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Global prevalence of hidradenitis suppurativa and geographical variation—systematic review and meta-analysis

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Abstract

Background: There is a significant variation in the reported prevalence of hidradenitis suppurativa (HS), ranging from 0.03–4%. We hypothesized that this significant variation may be due to different prevalence rates of HS according to geographical location as well as sex.

Objective: We aimed to perform a meta-analysis to determine pooled overall prevalence of HS, prevalence stratified according to geographical region and sex.

Materials and methods: A systematic review was performed by searching Ovid Medline, PubMed, Cochrane Library, DARE, and Embase, from inception to August 2018. A systematic review and meta-analysis was performed according to PRISMA guidelines. A meta-analysis of proportions was performed to determined pooled prevalence rates, with meta-regression based on geographic region. Prevalence in males versus females was also performed according to region.

Results: The overall pooled prevalence rate was 0.3% (0.2–0.6%) based on 118,760,093 HS cases available. Subgroup analysis demonstrated prevalence differences, with the highest being in Europe 0.8% (0.5–1.3%), compared to the USA 0.2% (0.1–0.4%), Asia-Pacific 0.2% (0.01–2.2%), and South America 0.2% (0.01–0.9%). Prevalence in males was lower compared to females in the USA (OR 0.403, 95% CI 0.37–0.439, $P < 0.001$) as well as in Europe (OR 0.635, 95% CI 0.397–1.015, $P = 0.08$) but not in the Asia-Pacific region (OR 0.936, 95% CI 0.319–2.751, $P = 0.78$).

Conclusion: Prevalence of HS varies significantly according to the geographical population. This variation is likely attributed to different ethnicity distributions amongst different continents.

Level of evidence: III

Keywords: Hidradenitis suppurativa, Prevalence, Geography, Ethnicity, Epidemiology

Introduction

Hidradenitis suppurativa (HS) is a chronic and progressive skin disorder characterized by the formation of inflammatory lesions particularly in the axilla, groin, buttocks, and inframammary regions (Jemec 2012). Initially, starting as inflamed nodules, these lesions can develop into painful abscesses, sinus tracts, and scarring. Given that HS has a significant and detrimental impact on patient quality of life (Alavi et al. 2015; Wolkenstein et al. 2007), there is a need for increased understanding regarding the prevalence, incidence, and epidemiology associated with this condition.

Prevalence of HS reported in the literature has significant variation, ranging from 0.03% to 4% (Jemec and Kimball 2015; Saunte and Jemec 2017; Delany et al. 2018; Ingram et al. 2018). A more precise understanding of the prevalence of HS would have implications in quantifying the resources required to meet the needs of this patient population and would influence healthcare

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provision. It is likely that there are multiple contributing factors to the significant variation in HS prevalence reported in the literature. Variation in study design is one such factor, including registry-based studies, prospective physical examination of patients, data reported from cross-sectional population studies, and diagnosis by patient-completed questionnaires.

One less studied factor is the influence of geography and ethnicity on the prevalence of HS. Recent studies from Korea show they have much lower rates of HS compared to Caucasians and African Americans based on population study data (Lee et al. 2018). We hypothesized that this significant variation may be due to different prevalence rates of HS according to geographical location as well as sex. To assess the impact of these factors, we performed a systematic review and meta-analysis of available population studies published and performed subgroup analysis to determine the impact of geographic region and sex on HS prevalence.

Methods

Search strategy

The current systematic review and meta-analysis was performed according to recommended PRISMA guidelines (Moher et al. 2009). As no human or animal subjects were involved in this study, ethics approval was not required. Electronic searches were performed using Ovid Medline, PubMed, Cochrane Central Register of Controlled Trials (CCTR), Cochrane Database of Systematic Reviews (CDSR), ACP Journal Club, Database of Abstracts of Review of Effectiveness (DARE), PsycINFO, and Embase, from their dates of inception to August 2018. To achieve maximum sensitivity of the search strategy and identify all studies, we combined the terms "hidradenitis suppurativa," "acne inversa," "velpeau," "verneuil," "prevalence," "epidemiology," and "incidence" as either keywords or MeSH terms (Additional file 1: Table S1). The reference lists of all retrieved articles were reviewed for further identification of potentially relevant studies. All identified articles were systematically assessed using the inclusion and exclusion criteria. A protocol was not registered for the present systematic review and meta-analysis.

