described subsequently), these data are generalizable to other populations in the United States and worldwide. The incidence rates are listed in the Table. Many of the included studies also calculated the trends in the incidence rates during the time period studied; incidence rates were often reported in 5- to 10-year intervals. These reports found an increase in the incidence of most of the studied skin diseases over the decades. The reasons for the increase in the incidence of many of the skin diseases are unknown but may include a true change in incidence, changes in patterns of diagnosis over the decades, greater physician awareness of the diagnoses, and other specific risk factors for each of the reported skin diseases.

Can different studies of the same disease using REP data be compared for epidemiologic trends? Nonmelanoma skin cancer, malignant melanoma, SLE, psoriasis, psoriatic arthritis, and herpes zoster have been the subject of repeated reports from different time periods. These studies were not always comparable because of differences in the diagnostic classification criteria, differences in the age groups included, and overlapping study time periods.

The epidemiology of skin cancers has been extensively studied. The incidence of basal cell carcinoma has been gradually increasing,[5] in particular in patients younger than 40 years.[6] The incidence of squamous cell carcinoma has dramatically increased over the past couple of decades[8] compared with previous decades[7]; the incidence rate has also been increasing over each decade.[6] The incidence of cutaneous melanoma has been studied[9,10]: the incidence rates were relatively stable from

ARTICLE HIGHLIGHTS

- Reliable population-based studies that estimate the incidence of skin diseases are few because of the lack of well-enumerated populations from which affected patients can be identified.
- In Olmsted County, Minnesota, the Rochester Epidemiology Project, a unique research infrastructure system, enables population-based research studies of the epidemiology of diseases.
- We present a summary of published data from the past 4 decades that describes the incidence of skin and skin-related diseases derived from the Rochester Epidemiology Project.
- Reports found that the incidence of most of the studied skin diseases has increased over the decades.

TABLE. Incidence of Skin Diseases in Olmsted County, Minnesota[a]

