National, regional and worldwide estimates of the epidemiology of psoriasis: A systematic analysis and modelling study

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National, regional and worldwide estimates of the epidemiology of psoriasis: A systematic analysis and modelling study

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Abstract

Objective

Psoriasis is a chronic inflammatory skin disease associated with several comorbidities, unhealthy lifestyle behaviours and psychological burden. Now recognised as a severe non-communicable disease, the World Health Organization has reported a lack of knowledge on the worldwide epidemiology of psoriasis. We aimed to provide information on the incidence of psoriasis and global, regional and country-specific estimates of its prevalence.

Design

Systematic review and meta-analysis.

Data Sources

MEDLINE, EMBASE, Web of Science, SciELO, Korean Journal Databases, Russian Science Citation Index, WPRIM, SaudiMedLit, Informit, IndMed, and HERDIN were searched systematically from their respective inception dates to November 2017.

Methods

Studies reporting on the incidence and prevalence of psoriasis from the general population were included. Incidence data were summarised descriptively, whereas Bayesian hierarchical models were fitted to estimate the global, regional and country-specific prevalence (95% Uncertainty Intervals) of psoriasis.

Results

In all, 24,241 records were identified and 139 studies met the inclusion criteria. In adults, the incidence of psoriasis varied from 78.08/100,000 person-years (70.0 to 86.0) in the USA to 321.0 in Italy; whereas the prevalence of psoriasis varied between 0.17% (0.05% to 0.66%) in East Asia to 2.50% (1.12% to 5.66%) in Western Europe. Prevalence of psoriasis was higher in Australasia (2.37%, 0.67% to 8.38%); North America (1.97%, 0.69% to 5.12%); high-income Southern-Latin America (1.71%, 0.43% to 4.80%) and high-income Asia Pacific (1.41%, 0.25% to 5.09%).

Discussion

Eighty-three percent of the countries of the world lack information on the epidemiology of psoriasis. The disease occurs more frequently in adults than in children. It is unequally distributed across geographical regions, being more frequent in high-income countries and in regions with older populations. The estimates provided can help guide countries and the international community on public health decisions on the appropriate management of psoriasis and to assess its natural history over time.

What is already known on this topic

- Psoriasis is a chronic, disabling skin disease associated with several psychological, metabolic and cardiovascular comorbidities. In 2014, psoriasis was recognised as a serious non-communicable disease by the World Health Assembly and the ensuing World Health Organisation (WHO) Global Report on Psoriasis called for greater understanding of the epidemiology of psoriasis.
- Information on the epidemiology of psoriasis has been generated for 21 regions of the world but not for individual countries.

What this study adds

- This systematic review and meta-analysis provides global, regional and for the first time country-specific estimates of the prevalence of psoriasis.
- Psoriasis is a common disease mainly affecting adult populations. The disease is unequally distributed across the world, being more frequent in high-income countries; however this is more likely the result of better access to care and more data and financial resources to undertake studies on the epidemiology of the disease.
- An improved understanding of the epidemiology of psoriasis is important to inform resource allocation to reduce morbidity, disability and mortality associated with the disease. Greater investment is required to reduce existing inequalities across the globe regarding access to care for people with psoriasis, as well as research aimed at better managing the disease and improving the quality of life of people it affects.

Introduction

Psoriasis is a chronic, immune-mediated inflammatory skin disease [1], consisting of red, heavily scaled plaques occurring most commonly on the elbows, knees, scalp and lower back but any skin surface can be involved. The condition greatly affects people's quality of life [2] to the extent that it may be life-ruining and stigmatising. It is now considered a systemic disease being associated with several psychological, metabolic and cardiovascular comorbidities. Life-span is reduced as a consequence [3]. In addition to the psychological and social burden related to psoriasis, the cost to both patients and healthcare systems is high [4]. Psoriasis can occur at any age although most cases present before 35 years of age [5]. In 2014 the World Health Organisation (WHO) recognised psoriasis as a serious non-communicable disease (NCD) [6] and the accompanying WHO report (2016) [6] emphasised the need to better understand the global burden of the disease so as to inform policy-makers and healthcare professionals.

Studies reporting information on the incidence of psoriasis are limited. Current estimates come from Europe and North-America and mainly report on the incidence of psoriasis in adults or on the overall population.

Additionally, there have been a number of studies reporting on the prevalence of psoriasis. Earlier study-specific estimates of the prevalence of psoriasis in adults range between 0.27% (95% CI: 0.17 to 0.36) [7] and 11.4% [8] with age, gender, geography, ethnicity, genetic and environmental factors contributing to the variation of the prevalence of the disease [9]. Higher prevalence rates have been reported at higher latitudes and in Caucasians compared to other ethnic groups [10].

The Global Burden of Disease (GBD) group has generated estimates on the prevalence of psoriasis for 21 regions of the world [11] and more recently for the global population [12], these estimates date back to 2010 [11] and relate to wider regions only [11 12]. Over the past decade there has been an increase in research informing the epidemiology of psoriasis, above all in countries where no previous estimates existed. Finally, more recent studies often rely on better data quality, many of them ascertaining information from large, routinely collected databases and being more nationally representative than previous studies.

The Global Psoriasis Atlas is a recently founded long-term initiative with the aim of identifying and informing on the global burden of psoriasis [13]. The main goals are to provide a common methodology when conducting epidemiological studies on the occurrence

of the disease; to pool together existing data through publications and registries, and to enhance the understanding of psoriasis and its comorbidities [13].

Given the existing gaps in knowledge about the epidemiology of psoriasis, the aim of the study was to perform a systematic analysis (systematic review and meta-analysis) examining the incidence and prevalence of psoriasis and to generate global, regional and country-specific estimates of its prevalence.

Methods

The systematic review and statistical model follow the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) and Guidelines for Accurate and Transparent Health Estimates Reporting (GATHER) guidelines (eTables 10 and 11 respectively).

Study design

A systematic review of the incidence and prevalence of psoriasis was conducted involving the following steps: i) data identification and extraction; ii) a descriptive summary of incidence data; and iii) a statistical analysis to generate estimates of the global, regional and country-specific prevalence of psoriasis.

