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

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ABSTRACT OBJECTIVE

To systematically review and provide information on the incidence of psoriasis and quantify 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 inception dates to October 2019.

METHODS

Studies were included if they reported on the incidence or prevalence of psoriasis in the general population. Incidence data were summarised descriptively, whereas bayesian hierarchical models were fitted to estimate the global, regional, and country specific prevalence of psoriasis.

RESULTS

41 164 records were identified and 168 studies met the inclusion criteria. In adults, the incidence of psoriasis varied from 30.3 per 100 000 person years (95% confidence interval 26.6 to 34.1) in Taiwan to 321.0 per 100 000 person years in Italy. The prevalence of psoriasis varied from 0.14% (95% uncertainty interval 0.05% to 0.40%) in east Asia to 1.99% (0.64% to 6.60%) in Australasia. The prevalence of psoriasis was also high in western Europe (1.92%, 1.07% to 3.46%), central Europe (1.83%, 0.62% to 5.32%), North America (1.50%,

0.63% to 3.60%), and high income southern Latin America (1.10%, 0.36% to 2.96%).

CONCLUSIONS

Eighty one per cent of the countries of the world lack information on the epidemiology of psoriasis. The disease occurs more frequently in adults than in children. Psoriasis is unequally distributed across geographical regions; it is more frequent in high income countries and in regions with older populations. The estimates provided can help guide countries and the international community when making public health decisions on the appropriate management of psoriasis and assessing its natural history over time.

SYSTEMATIC REVIEW REGISTRATION
PROSPERO CRD42019160817.

Introduction

Psoriasis is a chronic, immune mediated inflammatory skin disease,¹ consisting of red, scaly 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 to the extent that it could be life ruining and stigmatising.² Psoriasis is now considered a systemic disease; it is associated with psychological, metabolic, arthritic, and cardiovascular comorbidities. Lifespan is reduced as a consequence.³ In addition to the psychological and social burden related to psoriasis, the cost to patients and healthcare systems is high.⁴ Psoriasis can occur at any age, although most patients present with the condition before 35 years old.⁵ In 2014 the World Health Organization recognised psoriasis as a serious non-communicable disease⁶ and the accompanying WHO report (2016)⁶ emphasised the need to better understand the global burden of the disease. To address this need, the Global Psoriasis Atlas (www.globalpsoriasisatlas.org) was established to conduct further research into the global prevalence and incidence of psoriasis, thereby helping to ensure better access to care for people with the disease.

Studies that report 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 in the overall population. Additionally, several studies have reported on the prevalence of psoriasis. Earlier study specific estimates of the prevalence of psoriasis in adults range between 0.27% (95% confidence interval 0.17 to 0.36)⁷ and 11.4%,⁸ with age, sex, geography, ethnicity, genetic and environmental factors contributing to the variation in the prevalence of the disease.⁹ Higher prevalence rates have been reported at higher latitudes

WHAT IS ALREADY KNOWN ON THIS TOPIC

Psoriasis is a chronic, disabling skin disease associated with psychological, metabolic, arthritic, and cardiovascular comorbidities

In 2014, the World Health Organization recognised psoriasis as a serious non-communicable disease and its report called for greater understanding of the epidemiology of the disease

The Global Burden of Disease group has produced estimates on the prevalence of psoriasis 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 country specific estimates of the prevalence of psoriasis

Psoriasis is a common disease that mainly affects the adult population, and is more frequent in high income countries

An improved understanding of the epidemiology of psoriasis is important when allocating resources to reduce morbidity, disability, and mortality associated with the disease

and in white people compared with other ethnic groups.¹⁰

The Global Burden of Disease 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 relate to wider regions,^{11 12} but not to individual countries. Over the past decade there has been an increase in research examining the epidemiology of psoriasis, particularly in countries where estimates were lacking. Recent studies have often been derived from better data quality resources, many of them extracting information from large, routinely collected and electronic health databases, which are more nationally representative than previous studies.

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

Methods

The systematic review and statistical model follow the PRISMA (preferred reporting items for systematic reviews and meta-analyses) and GATHER (guidelines for accurate and transparent health estimates reporting) guidelines (supplementary material 4, eTables 12 and 13, respectively).

Study design

We conducted a systematic review of the incidence and prevalence of psoriasis that involved several steps. These steps included data identification and extraction; a descriptive summary of incidence data; and a statistical analysis to generate estimates of the global, regional, and country specific prevalence of psoriasis by using the information extracted from the included studies examining the prevalence of the disease.

Data identification and extraction

Search strategy

We systematically searched 11 electronic and regional databases (Medline, Embase, Web of Science, SciELO, Korean Journal Databases, Russian Science Citation Index, WPRIM, SaudiMedLit, Informit, IndMed, and HERDIN) from their respective inception dates to October 2019. The main search terms were “psoriasis” (“psoriatic skin,” “pustulosis”), “incidence” (“incident studies” or “cohort studies,” or “longitudinal studies”), and “prevalence” (“prevalent studies” or “cross-sectional studies”). Supplementary material 1 gives full details about the search strategy. We also screened the references of all included studies and published review articles to identify any additional eligible studies.

Inclusion and exclusion criteria

We included studies if they reported on the prevalence or incidence of psoriasis in the general population. No

language restrictions were applied. We also included studies that estimated the prevalence or incidence of other skin or autoimmune diseases, but provided data on psoriasis. Studies that used dermatology clinic case series, or specific subgroups of the population, or only focused on psoriatic arthritis were excluded.