Reference, year	Time period	Skin disease	Population defined by age (y)	Total no. of cases	Age- and sex-adjusted incidence rate per 100,000 person-years (95% CI)[b]
Skin cancer					
Chuang et al,[5] 1990	1976-1984	Basal cell carcinoma	All	657	171.2 (157.8-184.5)
Christenson et al,[6] 2005	1976-2003	Basal cell carcinoma	≤40	417	23.4 (21.1-25.6)
Chuang et al,[7] 1990	1976-1984	Squamous cell carcinoma	All	169	47.9 (40.6-55.3)
Christenson et al,[6] 2005	1976-2003	Squamous cell carcinoma	≤40	68	3.9 (3.0-4.8)
Gray et al,[8] 1997	1984-1992	Squamous cell carcinoma	All	511	114.6 (104.5-124.7)
Resseguie et al,[9] 1977	1950-1974	Cutaneous malignant melanoma	All	42	4.9 (3.4-6.5)
Popescu et al,[10] 1990	1950-1985	Cutaneous malignant melanoma	All	107	8.2 (6.6-9.8)
Reed et al,[11] 2012	1970-2009	Cutaneous malignant melanoma	≥18 to 39	256	16.9 (14.8-19.0)
Connective tissue diseases					
Durosaro et al,[12] 2009	1965-2005	Cutaneous lupus erythematosus	All	156	4.3 (3.6-5.0)
		Classic discoid LE	All	129	3.6 (2.9-4.2)
		Subacute cutaneous LE	All	23	0.6 (0.4-0.9)
Peterson et al,[13] 1997	1960-1993	Morphea	All	82	2.7 (2.1-3.3)
Bendewald et al,[14] 2010	1976-2007	Dermatomyositis and its subtypes	All	29	1.0 (0.6-1.3)
Pillemer et al,[15] 2001	1976-1992	Primary Sjögren syndrome	All	53	4.1 (2.9-5.2)
Uramoto et al,[16] 1999	1980-1992	SLE	All	48	6.4 (4.5-8.2)
Kurland et al,[17] 1969	1951-1967	SLE	All	29	5.6 (3.5-7.6)
Nobrega et al,[18] 1966	1950-1965	Combined SLE	All	25	3.3 (2.0-4.6)
Michet et al,[19] 1985	1950-1979	SLE	All	25	2.3 (1.4-3.2)
		Suspected SLE	All	21	1.9 (1.1-2.7)
		Discoid LE	All	24	2.3 (1.4-3.3)
		Scleroderma	All	13	1.2 (0.5-1.8)
Psoriasis, psoriatic arthritis, and other papulosquamous diseases					
Tollefson et al,[20] 2010	1970-1999	Psoriasis	≤18	357	40.8 (36.6-45.0)
Icen et al,[21] 2009	1970-2000	Psoriasis	≥18	1633	78.9 (75.0-82.9)
Bell et al,[22] 1991	1980-1983	Psoriasis	All	132	61.2 (50.2-72.1)
Shbeeb et al,[23] 2000	1982-1991	Psoriasis	≥18	1056	107.7 (101.2-114.2)[c]
Wilson et al,[24] 2009	1970-1999	Psoriatic arthritis	≥18	147	7.2 (6.0-8.4)
Shbeeb et al,[23] 2000	1982-1991	Psoriatic arthritis	≥18	66	9.3 (7.0-11.6)
Chuang et al,[25] 1982	1969-1978	Pityriasis rosea	All	939	140.7 (131.1-150.3)
Infections and infestations					
McNamara et al,[26] 2007	1999	Lower extremity cellulitis	≥18	176	213.0 (181.2-244.9)
Matteson et al,[27] 1992	1983-1990	Lyme disease	All	17	2.3 (1.1-3.4)[d]
Ragozzino et al,[28] 1982	1945-1959	Herpes zoster	All	590	131.0 (...)[e]
Guess et al,[29] 1985	1960-1981	Herpes zoster	≤20	173	48.6 (41.3-55.9)
Yawn et al,[30] 2007	1996-2001	Herpes zoster	≥22	1669	374.0 (355.8-392.2)
Chuang et al,[31] 1983	1965-1979	Herpes progenitalis	All	392	49.8 (44.7-54.9)
Chuang et al,[32] 1984	1950-1978	Condyloma acuminatum	All	746	48.7 (44.9-52.5)
Wentworth et al,[33] 2013	1980-2009	Cutaneous nontuberculous mycobacterial infection	All	40	1.3 (0.9-1.7)
Vazquez et al,[34] 2013	1968-2008	Hidradenitis suppurativa	All	268	6.1 (5.4-6.9)
Other skin diseases					
Calamia et al,[35] 2009	1960-2005	Behçet disease	≥18	13	0.4 (0.2-0.5)
Reed and Davis,[36] 2009	1976-2005	Erythromelalgia	All	33	1.3 (0.8-1.7)
Safavi et al,[37] 1995	1975-1989	Alopecia areata	All	292	19.9 (17.6-22.3)
Heit et al,[38] 2001	1966-1990	Venous stasis syndrome	≥15	1131	87.0 (81.8-92.1)
		Venous ulcer	≥15	263	23.0 (18.4-23.5)

[a]LE = lupus erythematosus; SLE = systemic lupus erythematosus.

[b]Standardized to the 2000 US white population unless noted otherwise.

[c]Unable to identify age and sex counts for additional calculation. The reported result is the originally published age- and sex-adjusted incidence rate standardized to the 1980 US white population.

[d]Unable to identify age and sex counts for additional calculation. The reported result is the originally published age- and sex-adjusted incidence rate standardized to the 1990 US white population.

[e]Unable to identify age and sex counts for additional calculation. The reported result is the originally published age-adjusted incidence rate standardized to the 1970 US white population; the 95% CI was not provided.