Data identification and extraction

Search strategy

Eleven electronic and regional databases (MEDLINE, EMBASE, Web of Science, SciELO, Korean Journal Databases, Russian Science Citation Index, WPRIM, SaudiMedLit, Informit, IndMed, and HERDIN) were searched systematically from their respective inception dates to November 2017. The main search terms used were "psoriasis" ("psoriatic skin", "pustulosis"), "incidence" ("incident studies" or "cohort studies" or "longitudinal studies") and "prevalence" ("prevalent studies" or "cross-sectional studies"); and the full details are available in Appendix 1.

Inclusion and exclusion criteria

Studies were included if they reported on the prevalence and/or incidence of psoriasis from the general population. There were no language restrictions. Studies estimating the

prevalence and/or incidence of other skin or autoimmune diseases, but providing data on psoriasis were also included. Studies using dermatology clinic case series, or specific sub-groups of the population, or only focusing on psoriatic arthritis were excluded.

Data extraction

In the first stage, the titles and abstracts identified from searching the databases were independently screened for eligibility by two authors (RP and IYKI). Eligible papers were critically appraised and those meeting the inclusion criteria were selected for data extraction. All included studies were critically appraised for the risk of bias using the Appraisal tool for Cross-Sectional Studies (AXIS) [14]. Studies were classified as having high, medium or low risk of bias or unclear according to the quality of the methods used and results reported in the study. These judgments were made independently by the two reviewers. In addition, the references of all included studies and published review articles were also screened to identify any additional eligible studies.

Analysis of incidence data

Due to the sparsity of the studies reporting on the incidence of psoriasis, these were summarised descriptively. Incidence rates per 100,000 person-years (95% Confidence Intervals) are presented. Results were analysed by country and age category (children, adults or all ages). Within each country and age category, where possible, variations in the incidence of psoriasis were explored. When multiple studies collected data from the same data set and time-period, only the most recent or the most complete papers were reported. When the same study presented measures of incidence of psoriasis from different databases or populations, all results were reported.

Statistical analysis of prevalence data

Following data extraction, a filtering process was developed for inclusion of studies into the statistical model as some used the same data resource. To prevent duplication, the study with the most recent or complete data regarding the variable of interest or most robust in terms of methodology used was included (Appendix 1).

A Bayesian hierarchical linear mixed model was fitted to estimate the global, regional and country-specific prevalence of psoriasis. This type of statistical model is considered the gold standard in situations where data are sparse and heterogeneous [15]. In the Bayesian

hierarchical model, estimates of the prevalence of psoriasis were informed both by study data from the same country, if available, and by study data from other countries. The model is briefly described below and a full description provided in Appendix 1.

The outcome was the log-transformed prevalence of psoriasis, allowing us to use a linear model and ensuring predictions within the 0-100% range, when back-transformed. Countries were mapped according to the GBD classification with 189 countries nested in 21 regions, and regions nested in 7 super-regions. High levels of heterogeneity in the global prevalence of psoriasis were expected due to: i) varying age strata, or whether the prevalence was estimated on children, adults or the overall population; ii) type of diagnostic method, or whether the diagnosis was made by a physician, dermatologist or was self-reported; and iii) type of estimate, or whether the estimate was calculated as point, period or life-time prevalence [8]. Thus, the hierarchical model had three levels (super-regions, regions and countries), three random intercepts for these, and three fixed covariates: age strata, type of diagnostic method (physician, dermatologist or self-reported diagnosis) and type of prevalence measure (point, period or lifetime prevalence). 'Age strata' included children, adults or the overall population (children and adults combined). Geographical clustering was used in the model to inform and generate estimates for countries with missing information.

The statistical model was fitted using Bayesian inference, sampling from the posterior distribution over the parameters using the Hamiltonian Markov Chain Monte Carlo method. Four chains of 2000 iterations each were used to run the model. After fitting the model, posterior predictions were made for each country and age strata permutation. Prevalence estimates are provided in the context of 95% Uncertainty Intervals (UIs). In order to obtain the number of people affected by psoriasis by country, each country-specific prevalence estimate was multiplied by the size of its population using the United Nation population structure for the year 2017 [16]. The fit of each model was assessed by evaluating i) the measures relative to the effective sample size and autocorrelation; and ii) the trace plots (Appendix 1). All analyses were performed in R (3.4.1) using the RStanArm package, which relies on Stan.

Patient and public involvement

The International Federation of Psoriasis Associations (IFPA) area a collaborating organisation on the GPA and works, plans and findings have been presented to members of

the IFPA during GPA Steering Group meetings when IFPA members were able to ask questions on the study design and findings.

Results

In total, 24,241 records were identified from searching the databases. Of the 271 papers that were critically appraised and assessed for eligibility, 139 reported on the incidence and/or prevalence of psoriasis in the general population (Appendix 1). Specifically, 8 studies focused on the incidence of psoriasis (eTable 2); 125 reported on the prevalence of psoriasis (eTable 3); and six studies reported on both incidence and prevalence.

Incidence of psoriasis

The 14 studies reporting on the incidence of psoriasis from the general population were conducted in Western and Eastern Europe (9 studies); and North America (5 studies).
Seven studies reported on the incidence of psoriasis in all ages. Here, the incidence of the disease varied from 59.9 (49.5 to 70.3) in North America (USA) [17] to 521.0 in Western Europe (Germany) [18]. While Springate *et al* (2017) [3] and Znamenskaya *et al* (2012) [19] reported a slight decline in the incidence of psoriasis in all ages in the UK (from 159.0 to 129.0 between 1999 and 2013) and Russian Federation (from 70.5 to 69.6 between 2009 and 2011), respectively, the incidence of psoriasis in Denmark has been inconsistent, with a decrease in incidence from 140.1 to 104.0 between 2003 and 2005 followed by an increase to 181.0 in 2010 which then decreased to 151.2 in 2012 [20].
Only two studies, from Italy and the USA, explored the incidence of psoriasis in children over a 7-year and 30-year period, respectively (Table 1) [21 22]. While Tollefson *et al* (2010) [22] reported a steady rise in the incidence of psoriasis in the USA between 1970 and 2000, Cantarutti *et al* (2015) [21] found that the incidence of psoriasis in Italy was stable between 2006 and 2012 (Table 1).
In adults, the incidence of psoriasis was higher than in children and varied from 78.0 (70.0 to 86.0) [23] in the USA to 321.0 in Italy [24]. While the data showed a steadily increasing trend in incidence of psoriasis in adults in the USA between 1970 and 2000 (Table 1) [25], data from Canada and Italy showed a slightly decreasing trend in incidence over time [24 26].