Data extraction

In the first stage, two authors (RP and IYKI) independently screened the titles and abstracts identified from searching the databases for eligibility. Eligible papers were critically appraised and those meeting the inclusion criteria were selected for data extraction. We critically appraised all included studies for risk of bias by using the appraisal tool for cross-sectional studies (AXIS).¹³ This quality assessment tool comprises 20 items that cover several domains: identification of research aim, appropriateness of study design, use of valid measures and statistical analyses, and consideration of bias. Supplementary material 1 (text 2.5) and supplementary material 3 (eTable 14) give full details about the AXIS tool, the items included, and the risk of bias assessment. Studies were classified as having high, medium, or low risk of bias, or were rated as unclear according to the quality of the methods used and results reported in the study. The two authors independently made these judgments, and reached consensus on the final rating if needed.

Analysis of incidence data

Because a limited number of studies reported on the incidence of psoriasis, these were summarised descriptively. We report incidence rates per 100 000 person years (95% confidence intervals). Results were analysed by country and age category (children, adults, or all ages), and if possible, we explored variation in the incidence of psoriasis within each country and age category.

Statistical analysis of prevalence data

After data extraction, we developed a filtering process for inclusion of studies in the statistical model because some studies used the same data resource. To prevent duplication, we included studies with the most recent or complete data on the variable of interest, or the most robust in terms of the methods used (supplementary material 1, eTable 2).

We fitted a bayesian hierarchical linear mixed model to estimate the global, regional, and country specific prevalence of psoriasis. This type of statistical model is considered the gold standard when data are sparse and heterogeneous.¹⁴ In the bayesian hierarchical model, estimates of the prevalence of psoriasis were informed by study data from the same country, if available, and by study data from other countries. We briefly describe the model below; supplementary material 2 (text 4) provides a full description.

The outcome was the log transformed prevalence of psoriasis, which allowed us to use a linear model and ensure predictions within the 0-100% range when back transformed. We mapped countries according

to the Global Burden of Disease classification: 189 countries were nested in 21 regions, and regions were nested in seven super regions (table 1), the hierarchy of which mainly follows geography and income. High levels of heterogeneity in the global prevalence of psoriasis were expected for several reasons: varying age strata, or whether the prevalence was estimated in children, adults, or the overall population; type of diagnostic method, or whether the diagnosis was made by a physician, a dermatologist, or was self-reported; and type of estimate, or whether the estimate was calculated as point, period, or lifetime prevalence.⁸ Therefore, the hierarchical model had four levels (global, super regions, regions, and countries), four 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).

We used geographical clustering in the model to inform and generate estimates for countries with missing information. In particular, for countries with no data available, the model estimates were based on borrowed evidence from higher levels. For example, the region estimate value was used for the country estimate when no country specific data were available; the super region estimate value was used for countries when no data were available within a region. It is also noteworthy that the region and super region estimates are always obtained from studies identified at the country level; therefore there are no regional or super regional level studies. Supplementary material 2 (eTables 6-11) reports information on countries with observed or missing data.

The statistical model was fitted using bayesian inference, sampling from the posterior distribution over the parameters by using the Hamiltonian Markov chain Monte Carlo method. We used four chains of 2000 iterations each to run the model. After fitting the model, posterior predictions were made for each country and age strata permutation. We provide prevalence estimates in the context of 95% uncertainty intervals. To obtain the number of people affected by psoriasis by country, each country specific prevalence estimate was multiplied by the size of its population; we used the United Nations population structure for the year 2017.¹⁵ We assessed the fit of each model by evaluating the measures relative to the effective sample size and autocorrelation, and the trace plots (supplementary material 2, eFig 2). All analyses were performed in R (version 3.6.1) by using the RStanArm package, which relies on Stan.

Patient and public involvement

The International Federation of Psoriasis Associations (IFPA) are a collaborating organisation on the Global Psoriasis Atlas. Members of IFPA include people with psoriasis and our work plans and findings were presented during Global Psoriasis Atlas Steering Group meetings at which IFPA members asked questions about the study design and findings.

Results

We identified 41 164 records by searching the databases. Of the 308 papers that were critically appraised and assessed for eligibility, 168 reported on the incidence or prevalence of psoriasis in the general population (supplementary material 1, eFig 1). Specifically, nine studies focused on the incidence of psoriasis (eTable 1), 145 reported on the prevalence of psoriasis (eTable 2), and 14 studies reported on both incidence and prevalence (eTable 1).

Incidence of psoriasis

The 23 studies that reported on the incidence of psoriasis in the general population were conducted mainly in western and eastern Europe (16 studies), and North America (six studies). Twelve studies reported on the incidence of psoriasis in all ages, with the incidence of the disease varying from 31.4 per 100 000 person years in eastern Europe (Russia)¹⁶ to 521.1 per 100 000 person years in western Europe (Germany).¹⁷ Springate and colleagues³ reported a slight decline in the incidence of psoriasis in all ages in the United Kingdom (from 159.0 to 129.0 per 100 000 person years between 1999 and 2013). Kubanova and colleagues¹⁸ also reported a slight decline in the incidence in Russia (from 69.8 to 65.0 per 100 000 person years between 2010 and 2016). However, the incidence of psoriasis in Denmark has been inconsistent, with a decrease from 140.1 to 104.0 per 100 000 person years between 2003 and 2005, followed by an increase to 181.0 in 2010, which then decreased to 151.2 in 2012 (table 2).¹⁹

Only two studies, from Italy and the United States, explored the incidence of psoriasis in children over a seven year and 30 year period, respectively (table 2).^{20 21} While Tollefson and colleagues²¹ reported a steady rise in the incidence of psoriasis in the US between 1970 and 2000, Cantarutti and colleagues²⁰ found that the incidence of psoriasis in Italy was stable between 2006 and 2012 (table 2).