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1950 through 1967 but increased from 1968 to 1985. In younger patients, the incidence of melanoma has been found to be increasing rapidly, especially in women. From 1970 to 2009, the incidence of melanoma increased 8-fold in young women and 4-fold in young men.[11]

There are a number of articles about the incidence of lupus erythematosus, dermatomyositis, and other connective tissue diseases. Durosaro et al[12] studied the incidence of cutaneous lupus and found that the incidence of cutaneous lupus alone (excluding patients with concurrent SLE) was comparable to that of SLE. Discoid lupus erythematosus was the most common form of cutaneous lupus. The incidence rate of SLE has been estimated at different time periods and has been found to increase almost 3-fold from the 1950s to 1992.[16] The incidence of morphea was found to be higher than that reported previously.[13] Bendewald et al[14] studied the incidence of dermatomyositis and found that the recently described amyopathic dermatomyositis accounted for approximately 20% of the cases of dermatomyositis. The incidence of primary Sjögren syndrome was much higher in women than in men.[15]

The incidence of papulosquamous diseases, including psoriasis and the related psoriatic arthritis, has been the subject of multiple REP studies. The incidence rate of psoriasis in adults (patients aged 18 years and older) has been estimated at different time periods[21,23] and has been found to increase almost 2-fold from the 1970s to 2000s.[19] The incidence of pediatric psoriasis in patients younger than 18 years has been found to be less than that in adults, but it increases with the increase in age.[20] The incidence of psoriatic arthritis was much less than that of psoriasis in 2 separate studies.[23,24] The incidence of pityriasis rosea was found to be high.[25]

The epidemiology of selected skin-related infections and infestations has been studied. The incidence of herpes zoster has repeatedly been found to be very high,[28] though higher in adults[30] than in children.[29] Lower extremity cellulitis in adults is also very common.[26] Condyloma acuminatum[32] and herpes progenitalis[31] are quite common, whereas hidradenitis suppurativa,[34] Lyme disease,[27] and cutaneous nontuberculous mycobacterial infection[33] are much less common.

Other miscellaneous skin or skin-related diseases that have been studied by using the REP include Behçet disease[35] and erythromelalgia,[36] both of which had relatively low incidence rates. The incidence of venous stasis syndrome and venous ulcers in adults[38] has been found to be high. The incidence of alopecia areata is also quite high.[37]

Strengths and Limitations

The strengths of studies using the REP infrastructure system are the availability of complete medical records of more than 4 decades and the ability to examine trends by using consistent eligibility criteria.

We acknowledge the limitations of the present study. All included REP studies also had several potential limitations. The REP resources are limited in that a disease or disorder is captured only after it is recognized by the physician, recorded, and then retrieved for research purposes. As a result, diseases that do not come to medical attention would not be included. Furthermore, inhomogeneity among the physicians who make the diagnoses may occur. Some of the included studies were also published before the adoption of accepted diagnostic classification criteria, which may result in a higher or lower incidence of a certain skin disease. The racial profile of Olmsted County is not representative of the United States. The population of Olmsted County is mostly white. Certain racial and ethnic groups are underrepresented in this population. Skin types of different races and ethnicities place individuals at varying risks of certain skin diseases. Olmsted County is relatively small (about 146,000 persons according to 2011 census data), and so there may be few cases of a rare disease. Also important to consider is the possible effect of Olmsted County's geographic latitude on the incidence of certain skin diseases. Moreover, because the health care system is the largest employer in this county, the population of Olmsted County may be more aware of the possibility of a skin disease and may more often seek care for it than does the general US population. Only skin and selected skin-related diseases have been studied by using the REP. Furthermore, all included studies may have some limitations because of their retrospective design. Finally, we reviewed only the published data. We did not assess the patient files ourselves.

CONCLUSION

Epidemiologic data are essential to an understanding of human disease and its implications and are most reliably derived from population-based studies. Reliable population-based studies that assess the incidence of skin diseases are few because of the lack of well-enumerated populations from which affected patients can be identified. The REP is a resource that enables population-based studies of the epidemiology of diseases in Olmsted County. We present a summary of published REP data describing the incidence of skin and skin-related diseases in Olmsted County. In studies in which trends in incidence rates were estimated, an increase in incidence of the studied skin diseases over the decades was reported.

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Abbreviations and Acronyms: **REP** = Rochester Epidemiology Project; **SLE** = systemic lupus erythematosus

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