Selection criteria

All studies reporting the prevalence of HS were included in the present review. All studies must have included the proportion of patients with HS in the population studied. All publications were limited to those involving human subjects. Language was not an exclusion criterion. Abstracts, case reports, conference presentations, editorials, and expert opinions were excluded. Review articles were omitted because of potential publication bias and duplication of results.

Data extraction

All data were extracted from article texts, tables, and figures. The data collected included in the study are as follows: the proportion of patients with HS in the population studied, the geography of the population studied, and proportion of males and females.

Statistics

A meta-analysis of proportions was conducted for the available main perioperative and postoperative variables. Firstly, to establish variance of raw proportions, a logit transformation was applied. To incorporate heterogeneity (anticipated among the included studies), transformed proportions were combined using DerSimonian-Laird random effects models. Finally, the pooled estimates were back-transformed. Heterogeneity was evaluated using Cochran's Q and I^2 test. All analyses were performed using the metafor package for R version 3.4. P values < 0.05 were considered statistically significant.

Results

A total of 740 studies were identified through electronic database searches and from other sources such as reference lists. After exclusion of duplicate or irrelevant references, 46 potentially relevant articles were retrieved (Fig. 1). After detailed evaluation of these articles, 16 studies (Delany et al. 2018; Ingram et al. 2018; Lee et al. 2018; Calao et al. 2018; Cosmatos et al. 2013; Garg et al. 2017; Ianhez et al. 2018; Jemec et al. 1996; Lookingbill, 1988; Reeder et al. 2014; Revuz et al. 2008; Richard et al. 2018; Theut Riis et al. 2018; Santos et al. 2017; Shahi et al. 2014; Sung and Kimball, 2013) remained for assessment. The study characteristics are summarized in Table 1. All included studies were population studies. There were two studies from the Asia-Pacific region, six studies from the USA, six studies from Europe, and two studies from South America (Additional file 2).

The overall pooled prevalence rate was 0.3% (0.2–0.6%) based on 118,760,093 HS cases available (Fig. 2). Subgroup analysis demonstrated prevalence differences, with the highest being in Europe 0.8% (0.5–1.3%), compared to the USA 0.2% (0.1–0.4%), Asia-Pacific 0.2% (0.01–2.2%), and South America 0.2% (0.01–0.9%).

Pooled analysis was also performed to determine whether the prevalence of HS in males was lower or higher compared to females. The overall meta-analysis demonstrated that the prevalence in males was similar to that compared to females (OR 0.58, 95% CI 0.33–1.04) (Fig. 2). Subgroup analysis was performed according to geographical region. Prevalence in males was lower compared to females in the USA (OR 0.403, 95% CI 0.37–0.439, $P < 0.001$) as well as in Europe (OR 0.635, 95% CI 0.397–1.015, $P = 0.08$) but not in the Asia-Pacific region (OR 0.936, 95% CI 0.319–2.751, $P = 0.78$) (Fig. 3).