The incidence of psoriasis was higher in adults than in children, varying from 30.3 per 100 000 person years (95% confidence interval 26.6 to 34.1)²² in Taiwan to 321.0 per 100 000 person years in Italy.²³ While the data show a steadily increasing trend in incidence of psoriasis in adults in the US between 1970 and 2000 (table 2),²⁴ data from Canada, Italy, and Taiwan show a slightly decreasing trend in incidence over time.^{22 23 25}

Variation in the incidence of psoriasis by age and sex

The incidence of psoriasis in children increased with age from 13.5 per 100 000 person years (0-3 years old) to 53.1 per 100 000 person years (14-18 years old; table 3).²¹ Despite higher estimates of psoriasis incidence from the UK^{26 27} than the US,^{24 28} all of these studies showed a similar trend of increasing psoriasis incidence up to 39 years of age. The incidence then decreased at 40-49 years before increasing again with a second peak at around 50-59 years (UK²⁷) or 60-69 years (UK²⁶ and US^{24 28}). The incidence of psoriasis decreased towards the end of life.

Table 1 | Countries and territories in analysis regions. The table gives the full details of the geographical groups and hierarchy used in the statistical model. The classification is the same as the one used by the Global Burden of Disease and by the United Nations.¹⁵ The hierarchy mainly follows geography and income

Region	Countries
Central Europe, eastern Europe, and central Asia	
Asia, central	Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, Mongolia, Tajikistan, Turkmenistan, Uzbekistan
Europe, central	Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Hungary, Montenegro, Poland, Romania, Serbia, Slovakia, Slovenia, TFYR Macedonia
Europe, eastern	Belarus, Estonia, Latvia, Lithuania, Moldova, Russia, Ukraine
High income	
Asia Pacific, high income	Brunei Darussalam, Japan, Republic of Korea, Singapore
Australasia	Australia, New Zealand
Europe, western	Austria, Belgium, Cyprus, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Israel, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom
Latin America, southern	Argentina, Chile, Uruguay
North America, high income	Canada, United States of America
Latin America and Caribbean	
Caribbean	Antigua and Barbuda, Bahamas, Barbados, Belize, Cuba, Dominican Republic, Grenada, Guyana, Haiti, Jamaica, Puerto Rico, Saint Lucia, Saint Vincent and the Grenadines, Suriname, Trinidad and Tobago, Virgin Island (US)
Latin America, Andean	Bolivia, Ecuador, Peru
Latin America, central	Colombia, Costa Rica, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Venezuela (Bolivarian Republic of)
Latin America, tropical	Brazil, Paraguay
North Africa and Middle East	
North Africa and the Middle East	Afghanistan, Algeria, Bahrain, Egypt, Iran (Islamic Republic of), Iraq, Jordan, Kuwait, Lebanon, Libyan Arab Jamahiriya, Morocco, Occupied Palestinian Territory, Oman, Qatar, Saudi Arabia, Sudan, Syrian Arab Republic, Sudan, Tunisia, Turkey, United Arab Emirates, Yemen
South Asia	
Asia, south	Bangladesh, Bhutan, India, Nepal, Pakistan
South East Asia, east Asia, and Oceania	
Asia, east	China, Dem. People's Republic of Korea, Taiwan
Asia, South East	Cambodia, Indonesia, Lao People's Democratic Republic, Malaysia, Maldives, Mauritius, Myanmar, Philippines, Seychelles, Sri Lanka, Thailand, Timor-Leste, Vietnam
Oceania	Fiji, Guam, Kiribati, Marshall Islands, Micronesia (Fed. States of), Papua New Guinea, Samoa, Solomon Islands, Tonga, Vanuatu
Sub-Saharan Africa	
Sub-Saharan Africa, central	Angola, Central African Republic, Congo, Democratic Republic of the Congo, Equatorial Guinea, Gabon
Sub-Saharan Africa, eastern	Burundi, Comoros, Djibouti, Eritrea, Ethiopia, Kenya, Madagascar, Malawi, Mozambique, Rwanda, Somalia, South Sudan, Uganda, United Republic of Tanzania, Zambia
Sub-Saharan Africa, southern	Botswana, Lesotho, Namibia, South Africa, Swaziland, Zimbabwe
Sub-Saharan Africa, western	Benin, Burkina Faso, Côte d'Ivoire, Cameroon, Cape Verde, Chad, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Mauritania, Niger, Nigeria, São Tomé and Príncipe, Senegal, Sierra Leone, Togo

We found a lack of agreement in the published studies about variations in incidence rates by sex. Although the overall incidence rate was higher in girls than in boys aged less than 18 years (43.9 and 37.9 per 100 000 person years, respectively), this pattern was not consistent across all age bands.²¹

Some studies reported higher incidence in women than in men,^{3 19 26 28} whereas other studies presented contrasting results.^{23 24} When we examined the incidence of psoriasis by sex and age bands, the two peaks for age at onset in women were more frequently around 18-29 and 50-59 years, whereas in men they

Table 2 | List of studies providing incidence rates in children, adults, and all ages

Study, country, study period	Diagnostic method	Age of population	No with psoriasis	Incidence rate per 100 000 person years (95% CI)		
				Entire group	Female population	Male population
Children						
Cantarutti et al (2015), Italy						
2006-12	Family paediatrician	≤14	—	—	—	—
2006				61.0 (50.0 to 80.0)*	—	—
2007				45.0 (30.0 to 60.0)*	—	—
2008				54.0 (40.0 to 70.0)*	—	—
2009				53.0 (40.0 to 70.0)*	—	—
2010				53.0 (40.0 to 70.0)*	—	—
2011				40.0 (30.0 to 50.0)*	—	—
2012				57.0 (40.0 to 80.0)*	—	—
Tollefson et al (2010), US						
1970-99	Dermatologist or physician	<18	357	40.8 (36.6 to 45.1)*†	43.9 (37.6 to 50.2)*†	37.9 (32.2 to 43.6)*†
1970-74				29.6 (20.9 to 38.3)*†	—	—
1975-79				35.7 (25.9 to 45.5)*†	—	—
1980-84				31.4 (22.0 to 40.8)*†	—	—
1985-89				42.7 (31.8 to 53.7)*†	—	—
1990-94				40.0 (29.7 to 50.3)*†	—	—
1995-99				62.7 (50.4 to 65.0)*†	—	—