Variation in the incidence of psoriasis by age and gender

In children, the incidence of psoriasis increased with age from 13.5 (0-3 years old) to 53.1 (14-18 years old) (Table 2) [22]. Despite higher estimates of psoriasis incidence from the UK [27 28] than the USA [17 25], all of these studies showed a similar trend of increasing psoriasis incidence up to 39 years of age, which then decreased at 40-49 years of age before increasing again with a second peak at around 50-59 years of age (UK [28]) or 60-69 years of age (UK [27] and USA [17 25]). The incidence of psoriasis then decreased towards the end of life.

There was lack of agreement in the published studies about variations in incidence rates by gender. Although the overall incidence rate was higher in girls than in boys aged less than 18 years (43.9 and 37.9, respectively), this pattern was not consistent across all age bands [22]. While some studies reported higher incidence in women than in men [3 17 20 27], other studies presented contrasting results [24 25]. When examining the incidence of psoriasis by gender and age bands, the two peaks for age at onset in women were more frequently around 18-29 and 50-59 years of age, whereas in men they occurred more frequently around 30-39 and 60-69/70-79 years of age [17 25 27 28].

Prevalence of psoriasis

The 131 studies reporting on the prevalence of psoriasis from the general population were identified from 12 regions of the world (Table 3). The majority of studies (87; 66%) were conducted in high-income countries; these also contributed the highest number of nationally representative studies. Due to overlapping data sources, 101 independent data points were included in the statistical analysis. These came from 32 out of 189 (17%) countries of the world (Figure 1). The majority of studies included in the statistical analyses were graded as low-medium risk of bias (70.3%) (Appendix1). Given the adjustments, the estimates of the prevalence of psoriasis are reported for each age stratum according to the physician or dermatologist diagnosis and regarding lifetime prevalence, whereas the number of people affected by psoriasis is reported for the adult population.

Regionally, the occurrence of the disease for the overall population varied from 0.12% (0.03% to 0.42%) in East Asia to 1.74% (0.79% to 3.78%) in Western Europe. Country-specific prevalence of psoriasis varied substantially. Considering the estimate for the overall population, Norway (1.98%; 0.82% to 4.79%), Italy (1.97%; 0.78% to 5.23%), Israel (1.95%; 0.72% to 5.72%), Australia (1.95%; 0.50% to 8.01%), Denmark 1.91% (0.75% to 4.96%) and

Sweden (1.91%; 0.70% to 5.41%) had the highest estimates of the prevalence of psoriasis (Appendix 1). The estimated prevalence of psoriasis in countries from East Asia was much lower, Taiwan being the country with the lowest prevalence worldwide (0.06%; 0.01% to 0.28%).

Psoriasis occurred more frequently in adults than in children. In children, the prevalence of psoriasis varied between 0.01% (0.00% to 0.05%) in East Asia to 0.18% (0.07% to 0.46%) in Western Europe (Figure 3). In adults, the disease varied between 0.17% (0.05% to 0.66%) in East Asia to 2.50% (1.12% to 5.66%) in Western Europe. Other regions with an occurrence of the diseases above 1% were Australasia (2.37%; 0.67% to 8.38%); high-income North America (1.97%; 0.69% to 5.12%); high-income Southern-Latin America (1.71%; 0.43% to 4.80%) high-income Asia Pacific (1.41%; 0.25% to 5.09%); Central Europe (1.12%; 0.25% to 4.62%); Central Asia (1.12%; 0.25% to 4.62%); and Eastern Europe (1.04%; 0.19% to 4.68%); Figure 4.

Given the strong association of psoriasis with age, prevalence of psoriasis varied across countries also because of differences in regional and country-specific age structures. Considering country-specific estimates, the physician lifetime prevalence of psoriasis in adults was highest in Norway (2.85%; 1.13% to 7.30%), Italy (2.83%; 1.11% to 7.59%), Israel (2.80%; 1.00% to 8.64%), Australia (2.80%; 0.81% to 10.15%), Denmark (2.75%; 1.09% to 7.10%) and Sweden (2.74%, 0.97% to 7.63%); however the countries with the highest number of adults affected were the USA (4.5 million; 1.5 to 12.7); India (4.4 million; 0.7 to 23.5); China (2.9 million; 0.8 to 10.2); Germany (1.8 million; 0.7 to 4.6); Italy (1.4 million; 0.5 to 3.7); Japan (1.3 million; 0.2 to 5.7); and the United Kingdom (1.3 million; 0.5 to 3.0).

Globally, in 2017, an estimated 29.4 million adults people had psoriasis, corresponding to a physician diagnosed lifetime prevalence of 0.59% (0.14% to 2.21%) of the adults population worldwide.

Additional sources of heterogeneity in the estimates were factors such as type of diagnostic method (self-reported, or made by a physician or dermatologist) and type of prevalence estimate (period, point or lifetime prevalence). Specifically, the self-reported life-time prevalence of psoriasis for the adults population may be as high as 4.08% (2.25% to 7.37%) in Western Europe and up to 0.96% (0.26% to 3.26%) globally affecting approximately 48.0 million adults worldwide. The full prevalence estimates by 21 regions and 189 countries are shown in Appendix 1.

Discussion

Main findings

The systematic review highlighted limited epidemiological data on the incidence of psoriasis, with the majority of studies conducted mainly in Europe and North America. Findings revealed consistency across studies regarding the bimodal age pattern of the onset of the disease. There was no agreement on specific gender differences or trends over time.

The prevalence of the disease was highest in high-income countries such as Western Europe, Australasia and North America; however the largest adult populations affected by psoriasis resided in the USA, India, China followed by Germany, Italy and the UK. Both the incidence and the prevalence of psoriasis had a strong association with age; being less common in children and occurred more frequently in adults.

Strengths and limitation of the study

The study has several key strengths. First, an extensive systematic review was undertaken to search for all available literature since inception, using eleven electronic and regional databases with no restriction on language. Second, the use of a Bayesian framework approach to analyse the data, which is the optimal technique when data are sparse and heterogeneous [15]. Third, the adjustment in the statistical model for potential sources of heterogeneity such as age strata, type of diagnostic method and type of prevalence measure used to calculate the prevalence of the disease. Finally, our analysis generated estimates for 21 regions and 189 countries of the world.