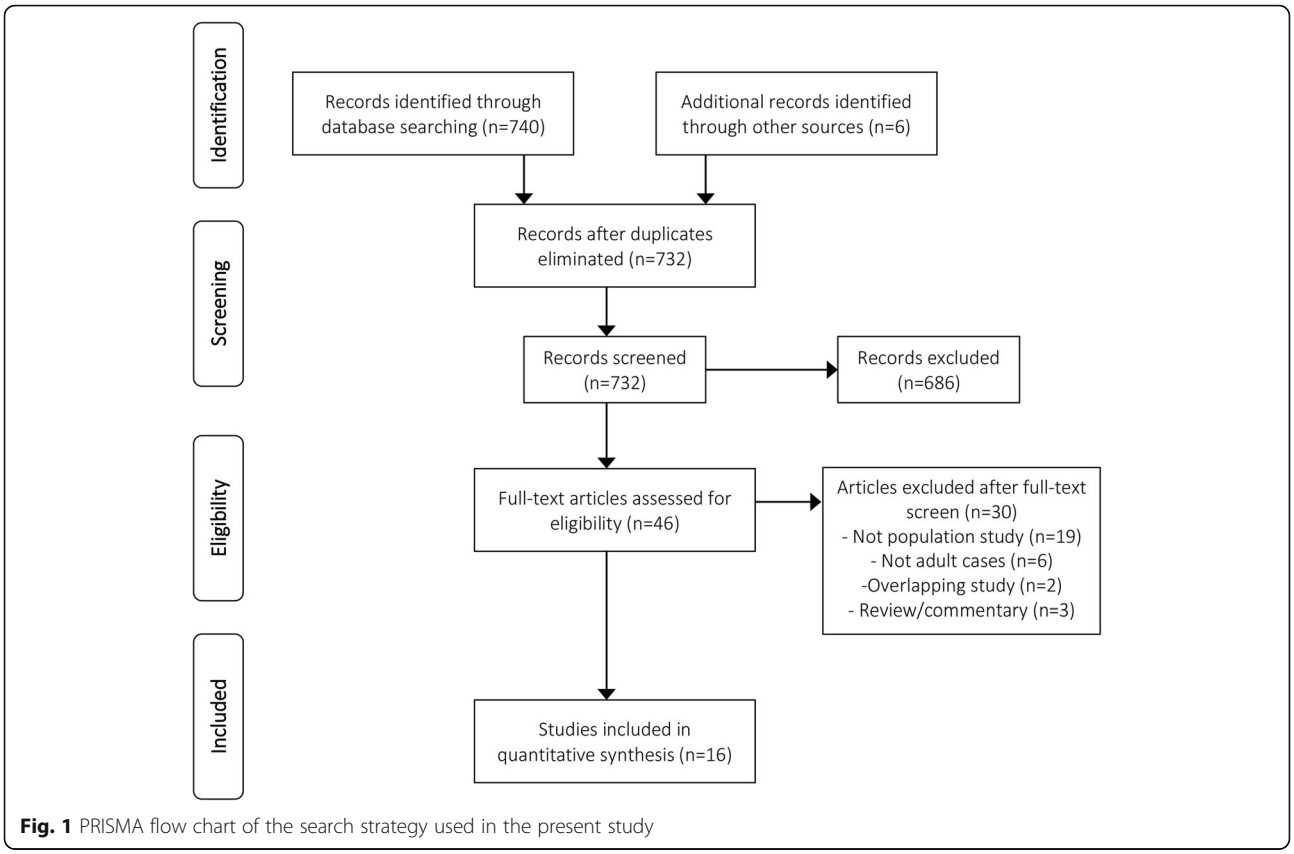

Fig. 1 PRISMA flow chart of the search strategy used in the present study

Table 1 Characteristics of included studies in the present systematic review and meta-analysis. –, not reported

First author	Year	Study period	Country	Geographical region	Study size	Males	Females
Calao	2018	2015–2016	Australia	Asia-Pacific	11,433	5616	5817
Cosmatos	2013	2007	USA	USA	15,054,519	7,233,818	7,820,701
Delaney	2017	2015	Ireland	Europe	15,547	15,476	15,476
Garg	2017	1999–2016	USA	USA	45,855,960	20,832,510	25,023,450
Ianhez	2018	2017	Brazil	South America	17,004	–	–
Ingram	2017	2013	UK	Europe	4,364,308	–	–
Jemec	1996	1992–1993, 1994–1995	Denmark	Europe	585	276	231
Lee	2018	2007–2016	Korea	Asia-Pacific	51,103,943	25,573,939	25,576,389
Lookingbill	1988	1985–1986	USA	USA	1106	–	–
Reeder	2014	2011–2012	USA	USA	8480	–	–
Revuz	2008	2005	France	Europe	6887	–	–
Richard	2018	2016	France	Europe	20,012	9760	10,252
Riis	2018	1995–2015	Denmark	Europe	27,765	14,558	12,238
Santos	2017	2000–2014	Portugal	South America	1,569,333	–	–
Shahi	2014	1968–2008	USA	USA	139,280	65,649	71,240
Sung	2013	2007–2011	USA	USA	563,931	–	–