(Continued)

Table 2 | Continued

Study, country, study period	Diagnostic method	Age of population	No with psoriasis	Incidence rate per 100 000 person years (95% CI)		
				Entire group	Female population	Male population
Adults						
Eder et al (2017), Canada						
2000-15	Physician	≥20	—	—	—	—
2000				114.0 (112.0 to 116.0)*†	—	—
2001				111.0 (109.0 to 113.0)*†	—	—
2002				103.0 (101.0 to 105.0)*†	—	—
2003				101.0 (99.0 to 103.0)*†	—	—
2004				101.0 (99.0 to 103.0)*†	—	—
2005				97.0 (95.0 to 99.0)*†	—	—
2006				97.0 (95.0 to 99.0)*†	—	—
2007				96.0 (94.0 to 98.0)*†	—	—
2008				96.0 (94.0 to 98.0)*†	—	—
2009				95.0 (93.0 to 97.0)*†	—	—
2010				95.0 (93.0 to 97.0)*†	—	—
2011				98.0 (96.0 to 100.0)*†	—	—
2012				100.0 (98.0 to 102.0)*†	—	—
2013				105.0 (103.0 to 107.0)*†	—	—
2014				102.0 (100.0 to 104.0)*†	—	—
2015				105.0 (103.0 to 107.0)*†	—	—
Eder et al (2019), Canada						
2000-15	Physician	≥20	—	—	—	
2000			9873	111.1 (108.9 to 113.4)*†	—	—
2001			9849	108.6 (106.5 to 110.8)*†	—	—
2002			9203	99.7 (97.6 to 101.8)*†	—	—
2003			9111	97.3 (95.3 to 99.3)*†	—	—
2004			9060	95.3 (93.3 to 97.3)*†	—	—
2005			8645	89.8 (87.9 to 91.8)*†	—	—
2006			8979	92.7 (90.7 to 94.7)*†	—	—
2007			8601	87.6 (85.7 to 89.6)*†	—	—
2008			8585	85.9 (84.0 to 87.8)*†	—	—
2009			8610	85.2 (83.4 to 87.1)*†	—	—
2010			8399	81.8 (80.0 to 83.7)*†	—	—
2011			8868	85.0 (83.2 to 86.9)*†	—	—
2012			8883	83.9 (82.1 to 85.7)*†	—	—
2013			8789	82.1 (80.3 to 83.9)*†	—	—
2014			8212	76.1 (74.4 to 77.9)*†	—	—
2015			7541	68.7 (67.1 to 70.3)*†	—	—
Vena et al (2010), Italy						
2001-05	Physician	≥18	5792	—	—	—
2001				321.0*	291.0*	357.0*
2005				230.0*	207.0*	254.0*
Pezzolo et al (2019), Italy						
2003-04	Self-reported diagnosis	≥25	—	302 (232 to 392)*	380 (270 to 535)*	296 (197 to 443)*
Wei et al (2018), Taiwan						
2001	—	≥16	333	42.0 (37.5 to 46.5)*†	—	—
2002			320	40.1 (35.7 to 44.5)*†	—	—
2003			329	41.7 (37.2 to 46.3)*†	—	—
2004			370	46.9 (42.1 to 51.8)*†	—	—
2005			272	33.8 (29.7 to 37.8)*†	—	—
2006			325	39.7 (35.3 to 44.1)*†	—	—
2007			295	35.7 (31.5 to 39.8)*†	—	—
2008			291	34.1 (30.1 to 38.2)*†	—	—
2009			322	37.8 (33.5 to 42.0)*†	—	—
2010			316	36.7 (32.5 to 40.9)*†	—	—
2011			338	40.3 (35.8 to 44.8)*†	—	—
2012			327	37.2 (33.0 to 41.5)*†	—	—
2013			273	30.3 (26.6 to 34.1)*†	—	—
Khalid et al (2013), UK						
2007-09	Physician	≥18	10 832	280.0 (280.0 to 290.0)*†	—	—
Tillett et al (2017), UK						
1998-2014	Physician	≥18	88 858	183.0 (182.0 to 184.0)*	186.0 (184.0 to 188.0)*	179.0 (178.0 to 181.0)*
Shbeeb et al (1995), US						
1982-91	—	—	—	78.0 (70.0 to 86.0)*†	—	—

(Continued)