Limitations of the study also need to be acknowledged. First, due to the sparsity of data on the incidence of psoriasis, it was not possible to include these in the statistical model. Second, the use of non-nationally representative data in many low-income and middle-income countries, where only small studies with limited information were available, resulted in greater uncertainty for some estimates. Third, due to reporting of the data in the included studies, it was not possible to provide estimates by gender and by 5-year age bands; therefore no age-standardised estimates were calculated. However, using the information on wide age strata it was possible to estimate the prevalence of psoriasis by children, adults and the overall population. Fourth, due to the complete lack of information for several countries and regions, in some circumstances it was only possible to use the estimate of the wider regions or super-regions for countries they were nested in. For this reason, estimates from countries with no data might be helpful in guiding policymakers, healthcare practitioners and patients but need to be interpreted with caution.

Comparison with other studies

There is limited research performing similar analyses [11 12]. Hay *et al* [11] provided estimates of the prevalence of psoriasis for 21 regions of the world. Compared to their findings our estimates are lower, the main differences are to be found in the data sources used. Our systematic review was more extensive and included more recent studies. Furthermore, our statistical model adjusted for important sources of heterogeneity such as type of diagnostic methods and type of prevalence measure. If we restricted our analysis to the self-reported lifetime prevalence of psoriasis then our estimate of the global prevalence of psoriasis would be similar [12]. A major strength of our research compared to Hay *et al* [11] and James *et al* [12] is that we were able to provide a measure of the prevalence of psoriasis for 189 countries.

Contrary to what has been suggested previously [3 8], there was no clear North-South gradient. Conversely, it appeared that the prevalence of psoriasis varied according to income, similarly to the distribution of the disease burden, measured as disability-adjusted life years (DALYs) reported in Karimkhani *et al* [29]. Countries located in high-income regions had a higher prevalence of psoriasis compared to low-income countries/regions. Possible explanations for this observed pattern are: i) the results might be an artefact due to high-income countries having better healthcare systems, more awareness of the disease, better data quality, and studies from these countries reporting data from large population-based and nationally representative databases; ii) high-income countries also have a higher proportion of the population that is comprised of the elderly, which means life expectancy is higher yielding to a higher prevalence of psoriasis [3]; and iii) the lack of access to healthcare for many people with psoriasis will contribute to an underestimate of its prevalence in many least developed countries.

Interpretation of the findings

Findings revealed a high country-specific variation of the prevalence of psoriasis with relatively low figures in regions with young populations, such as South-Asia and Sub-Saharan Africa, and with relatively high figures in regions with a relatively old population such as the high-income regions. This was due to the strong association between the prevalence of psoriasis and age.

Our analysis reported the lifetime prevalence of psoriasis according to physician or dermatologist diagnosis. However, these estimates might be an underestimate of the true prevalence of the disease, since the majority of the data came from studies using databases

which only reflect those people with psoriasis seeking health care but may not reflect the underdiagnosed population. Conversely, when the analyses reported the estimates of the lifetime prevalence of self-reported psoriasis, these were higher in comparison, but with the risk of potential misdiagnosis of the disease. This is consistent with a recent study from Denmark which found that the prevalence of self-reported psoriasis was higher than the physician reported prevalence [30].

Conclusions

Research investigating the incidence and prevalence of psoriasis has increased in recent years; nevertheless there are considerable gaps in coverage of geographical areas reporting on this information, particularly from low-income and middle-income countries.

Psoriasis, now recognised as a chronic and disabling noncommunicable diseases [6], is associated with several comorbidities such as psoriatic arthritis, depression, obesity, diabetes, liver disease, metabolic syndrome and cardiovascular disease. Furthermore, people with psoriasis have a highly visible condition which can be stigmatising. Given this scenario and accounting for population growth and aging and the fact that psoriasis affects mainly the adult population, the burden associated with psoriasis might be greater than reported [11] and will continue to rise.

There is a clear need to improve the quality and volume of data on the epidemiology of psoriasis, including standardisation of methods, diagnostic criteria, and reporting of the incidence and prevalence of the disease. An improved understanding of the epidemiology of psoriasis is important to inform resource allocation to reduce morbidity, disability and mortality associated with the disease. Greater investment is required to reduce existing inequalities across the globe regarding access to care for people with psoriasis, as well as research aimed at better managing the disease and improving the quality of life of people it affects.

Contributors

IYKI, RP and DMA led on the conception and design of the study. IYKI and RP searched, extracted and critically appraised the studies included in the systematic review. RP and EK planned and performed the statistical analyses. IYKI and RP wrote the first draft of the manuscript. All authors contributed to the interpretation of the findings and the final draft of the paper. RP is the guarantor. The corresponding author attests that all listed authors meet authorship criteria and that no others meeting the criteria have been omitted.

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Competing interests

CEMG reports receiving honoraria and/or research grants from AbbVie, Almirall, Celgene, Eli Lilly, Galderma, Janssen, LEO Pharma, Novartis, Pfizer, Sandoz, Sanofi, and UCB Pharma.

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EK, IYKI and RP report no conflict of interests.

Ethical approval

Not required.

Data sharing

The raw data are available in the supplementary files or on request from RP and IYKI.

The manuscript's guarantor (RP) affirms that the manuscript is an honest, accurate, and transparent account of the study being reported; and that no important aspects of the study have been omitted; and that any discrepancy from the study as planned have been explained.

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Dissemination declaration

Findings of the study will be disseminated to patient organisations, specialist and non-specialist audience at international conferences and thorough the Global Psoriasis Atlas website which will contain all the information on the project.