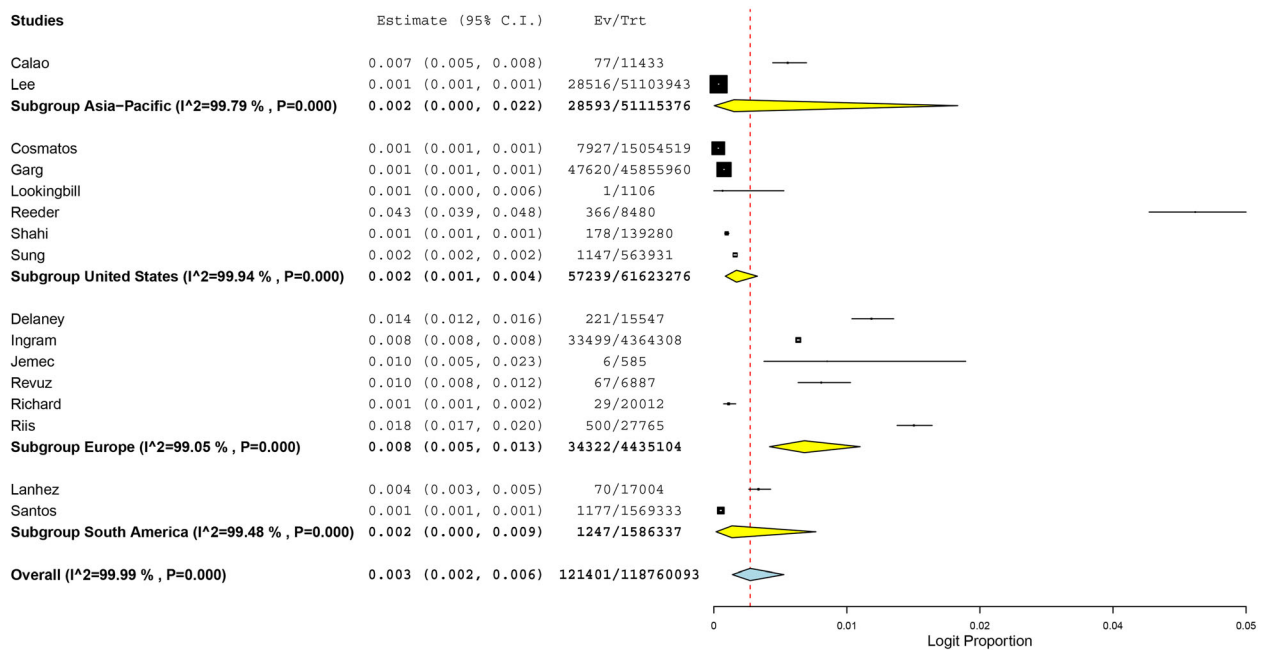

Fig. 2 Forest plot demonstrating the pooled prevalence of hidradenitis suppurativa, stratified according to geographic region

Discussion

There remains a lack of consensus as to the overall prevalence of HS in the general population. The large variation in reported prevalence rates of HS is likely contributed by differences in the ethnicity of the populations studied. A recent Japanese population study (Kurokawa et al. 2015) reported an HS prevalence of 0.06%, which was comparatively lower compared to HS prevalence rates described in Western populations (0.1–4%). As such, we hypothesized that ethnicity and hence geographical location is a potential contributing factor to the prevalence rates of HS.