Table 2 | Continued

Study, country, study period	Diagnostic method	Age of population	No with psoriasis	Incidence rate per 100 000 person years (95% CI)		
				Entire group	Female population	Male population
Icen et al (2009), US						
1970-2000	Dermatologist or physician	≥18	1633	78.9 (75.0 to 82.9)*†‡	73.2 (68.0 to 78.4)*†‡	85.5 (79.5 to 91.6)*†‡
1970-74				50.8 (41.9 to 59.6)*†‡	—	—
1975-79				53.2 (44.8 to 61.6)*†‡	—	—
1980-84				80.9 (70.8 to 91.1)*†‡	—	—
1985-89				78.9 (69.5 to 88.4)*†‡	—	—
1990-94				88.7 (79.1 to 98.3)*†‡	—	—
1995-99				100.5 (90.8 to 110.2)*†‡	—	—
All ages						
Egeberg et al (2017), Denmark						
2003-12	Physician	0-70+	—	—	—	—
2003				140.1 (137.1 to 143.2)*	146.8*	133.4*
2004				122.2 (119.4 to 125.1)*	130.7*	113.6*
2005				104.0 (101.4 to 106.7)*	107.5*	100.5*
2006				105.5 (102.9 to 108.2)*	110.4*	100.4*
2007				111.5 (108.7 to 114.2)*	110.8*	112.2*
2008				128.6 (125.7 to 131.6)*	128.8*	128.4*
2009				174.8 (171.4 to 178.3)*	192.6*	156.8*
2010				181.0 (177.5 to 184.5)*	199.5*	162.3*
2011				171.3 (167.9 to 174.7)*	187.9*	154.5*
2012				151.2 (148.0 to 154.5)*	165.9*	136.4*
Jacob et al (2016), Germany						
2007-10	Physician	—	14 686	521.1*	—	—
Sewerin et al (2019), Germany						
2009	—	—	—	—	46.3 to 58.2*	35.4 to 50.3*
2010	—	—	—	—	35.3 to 45.6*	26.4 to 39.4*
2011	—	—	—	—	21.7 to 30.5*	17.3 to 29.3*
2012	—	—	—	—	19.1 to 26.4*	17.1 to 26.3*
Shalom et al (2018), Israel						
2016	—	—	—	246 (241 to 251)*†	—	—
2017	—	—	—	243 (239 to 248)*†	—	—
Schonmann et al (2019), Israel						
2011	Dermatologist	0-85+	9770	282 (276 to 288)*†	268 (261 to 276)*†	296 (287 to 305)*†
2012			9796	278 (272 to 284)*†	273 (265 to 281)*†	283 (275 to 292)*†
2013			10 430	291 (285 to 297)*†	278 (270 to 286)*†	304 (295 to 312)*†
2014			10 072	276 (271 to 282)*†	263 (256 to 271)*†	290 (281 to 298)*†
2015			10 033	273 (267 to 279)*†	257 (250 to 265)*†	289 (280 to 297)*†
2016			10 505	281 (276 to 287)*†	269 (261 to 276)*†	294 (286 to 302)*†
2017			10 489	276 (270 to 281)*†	263 (256 to 271)*†	288 (280 to 296)*†
Znamenskaya et al (2012), Russia						
2009	Physician	0-18+	99 988	70.5*	—	—
2010			99 348	69.8*	—	—
2011			99 436	69.6*	—	—
Kubanova et al (2017), Russia						
2010	Physician	0-18+	—	69.8*	—	—
2011			—	69.6*	—	—
2012			—	68.4*	—	—
2013			—	65.9*	—	—
2014			—	64.7*	—	—
2015			—	62.8*	—	—
2016			—	65.0*	—	—
Odinets et al (2017), Russia						
2010	Physician	0-18+	1180	42.5*	—	—
2011			1136	40.8*	—	—
2012			1257	45.1*	—	—
2013			875	31.4*	—	—
2014			945	33.8*	—	—
2015			941	33.6*	—	—
2016			1094	39.0*	—	—
Donker et al (1998), Netherlands						
1987-88	Physician	0-65+	106	130.0 (120.0 to 140.0)*†	—	—
Donker et al (1998), Netherlands						
1995	Physician	0-65+	24	120.0 (70.0 to 190.0)*†	—	—
Huerta et al (2007), UK						
1996-97	Physician	0-80+	3994	140.0*	—	—

(Continued)

Table 2 | Continued

Study, country, study period	Diagnostic method	Age of population	No with psoriasis	Incidence rate per 100 000 person years (95% CI)		
				Entire group	Female population	Male population
Springgate et al (2017), UK						
1999-2013	Physician	0-100	—	—	—	—
1999			4279	159.0 (155.0 to 164.0)*†	161.0 (155.0 to 168.0)*†	158.0 (151.0 to 165.0)*†
2000			5398	163.0 (158.0 to 167.0)*†	162.0 (156.0 to 169.0)*†	163.0 (157.0 to 170.0)*†
2001			6286	164.0 (160.0 to 168.0)*†	163.0 (157.0 to 168.0)*†	166.0 (160.0 to 172.0)*†
2002			7259	170.0 (166.0 to 174.0)*†	174.0 (169.0 to 180.0)*†	166.0 (161.0 to 172.0)*†
2003			7977	172.0 (168.0 to 176.0)*†	178.0 (173.0 to 183.0)*†	166.0 (161.0 to 172.0)*†
2004			8209	166.0 (163.0 to 170.0)*†	170.0 (165.0 to 175.0)*†	163.0 (158.0 to 168.0)*†
2005			8522	165.0 (162.0 to 169.0)*†	173.0 (168.0 to 178.0)*†	158.0 (153.0 to 163.0)*†
2006			8499	161.0 (158.0 to 165.0)*†	169.0 (164.0 to 174.0)*†	154.0 (149.0 to 159.0)*†
2007			8807	165.0 (162.0 to 168.0)*†	170.0 (165.0 to 175.0)*†	160.0 (155.0 to 165.0)*†
2008			8964	163.0 (160.0 to 167.0)*†	165.0 (160.0 to 170.0)*†	162.0 (157.0 to 167.0)*†
2009			8518	155.0 (152.0 to 158.0)*†	159.0 (154.0 to 163.0)*†	152.0 (147.0 to 156.0)*†
2010			7715	143.0 (140.0 to 146.0)*†	145.0 (141.0 to 150.0)*†	140.0 (136.0 to 145.0)*†
2011			7499	140.0 (137.0 to 143.0)*†	144.0 (140.0 to 149.0)*†	135.0 (131.0 to 140.0)*†
2012			6992	131.0 (128.0 to 134.0)*†	136.0 (132.0 to 141.0)*†	126.0 (122.0 to 130.0)*†
2013	6350	129.0 (126.0 to 133.0)*†	131.0 (127.0 to 136.0)*†	127.0 (123.0 to 132.0)*†		
Bell et al (1991), US						
1980-83	Dermatologist or physician	0-70+	132	59.9 (49.5 to 70.3)*†	63.6 (48.9 to 78.3)*†	58.4 (42.8 to 74.1)*†
*Values reported from the study. †Age or sex adjusted. ‡Rate adjusted with linear interpolation between census years.						