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Table 1: List of studies providing incidence rates in children, adults, and all ages

Study	Country	Study period	Diagnostic method	Age	People with Ps	Incidence rate per 100,000 person-years (95% CI)	Incidence rate per 100,000 person-years (95% CI) female	Incidence rate per 100,000 person-years (95% CI) male
Children								
Cantarutti et al. (2015)	Italy	2006 - 2012	FP	≤14				
		2006				61.0 (50.0 to 80.0)[1]		
		2007				45.0 (30.0 to 60.0)[1]		
		2008				54.0 (40.0 to 70.0)[1]		
		2009				53.0 (40.0 to 70.0)[1]		
		2010				53.0 (40.0 to 70.0)[1]		
		2011				40.0 (30.0 to 50.0)[1]		
		2012				57.0 (40.0 to 80.0)[1]		
Tollefson et al. (2010)	USA	1970 - 1999	D/Ph	<18	357	40.8 (36.6 to 45.1)[1,2]	43.9 (37.6 to 50.2) [1,2]	37.9 (32.2 to 43.6) [1,2]
		1970 - 1974				29.6 (20.9 to 38.3)[1,2]		
		1975 - 1979				35.7 (25.9 to 45.5)[1,2]		
		1980 - 1984				31.4 (22.0 to 40.8)[1,2]		
		1985 - 1989				42.7 (31.8 to 53.7)[1,2]		
		1990 - 1994				40.0 (29.7 to 50.3)[1,2]		
		1995 - 1999				62.7 (50.4 to 65.0)[1,2]		
Adults								
Eder et al. (2017)	Canada	2000 - 2015	Ph	≥20				
		2000				114.0 (112.0 to 116.0)[1,2]		
		2001				111.0 (109.0 to 113.0)[1,2]		
		2002				103.0 (101.0 to 105.0)[1,2]		
		2003				101.0 (99.0 to 103.0)[1,2]		
		2004				101.0 (99.0 to 103.0)[1,2]		
		2005				97.0 (95.0 to 99.0)[1,2]		
		2006				97.0 (95.0 to 99.0)[1,2]		

		2007				96.0 (94.0 to 98.0)[1,2]		
		2008				96.0 (94.0 to 98.0)[1,2]		
		2009				95.0 (93.0 to 97.0)[1,2]		
		2010				95.0 (93.0 to 97.0)[1,2]		
		2011				98.0 (96.0 to 100.0)[1,2]		
		2012				100.0 (98.0 to 102.0)[1,2]		
		2013				105.0 (103.0 to 107.0)[1,2]		
		2014				102.0 (100.0 to 104.0)[1,2]		
		2015				105.0 (103.0 to 107.0)[1,2]		
Vena et al. (2010)	Italy	2001 - 2005	Ph	≥18	5,792			
		2001				321.0[1]	291.0[1]	357.0[1]
		2005				230.0[1]	207.0[1]	254.0[1]
Khalid et al. (2013)	UK	2007 - 2009	Ph	18 - 80+	10,832	280.0 (280.0 to 290.0)[1,2]		
Shbeeb et al. (1995)	USA	1982-1991				78.0 (70.0 to 86.0)[1,2]		
Icen et al. (2009)	USA	1970 - 2000	D/Ph	≥18	1,633	78.9 (75.0 to 82.9)[1,2,3]	73.2 (68.0 to 78.4) [1,2,3]	85.5 (79.5 to 91.6) [1,2,3]
		1970 - 1974				50.8 (41.9 to 59.6)[1,2,3]		
		1975 - 1979				53.2 (44.8 to 61.6)[1,2,3]		
		1980 - 1984				80.9 (70.8 to 91.1)[1,2,3]		
		1985 - 1989				78.9 (69.5 to 88.4)[1,2,3]		
		1990 - 1994				88.7 (79.1 to 98.3)[1,2,3]		
		1995 - 1999				100.5 (90.8 to 110.2)[1,2,3]		
All ages								
Egeberg et al. (2017)	Denmark	2003 - 2012	Ph	0 - 70+				
		2003				140.1 (137.1 to 143.2)[1]	146.8[1]	133.4[1]
		2004				122.2 (119.4 to 125.1)[1]	130.7[1]	113.6[1]
		2005				104.0 (101.4 to 106.7)[1]	107.5[1]	100.5[1]
		2006				105.5 (102.9 to 108.2)[1]	110.4[1]	100.4[1]
		2007				111.5 (108.7 to 114.2)[1]	110.8[1]	112.2[1]
		2008				128.6 (125.7 to 131.6)[1]	128.8[1]	128.4[1]
		2009				174.8 (171.4 to 178.3)[1]	192.6[1]	156.8[1]
		2010				181.0 (177.5 to 184.5)[1]	199.5[1]	162.3[1]

		2011				171.3 (167.9 to 174.7)[1]	187.9[1]	154.5[1]
		2012				151.2 (148.0 to 154.5)[1]	165.9[1]	136.4[1]
Jacob et al. (2016)	Germany	2007-2010	Ph		14,686	521.1[1]		
Znamenskaya et al. (2012)	Russian Federation	2009	Ph	0-18+	99988	70.5[1]		
		2010			99348	69.8[1]		
		2011			99436	69.6[1]		
Donker et al. (1998)	The Netherlands	1987 - 1988	Ph	0 - 65+	106	130.0 (120.0 to 140.0)[1,2]		
Donker et al. (1998)	The Netherlands	1995	Ph	0 - 65+	24	120.0 (70.0 to 190.0)[1,2]		
Huerta et al. (2007)	UK	1996 - 1997	Ph	0 - 80+	3,994	140.0[1]		
Springate et al. (2017)	UK	1999 - 2013	Ph	0 - 100				
		1999			4279	159.0 (155.0 to 164.0)[1,2]	161.0 (155.0 to 168.0)[1,2]	158.0 (151.0 to 165.0)[1,2]
		2000			5398	163.0 (158.0 to 167.0)[1,2]	162.0 (156.0 to 169.0)[1,2]	163.0 (157.0 to 170.0)[1,2]
		2001			6286	164.0 (160.0 to 168.0)[1,2]	163.0 (157.0 to 168.0)[1,2]	166.0 (160.0 to 172.0)[1,2]
		2002			7259	170.0 (166.0 to 174.0)[1,2]	174.0 (169.0 to 180.0)[1,2]	166.0 (161.0 to 172.0)[1,2]
		2003			7977	172.0 (168.0 to 176.0)[1,2]	178.0 (173.0 to 183.0)[1,2]	166.0 (161.0 to 172.0)[1,2]
		2004			8209	166.0 (163.0 to 170.0)[1,2]	170.0 (165.0 to 175.0)[1,2]	163.0 (158.0 to 168.0)[1,2]
		2005			8522	165.0 (162.0 to 169.0)[1,2]	173.0 (168.0 to 178.0)[1,2]	158.0 (153.0 to 163.0)[1,2]
		2006			8499	161.0 (158.0 to 165.0)[1,2]	169.0 (164.0 to 174.0)[1,2]	154.0 (149.0 to 159.0)[1,2]
		2007			8807	165.0 (162.0 to 168.0)[1,2]	170.0 (165.0 to 175.0)[1,2]	160.0 (155.0 to 165.0)[1,2]
		2008			8964	163.0 (160.0 to 167.0)[1,2]	165.0 (160.0 to 170.0)[1,2]	162.0 (157.0 to 167.0)[1,2]
		2009			8518	155.0 (152.0 to 158.0)[1,2]	159.0 (154.0 to 163.0)[1,2]	152.0 (147.0 to 156.0)[1,2]
		2010			7715	143.0 (140.0 to 146.0)[1,2]	145.0 (141.0 to 150.0)[1,2]	140.0 (136.0 to 145.0)[1,2]
		2011			7499	140.0 (137.0 to 143.0)[1,2]	144.0 (140.0 to 149.0)[1,2]	135.0 (131.0 to 140.0)[1,2]
		2012			6992	131.0 (128.0 to 134.0)[1,2]	136.0 (132.0 to 141.0)[1,2]	126.0 (122.0 to 130.0)[1,2]
		2013			6350	129.0 (126.0 to 133.0)[1,2]	131.0 (127.0 to 136.0)[1,2]	127.0 (123.0 to 132.0)[1,2]
Bell et al. (1991)	USA	1980 - 1983	D/Ph	0 - 70+	132	59.9 (49.5 to 70.3)[1,2]	63.6 (48.9 to 78.3)[1,2]	58.4 (42.8 to 74.1)[1,2]