Our meta-analysis supports our hypothesis, with an overall pooled HS prevalence rate of 0.3%. Subgroup analysis demonstrated highest prevalence in Europe 0.8%, compared to the USA 0.2%, Asia-Pacific 0.2%, and South America 0.2%. Prevalence in males was lower compared to females in the USA and Europe, but not in the Asia-Pacific region. These differences likely have a multifactorial underlying etiology, including a combination of genetic differences and immune and hormonal differences among the ethnicities. It has been previously reported that there are differences in gamma-secretase gene mutations occurring between Asian and European

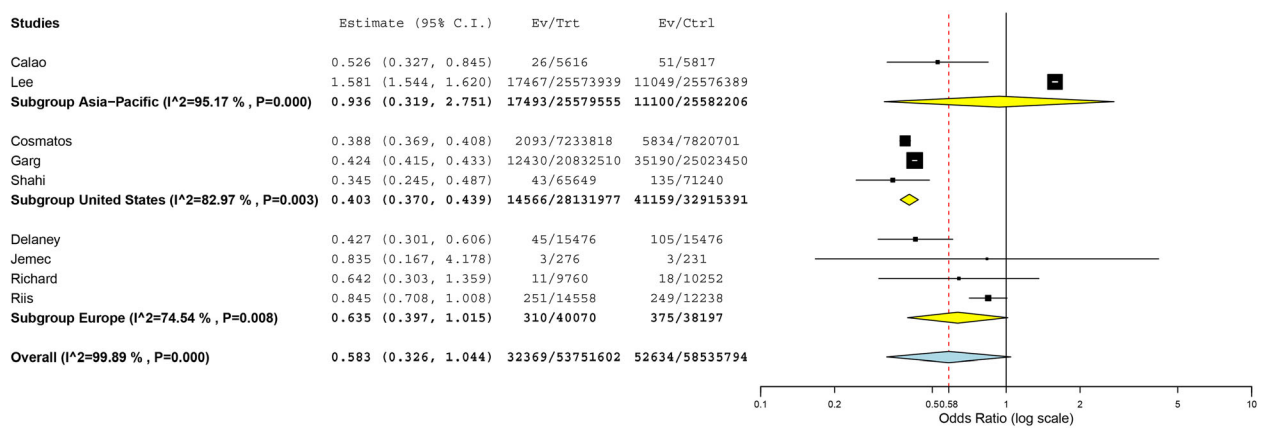

Fig. 3 Forest plot demonstrating odds of hidradenitis suppurativa in males compared to females, stratified according to geographical region

studies (Ingram 2016; Liu et al. 2016), implicating the role of genetics in the differences in the prevalence of HS observed.

Our meta-analysis also demonstrates that the sex predisposition of HS may vary according to geographical location and ethnicity. We found that in Asia-Pacific countries, the prevalence of HS in males appeared to be comparable to females, where as in Western and European countries, the prevalence was significantly lower in males compared to females. This suggests that there is an increased predisposition of HS in males in countries of Asian-Pacific ethnicity. Our findings are consistent with those of Lee and colleagues (Lee et al. 2018) who studied a Korean population. The authors reported a prevalence rate of 68.3 patients per 100,000 males, compared to 43.2 patients per 100,000 females, with male-to-female ratio of 1.6:1. Similar findings were reported by a Japanese epidemiological study by Kurokawa et al. (2015), with male-female ratio reported 2:1. The odds of HS prevalence were significantly lower in males compared to females across American populations and European populations included in this meta-analysis, with pooled male-female ratio of 0.4 in American patients and 0.64 in European patients. This implicates the significance of geography and ethnicity on the prevalence of HS.

The distribution of HS lesions also appears to differ based on geographical location and ethnicity. In the Japanese population as reported by Kurokawa et al. (2015), the body areas predominantly affected by HS were the buttocks. In contrast, HS in European patients tend to affect the groin and axillae, rather than the buttocks (Kurokawa et al. 2015; You et al. 2016; Schrader et al. 2014). This may be due to differences in the distribution of hairs and sweat glands in Asians compared with Europeans. A morphometric analysis of Korean adults demonstrated that the concentration of glands was lowest in the mammary areas for both females and males (Hwang and Baik, 1997), in contrast to studies in Europeans (Thomson, 1954). There are likely contributing factors to this association; for example, it is known that obesity rates in Asian countries such as Japan and Korea are significantly lower compared to Western countries.