*Values reported from the study.

†Age or sex adjusted.

‡Rate adjusted with linear interpolation between census years.

occurred more frequently around 30-39 and 60-69 or 70-79 years.^{24 26-28}

Prevalence of psoriasis

The 159 studies that reported on the prevalence of psoriasis in the general population were identified from 12 regions of the world (table 4). Most studies (107; 67%) were conducted in high income countries; these also contributed the highest number of nationally representative studies. Because of overlapping data sources, we included 129 independent data points in the statistical analysis; these came from 35 out of 189 (19%) countries of the world (fig 1). Most studies included in the statistical analyses were graded as low-medium risk of bias (76%; supplementary material 3, eTable 14). Supplementary material 2 (eTables 6-11) reports estimates of lifetime prevalence of psoriasis for the main analyses for each age stratum according to physician or dermatologist diagnosis, and self-reported lifetime prevalence; however, the number of people affected by psoriasis is reported for the adult population only.

Regionally, the occurrence of the disease for the overall population varied from 0.11% (95% uncertainty interval 0.04% to 0.30%) in east Asia to 1.58% (0.50% to 5.73%) in Australasia, and 1.52% (0.87% to 2.74%) in western Europe (fig 2). Country specific prevalence of psoriasis varied substantially. Considering the estimate for the overall population, Australia (1.88%, 0.59% to 6.10%), Norway (1.86%, 0.94% to 3.97%), Israel (1.81%, 0.83% to 4.44%), and Denmark (1.79%, 0.91% to 3.61%) had the highest estimates of the prevalence of psoriasis (supplementary material 2, eTable 8). The estimated prevalence of psoriasis in countries from east Asia was much lower, Taiwan being the country with the lowest prevalence worldwide (0.05%; 0.02% to 0.16%).

Psoriasis occurred more frequently in adults than in children. The prevalence of psoriasis in children

varied from 0.02% (95% uncertainty interval 0.01% to 0.04%) in east Asia to 0.22% (0.06% to 0.81%) in Australasia and 0.21% (0.11% to 0.41%) in western Europe (fig 3). In adults, the disease varied from 0.14% (0.05% to 0.40%) in east Asia to 1.99% (0.64% to 6.60%) in Australasia. Other regions with an occurrence of the disease above 1% were western Europe (1.92%, 1.07% to 3.46%), central Europe (1.83%, 0.62% to 5.32%), high income North America (1.50%, 0.63% to 3.60%), and high income southern Latin America (1.10%, 0.36% to 2.96%; fig 4).

Given the strong association of psoriasis with age, the prevalence of psoriasis also varied across countries because of differences in regional and country specific age structures. Considering country specific estimates, the physician diagnosed lifetime prevalence of psoriasis in adults was highest in Australia (2.38%, 0.78% to 7.01%), Norway (2.36%, 1.10% to 5.04%), Israel (2.28%, 0.98% to 5.65%), Denmark (2.26%, 1.15% to 4.58%), Romania (2.24%, 0.76% to 6.73%), Germany (2.20%, 1.12% to 4.38%), Sweden (2.10%, 0.94% to 4.74%), Poland (2.06%, 0.61% to 6.58%), and Italy (2.00%, 1.00% to 4.14%; fig 5 and eTable 7, supplementary material 2). However, the countries with the highest number of adults affected were the US (3.4 million, 95% uncertainty interval 1.5 to 7.7 million), India (2.9 million, 0.8 to 10.0 million), China (2.3 million, 0.9 to 6.1 million), Germany (1.5 million, 0.8 to 2.9 million), Brazil (1.2 million, 0.3 to 4.8 million), France (1.0 million, 0.5 to 2.1 million), and the UK (1.0 million, 0.5 to 1.9). Globally, in 2017, an estimated 29.5 million adults had psoriasis, corresponding to a physician diagnosed lifetime prevalence of 0.59% (95% uncertainty interval 0.19% to 1.66%) of the adult population worldwide.

Additional sources of heterogeneity in the estimates were factors such as type of diagnostic method