Abbreviations: CI, confidence intervals; Ps, Psoriasis; Diagnostic methods: D, dermatologists; FP, family paediatrician; N, nurse; Ph, physician; SR, self-reported diagnosis.
[1] Values reported from the study.
[2] Age and/or sex adjusted
[3] Rate adjusted with linear interpolation between census years.

Table 2 List of studies providing incidence rates by gender and age groups

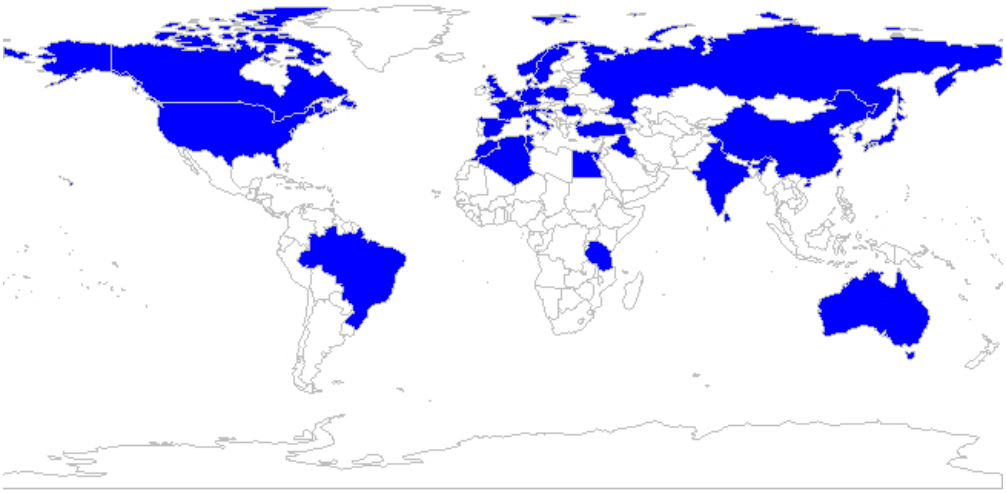
Study	Country	Study period	Diagnostic method	Age	People with Ps	Incidence rate per 100,000 person-years (95% CI)	Incidence rate per 100,000 person-years (95% CI) female	Incidence rate per 100,000 person-years (95% CI) male
Children								
Tollefson et al. (2010)	USA	1970 - 1999	D/Ph	<18	357	40.8 (36.6 to 45.1)[1,2]	43.9 (37.6 to 50.2) [1,2]	37.9 (32.2 to 43.6) [1,2]
				0 - 3	27	13.5 [1]	13.2 [1]	13.7 [1]
				4 - 7	84	42.2 [1]	40.2 [1]	44.1 [1]
				8 - 10	69	44.0 [1]	55.7 [1]	33.2 [1]
				11 - 13	75	52.2 [1]	49.6 [1]	54.6 [1]
				14 - 17	102	53.1 [1]	61.9 [1]	44.7 [1]
Adults								
Khalid et al. (2013)	UK	2007 - 2009	Ph	18 - 80+	10,832	280.0 (280.0 to 290.0)[1,2]		
				18 - 29			350.0 (320.0 to 380.0)[1]	250.0 (230.0 to 280.0)[1]
				30 - 39			320.0 (280.0 to 350.0)[1]	290.0 (260.0 to 320.0)[1]
				40 - 49			220.0 (200.0 to 240.0)[1]	220.0 (200.0 to 250.0)[1]
				50 - 59			310.0 (280.0 to 340.0)[1]	320.0 (300.0 to 360.0)[1]
				60 - 69			310.0 (280.0 to 350.0)[1]	370.0 (330.0 to 400.0)[1]
				70 - 79			290.0 (250.0 to 320.0)[1]	290.0 (250.0 to 330.0)[1]
				80+			160.0 (130.0 to 190.0)[1]	180.0 (140.0 to 230.0)[1]
Icen et al. (2009);	USA	1970 - 2000	D/Ph	≥18	1633	78.9 (75.0 to 82.9)[1,2,3]	73.2 (68.0 to 78.4) [1,2,3]	85.5 (79.5 to 91.6) [1,2,3]
				18 - 29	444	77.4[1]	75.6[1]	79.4[1]
				30 - 39	391	81.1[1]	69.2[1]	93.3[1]
				40 - 49	260	71.3[1]	69..0[1]	73.6[1]
				50 - 59	230	88.0[1]	90.7[1]	85.2[1]
				60 - 69	174	94.2[1]	76.2[1]	115.3[1]
				70 - 79	94	73.8[1]	71.2[1]	77.9[1]
				80+	40	51.4[1]	39.8[1]	80.0[1]
All ages								