The present meta-analysis is constrained by several limitations. Firstly, we were not able to stratify HS prevalence according to the severity of HS, as this data was not available in the majority of included studies. For studies reporting prevalence based on clinical assessment, there is selection bias in terms of people attending the clinical assessment. For data using population databases and registries, missing data is less likely for patients with closer follow-up with their family physicians and increased follow-up with their dermatologist. Inaccuracies and incomplete coding of diagnoses is another limitation of the use of population databases. The outcome definitions among studies vary significantly, which limit the interpretation of results. In some studies, outcome was defined as a self-reported HS diagnosis; in others, it was a valid administrative code for HS diagnosis; and in others, it was a physician-confirmed diagnosis of HS. There is also the possibility of confounding factors across geographical populations, such as lifestyle factors that may influence the occurrence of disease, race, ethnicity, obesity rates, and social determinants of health, which were not assessed by the included studies.

Conclusion

In conclusion, our meta-analysis demonstrates that the prevalence of HS varies significantly according to the geographical population. This variation is likely attributed to different ethnicity concentrations on different continents. Particularly, Asian populations were associated with lower prevalence compared to their European counterparts. Additionally, a higher relative prevalence of HS was found in Asian males compared to European and American males. These findings have implications in understanding the epidemiology and management of HS.

Supplementary information

Supplementary information accompanies this paper at https://doi.org/10.1186/s41702-019-0052-0.

Additional file 1: Table S1. Search strategy used in present systematic review and meta-analysis

Additional file 2: Table S2. Study characteristics of included studies

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None

Authors' contributions

KP, OC, and SDS had full access to all of the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis; contributed to the study concept and design; contributed to the acquisition, analysis, and interpretation of data; and contributed to the critical revision of the manuscript for important intellectual content. KP and SDS contributed to the drafting of the manuscript. KP performed the statistical analysis. No funding was obtained. SDS contributed to the administrative, technical, or material support and study supervision. KP and OC performed the literature search. All authors contributed to the provision of study materials or patients and the collection and assembly of data and approved the final manuscript.

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Availability of data and materials

All available in the manuscript

Ethics approval and consent to participate

Not applicable. Not required as no patients or animals involved in this study.

Consent for publication

Not applicable, as no patients involved in this study.

Competing interests
SD Smith is a member of the advisory board at ABBVIE and Janssen Cilag and an investigator at ABBVIE and Novartis. The other authors declare that they have no conflict interests.