Table 3 | List of studies providing incidence rates -by sex and age groups

Study, country, and study period	Diagnostic method	Age of population	No with psoriasis	Incidence rate per 100 000 person years (95% CI)		
				Entire group	Female population	Male population
Children						
Tollefson et al (2010), US						
1970-99	Dermatologist or physician	<18	357	40.8 (36.6 to 45.1)*†	43.9 (37.6 to 50.2)*†	37.9 (32.2 to 43.6)*†
		0-3	27	13.5*	13.2*	13.7*
		4-7	84	42.2*	40.2*	44.1*
		8-10	69	44.0*	55.7*	33.2*
		11-13	75	52.2*	49.6*	54.6*
		14-17	102	53.1*	61.9*	44.7*
Adults						
Pezzolo et al (2019), Italy						
2003-04	Self-reported diagnosis	≥25	—	302 (232 to 392)*	380 (270 to 535)*	296 (197 to 443)*
		<35	—	186 (95 to 365)*	236 (101 to 554)*	137 (45 to 412)*
		35-44	—	342 (193 to 605)*	251 (98 to 642)*	433 (211 to 889)*
		45-54	—	219 (110 to 435)*	339 (156 to 739)*	96 (22 to 419)*
		55-64	—	385 (223 to 665)*	492 (252 to 961)*	269 (105 to 690)*
		65-74	—	420 (253 to 697)*	395 (199 to 782)*	456 (214 to 969)*
≥74	—	—	—	—	—	
Khalid et al (2013), UK						
2007-09	Physician	≥18	10 832	280.0 (280.0 to 290.0)*†	—	—
		18-29	—	—	350.0 (320.0 to 380.0)*	250.0 (230.0 to 280.0)*
		30-39	—	—	320.0 (280.0 to 350.0)*	290.0 (260.0 to 320.0)*
		40-49	—	—	220.0 (200.0 to 240.0)*	220.0 (200.0 to 250.0)*
		50-59	—	—	310.0 (280.0 to 340.0)*	320.0 (300.0 to 360.0)*
		60-69	—	—	310.0 (280.0 to 350.0)*	370.0 (330.0 to 400.0)*
		70-79	—	—	290.0 (250.0 to 320.0)*	290.0 (250.0 to 330.0)*
		≥80	—	—	160.0 (130.0 to 190.0)*	180.0 (140.0 to 230.0)*
Tillett et al (2017), UK						
1998-2014	Physician	≥18	88 858	183.0 (182.0 to 184.0)*	186.0 (184.0 to 188.0)*	179.0 (178.0 to 181.0)*
		18-29	14 292	174.0 (171.0 to 177.0)*	193.0 (188.0 to 197.0)*	157.0 (154.0 to 161.0)*
		30-39	15 169	176.0 (173.0 to 179.0)*	182.0 (178.0 to 186.0)*	170.0 (166.0 to 173.0)*
		40-49	15 423	164.0 (162.0 to 167.0)*	158.0 (155.0 to 162.0)*	170.0 (166.0 to 174.0)*
		50-59	16 218	195.0 (192.0 to 198.0)*	200.0 (196.0 to 204.0)*	190.0 (186.0 to 194.0)*
		60-69	14 536	216.0 (213.0 to 220.0)*	217.0 (212.0 to 222.0)*	216.0 (211.0 to 221.0)*
		70-79	9364	196.0 (192.0 to 204.0)*	196.0 (191.0 to 201.0)*	197.0 (191.0 to 203.0)*
		80-89	3856	149.0 (145.0 to 154.0)*	145.0 (139.0 to 151.0)*	157.0 (150.0 to 165.0)*
Icen et al (2009), US						
1970-2000	Dermatologist or physician	≥18	1633	78.9 (75.0 to 82.9)*†‡	73.2 (68.0 to 78.4)*†‡	85.5 (79.5 to 91.6)*†‡
		18-29	444	77.4*	75.6*	79.4*
		30-39	391	81.1*	69.2*	93.3*
		40-49	260	71.3*	69.0*	73.6*
		50-59	230	88.0*	90.7*	85.2*
		60-69	174	94.2*	76.2*	115.3*
		70-79	94	73.8*	71.2*	77.9*
		≥80	40	51.4*	39.8*	80.0*
All ages						
Schonmann et al (2019), Israel						
2015	Dermatologist	<1	—	23.0*	—	—
		1-4	—	58.0*	—	—
		5-14	—	117.0*	—	—
		15-24	—	186.0*	—	—
		25-34	—	315.0*	—	—
		35-44	—	299.0*	—	—
		45-54	—	302.0*	—	—
		55-64	—	347.0*	—	—
		65-74	—	350.0*	—	—
		75-84	—	288.0*	—	—
		≥85	—	173.0*	—	—

(Continued)

(self-reported, or diagnosis made by a physician or dermatologist) and type of prevalence estimate (period, point, or lifetime prevalence). Specifically, the self-reported lifetime prevalence of psoriasis for the adult population could be almost twice as high (3.77%, 95% uncertainty interval 1.32% to 12.27% in Australasia, and 3.63%, 2.36% to 5.43% in

western Europe) and up to 1.12% (0.38% to 2.84%) globally, affecting approximately 55.8 million adults worldwide. Supplementary material 2 (eTables 6-11) shows the prevalence estimates for the 21 regions and 189 countries, and according to the type of diagnoses (physician, dermatologist, or self-report) and lifetime prevalence.

Table 3 | Continued

Study, country, and study period	Diagnostic method	Age of population	No with psoriasis	Incidence rate per 100 000 person years (95% CI)		
				Entire group	Female population	Male population
Znamenskaya et al (2012), Russia						
2009	Physician	0-18+	99 988	70.5*	—	—
		0-14	6069	28.8*	—	—
		15-17	5864	118.2*	—	—
		≥18	88 055	76.0*	—	—
2010		0-18+	99 348	69.8*	—	—
		0-14	6045	28.2*	—	—
		15-17	5873	128.2*	—	—
		≥18	87 430	75.4*	—	—
2011		0-18+	99 436	69.6*	—	—
		0-14	6104	28.0*	—	—
		15-17	5681	126.7*	—	—
		≥18	87 651	75.2*	—	—
Kubanova et al (2017), Russia						
2010	Physician	0-18+	—	69.8*	—	—
		0-14	—	27.9*	—	—
		15-17	—	127.2*	—	—
		≥18	—	75.4*	—	—
2011		0-18+	—	69.6*	—	—
		0-14	—	28.0*	—	—
		15-17	—	126.7*	—	—
		≥18	—	75.2*	—	—
2012		0-18+	—	68.4*	—	—
		0-14	—	27.8*	—	—
		15-17	—	118.8*	—	—
		≥18	—	74.2*	—	—
2013		0-18+	—	65.9*	—	—
		0-14	—	27.3*	—	—
		15-17	—	115.6*	—	—
		≥18	—	71.7*	—	—
2014		0-18+	—	64.7*	—	—
		0-14	—	25.1*	—	—
		15-17	—	108.4*	—	—
		≥18	—	72.4*	—	—
2015		0-18+	—	62.8*	—	—
		0-14	—	24.0*	—	—
		15-17	—	99.3*	—	—
		≥18	—	69.6*	—	—
2016		0-18+	—	65.0*	—	—
		0-14	—	24.3*	—	—
		15-17	—	95.6*	—	—
		≥18	—	72.6*	—	—
Huerta et al (2007), UK						
1996-97	Physician	0-80+	3994	140.0*	—	—
		0-19		116.0*	121.0*	110.0*
		20-29		134.0*	155.0*	111.0*
		30-39		155.0*	131.0*	174.0*
		40-49		116.0*	105.0*	128.0*
		50-59		167.0*	172.0*	161.0*
		60-69		164.0*	144.0*	186.0*
		70-79		163.0*	118.0*	224.0*
		≥80		100.0*	82.0*	173.0*
Bell et al (1991), US						
1980-83	Dermatologist or physician	0-70+	132	59.9 (49.5 to 70.3)*†	63.6 (48.9 to 78.3)*†	58.4 (42.8 to 74.1)*†
		<20	21	30.9*	47.1*	14.8*
		20-29	25	49.1*	41.3*	59.5*
		30-39	25	71.7*	61.2*	82.9*
		40-49	12	51.4*	58.6*	43.8*
		50-59	18	94.6*	109.1*	78.3*
		60-69	17	112.6*	126.5*	93.8*
		≥70	14	77.4*	54.9*	130.6*