Znamenskaya et al. (2012)	Russian Federation	2009	Ph	0-18+	99988	70.5[1]		
				0-14	6069	28.8[1]		
				15-17	5864	118.2[1]		
				18+	88055	76.0[1]		
		2010		0-18+	99348	69.8[1]		
				0-14	6045	28.2[1]		
				15-17	5873	128.2[1]		
				18+	87430	75.4[1]		
		2011		0-18+	99436	69.6[1]		
				0-14	6104	28.0[1]		
				15-17	5681	126.7[1]		
				18+	87651	75.2[1]		
Huerta et al. (2007)	UK	1996 - 1997	Ph	0 - 80+	3,994	140.0[1]		
				0 - 19		116.0[1]	121.0[1]	110.0[1]
				20 - 29		134.0[1]	155.0[1]	111.0[1]
				30 - 39		155.0[1]	131.0[1]	174.0[1]
				40 - 49		116.0[1]	105.0[1]	128.0[1]
				50 - 59		167.0[1]	172..0[1]	161.0[1]
				60 - 69		164.0[1]	144.0[1]	186.0[1]
				70 - 79		163.0[1]	118.0[1]	224.0[1]
				80+		100.0[1]	82.0[1]	173.0[1]
Bell et al. (1991)	USA	1980 - 1983	D/Ph	0 - 70+	132	59.9 (49.5 to 70.3)[1,2]	63.6 (48.9 to 78.3)[1,2]	58.4 (42.8 to 74.1)[1,2]
				<20	21	30.9[1]	47.1[1]	14.8[1]
				20 - 29	25	49.1[1]	41.3[1]	59.5[1]
				30 - 39	25	71.7[1]	61.2[1]	82.9[1]
				40 - 49	12	51.4[1]	58.6[1]	43.8[1]
				50 - 59	18	94.6[1]	109.1[1]	78.3[1]
				60 - 69	17	112.6[1]	126.5[1]	93.8[1]
				70+	14	77.4[1]	54.9[1]	130.6[1]

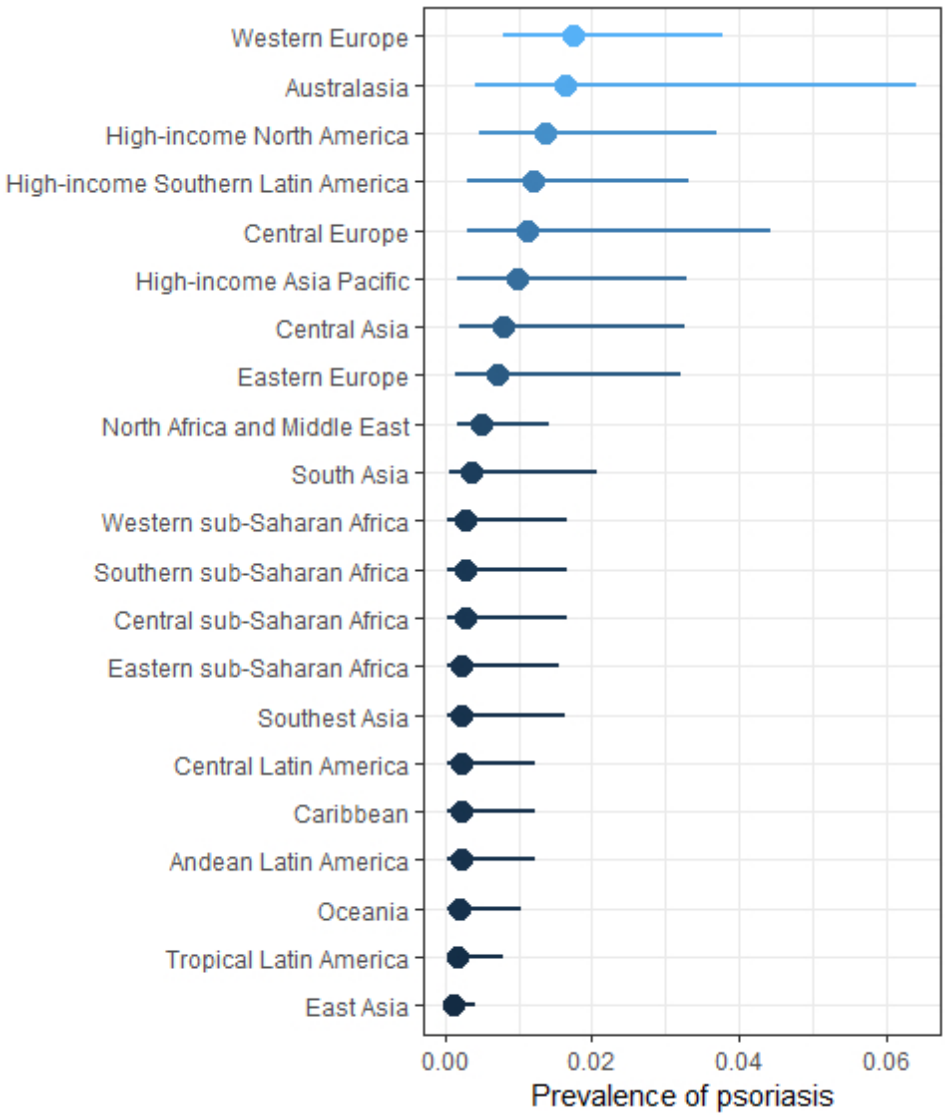
Abbreviations: CI, confidence intervals; Ps, Psoriasis; Diagnostic methods: D, dermatologists; FP, family paediatrician; N, nurse; Ph, physician; SR, self-reported diagnosis.
[1] Values reported from the study.
[2] Age and/or sex adjusted

Table 3 Distribution of studies (n=131) reporting on the prevalence of psoriasis according to regions