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References

Alavi A, Anooshirvani N, Kim WB, Coutts P, Sibbald RG. Quality-of-life impairment in patients with hidradenitis suppurativa: a Canadian study. American J Clin Derm. 2015;16:61–5.
Calao M, Wilson JL, Spelman L, et al. Hidradenitis Suppurativa (HS) prevalence, demographics and management pathways in Australia: a population-based cross-sectional study. PloS one. 2018;13:e0200683.
Cosmatos I, Matcho A, Weinstein R, Montgomery MO, Stang P. Analysis of patient claims data to determine the prevalence of hidradenitis suppurativa in the United States. J Am Acad Dermatol. 2013;68:412–9.
Delany E, Gormley G, Hughes R, et al. A cross-sectional epidemiological study of hidradenitis suppurativa in an Irish population (SHIP). J Eur Acad Dermatol Venereol. 2018;32:467–73.
Garg A, Kirby JS, Lavian J, Lin G, Strunk A. Sex-and age-adjusted population analysis of prevalence estimates for hidradenitis suppurativa in the United States. JAMA dermatol. 2017;153:760–4.
Hwang K, Baik S. Distribution of hairs and sweat glands on the bodies of Korean adults: a morphometric study. Cells Tissues Organs. 1997;158:112–20.
Ianhez M, Schmitt JV, Miot HA. Prevalence of hidradenitis suppurativa in Brazil: a population survey. Int J Dermatol. 2018;57:618–20.
Ingram J, Jenkins-Jones S, Knipe D, Morgan C, Cannings-John R, Piguet V. Population-based Clinical Practice Research Datalink study using algorithm modelling to identify the true burden of hidradenitis suppurativa. Br J Dermatol. 2018;178:917–24.
Ingram JR. The genetics of hidradenitis suppurativa. Dermatol clinics. 2016;34:23–8.
Jemec GB. Hidradenitis suppurativa. N Engl J Med. 2012;366:158–64.
Jemec GB, Heidenheim M, Nielsen NH. The prevalence of hidradenitis suppurativa and its potential precursor lesions. J Am Acad Dermatol. 1996;35:191–4.
Jemec GB, Kimball AB. Hidradenitis suppurativa: epidemiology and scope of the problem. J Am Acad Dermatol. 2015;73:S4–7.
Kurokawa I, Hayashi N, Society JAR. Questionnaire surveillance of hidradenitis suppurativa in Japan. J Dermatol. 2015;42:747–9.
Lee JH, Kwon HS, Jung HM, Kim GM, Bae JM. Prevalence and comorbidities associated with hidradenitis suppurativa: a nationwide population-based study. J Eur Acad Dermatol Venereol. 2018;32:1784–90.
Liu M, Davis J, Idler K, Mostafa N, Okun M, Waring J. Genetic analysis of NCSTN for potential association with hidradenitis suppurativa in familial and nonfamilial patients. Br J Dermatol. 2016;175:414–6.
Lookingbill DP. Yield from a complete skin examination: findings in 1157 new dermatology patients. J Am Acad Dermatol. 1988;18:31–7.
Moher D, Liberati A, Tetzlaff J, Altman DG. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. Ann Intern Med. 2009;151:264–9.
Reeder VJ, Mahan MG, Hamzavi IH. Ethnicity and hidradenitis suppurativa. J Invest Dermatol. 2014;134:2842.
Revuz JE, Canoui-Poitrine F, Wolkenstein P, et al. Prevalence and factors associated with hidradenitis suppurativa: results from two case-control studies. J Am Acad Dermatol. 2008;59:596–601.
Richard MA, Corgibet F, Beylot-Barry M, et al. Sex-and age-adjusted prevalence estimates of five chronic inflammatory skin diseases in France: results of the «OBJECTIFS PEAU» study. J Eur Acad Dermatol Venereol. 2018;32:1967–71.
Santos JV, Lisboa C, Lanna C, Costa-Pereira A, Freitas A. Is the prevalence of hidradenitis suppurativa being overestimated in Europe? Or is the disease underdiagnosed? Evidence from a nationwide study across Portuguese public hospitals. Int J Dermatol. 2017;56:1491–2.
Saunte DML, Jemec GBE. Hidradenitis suppurativa: advances in diagnosis and treatment. Jama. 2017;318:2019–32.
Schrader AM, Deckers IE, van der Zee HH, Boer J, Prens EP. Hidradenitis suppurativa: a retrospective study of 846 Dutch patients to identify factors associated with disease severity. J Am Acad Dermatol. 2014;71:460–7.
Shahi V, Alikhan A, Vazquez BG, Weaver AL, Davis MD. Prevalence of hidradenitis suppurativa: a population-based study in Olmsted County. Minnesota. Dermatology. 2014;229:154–8.
Sung S, Kimball AB. Counterpoint: analysis of patient claims data to determine the prevalence of hidradenitis suppurativa in the United States. J Am Acad Dermatol. 2013;69:818–9.
Theut Riis P, Pedersen O, Sigsgaard V, et al. Prevalence of patients with self-reported hidradenitis suppurativa in a cohort of Danish blood donors: a cross-sectional study. Br J Dermatol. 2018;180:774–81.
Thomson M. A comparison between the number and distribution of functioning eccrine sweat glands in Europeans and Africans. J Physiol. 1954;123:225–33.
Wolkenstein P, Loundou A, Barrau K, Auquier P, Revuz J. Dermatology QoLGotFSo. Quality of life impairment in hidradenitis suppurativa: a study of 61 cases. J Am Acad Dermatol. 2007;56:621–3.
You HR, Yun SJ, Lee S-c, Won YH, Lee JB. Clinical characteristics and epidemiology of hidradenitis suppurativa in Korea: a single-center study. Korean J Dermatol. 2016;54:723–7.

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