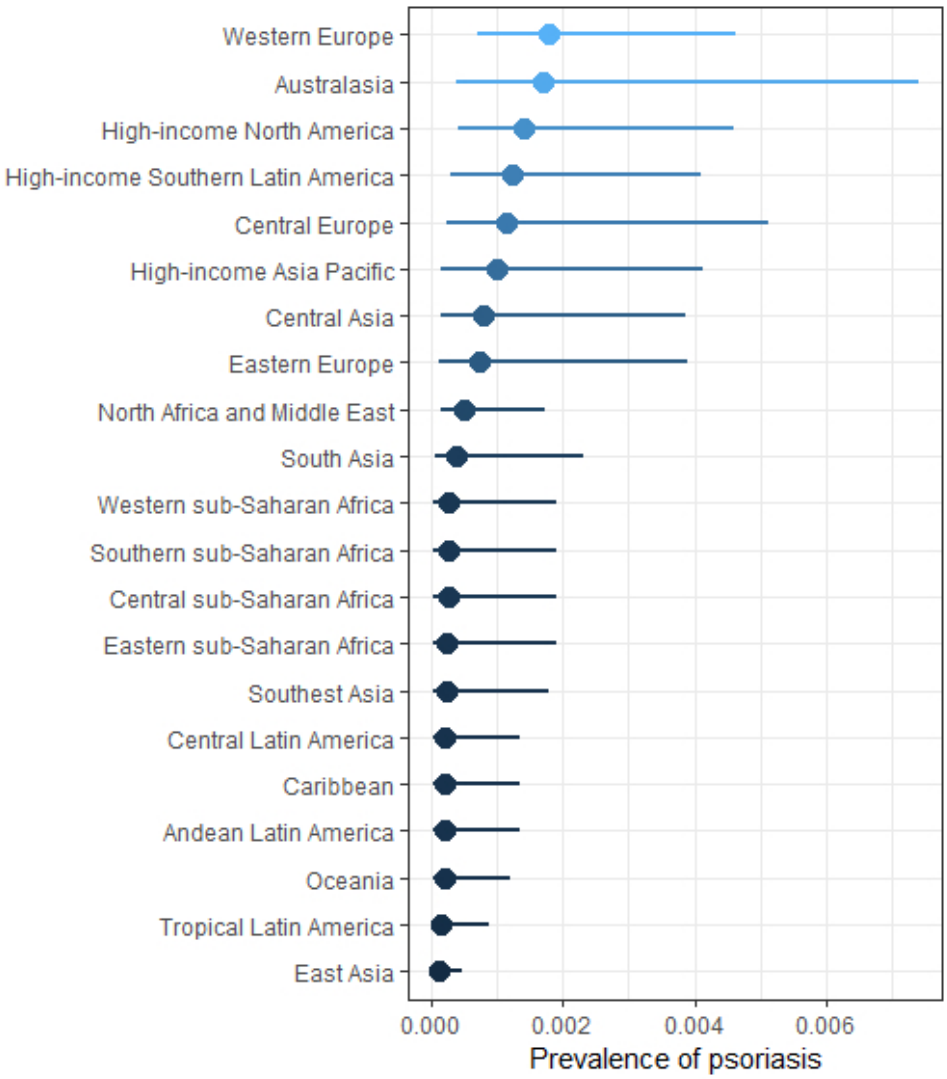
Region	Number of studies
Western Europe	64
High-income North America	17
East Asia	15
North Africa and the Middle East	15
Central Europe	4
Tropical Latin America	4
High-income Asia Pacific	3
Australasia	3
Eastern Europe	2
South Asia	2
Southeast Asia	1
Eastern-sub-Saharan	1



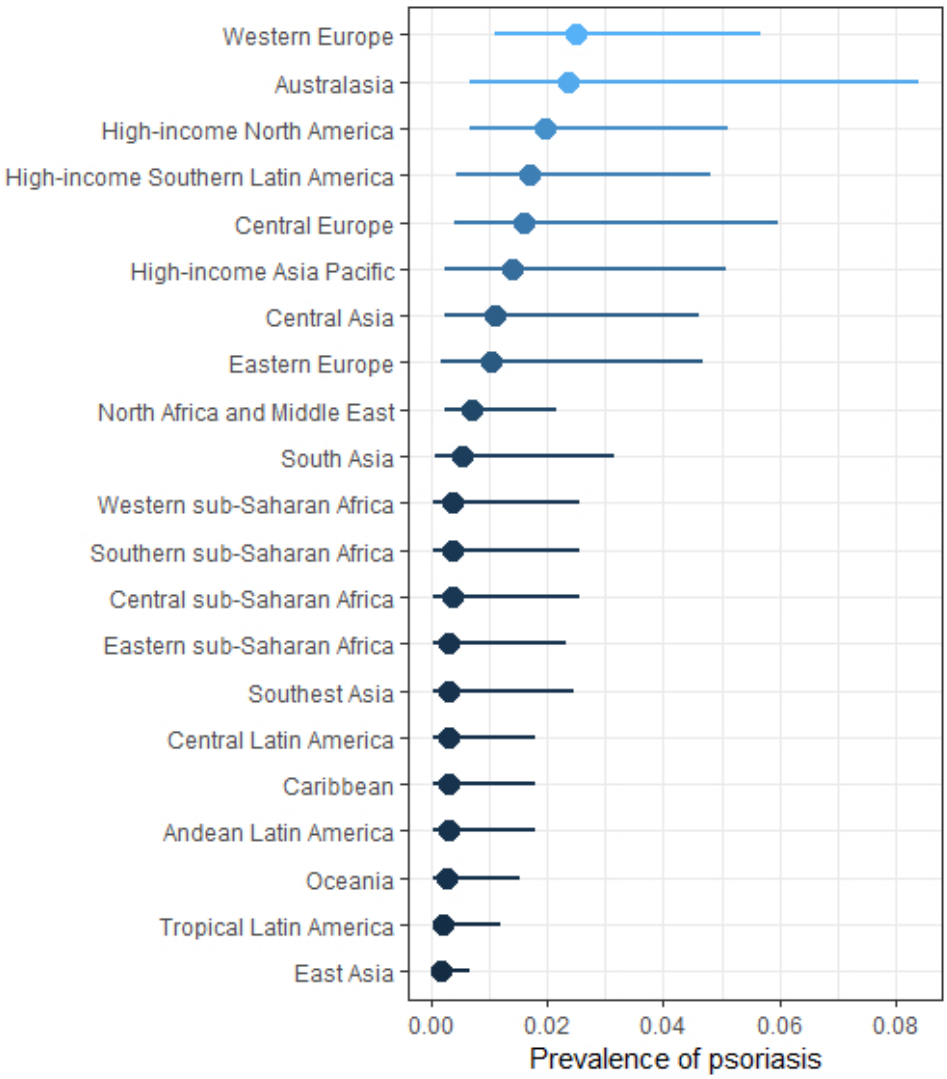
Countries reporting information on the prevalence of psoriasis



Prevalence of psoriasis in the overall population for 21 world regions



Prevalence of psoriasis in children for 21 world regions



Prevalence of psoriasis in adults for 21 world regions