*Values reported from the study.

†Age or sex adjusted.

Table 4 | Distribution of studies (n=159) reporting on the prevalence of psoriasis according to regions

Region	No of studies*
Western Europe	97
High income North America	20
East Asia	16
North Africa and the Middle East	18
Central Europe	6
Tropical Latin America	5
High income Asia Pacific	4
Australasia	3
Eastern Europe	4
South Asia	3
South East Asia	1
Eastern sub-Saharan Africa	1

*The number of studies is higher than 159 because some studies reported data on many countries belonging to different regions.

Discussion

Main findings

This systematic review highlighted that epidemiological data on the incidence of psoriasis are limited, with studies conducted mainly in Europe and North America. Findings revealed consistency across studies about the bimodal age pattern of the onset of the disease. No agreement was found on specific sex differences or trends over time.

The prevalence of the disease was highest in high income countries such as Australasia, western Europe, central Europe, and North America. However, the largest adult populations affected by psoriasis lived in the US, India, and China, followed by Germany, Brazil, France, and the UK. Both the incidence and the prevalence of psoriasis had a strong association with age; the disease was less common in children and occurred more frequently in adults.

Strengths and limitation of the study

The study has several key strengths. Firstly, we undertook an extensive systematic review to search for all available literature since inception by using 11

electronic and regional databases with no restriction on language. Secondly, we used a bayesian framework approach to analyse the data, which is the optimal technique when data are sparse and heterogeneous.¹⁴ Thirdly, the statistical model was adjusted 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. Firstly, because of limited information on the incidence of psoriasis, it was not possible to include these data in the statistical model. Secondly, in many low income and middle income countries, only small studies with limited information were available, which resulted in greater uncertainty for some estimates. Thirdly, it was not possible to provide estimates by sex and by five year age bands because of the reporting of the data in the included studies; therefore, no age standardised estimates were calculated. However, by using the information on wide age strata we could estimate the prevalence of psoriasis in children, adults, and the overall population. Fourthly, individual studies provided limited information on their sample sizes; therefore, we could not include this information in the statistical model to give more weight to larger studies. Fifthly, the grouping and hierarchy of the countries within region and super region, which aligns with the Global Burden of Disease methods, are mainly based on geography and income. Therefore, these methods might have influenced the income related patterns highlighted in the findings. Finally, because of the complete lack of information for several countries and regions, in some circumstances we could only use estimates of the wider regions or super regions for countries they were nested in. For this reason, estimates for countries with no data might be helpful in guiding policy makers, healthcare practitioners, and patients, but need to be interpreted

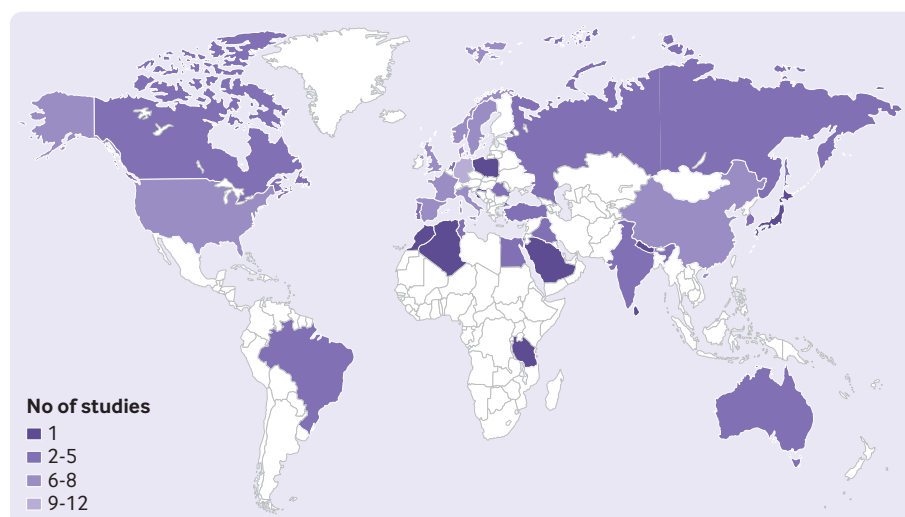


Fig 1 | Distribution of number of studies included in statistical analysis by country. Countries with no observed data are white

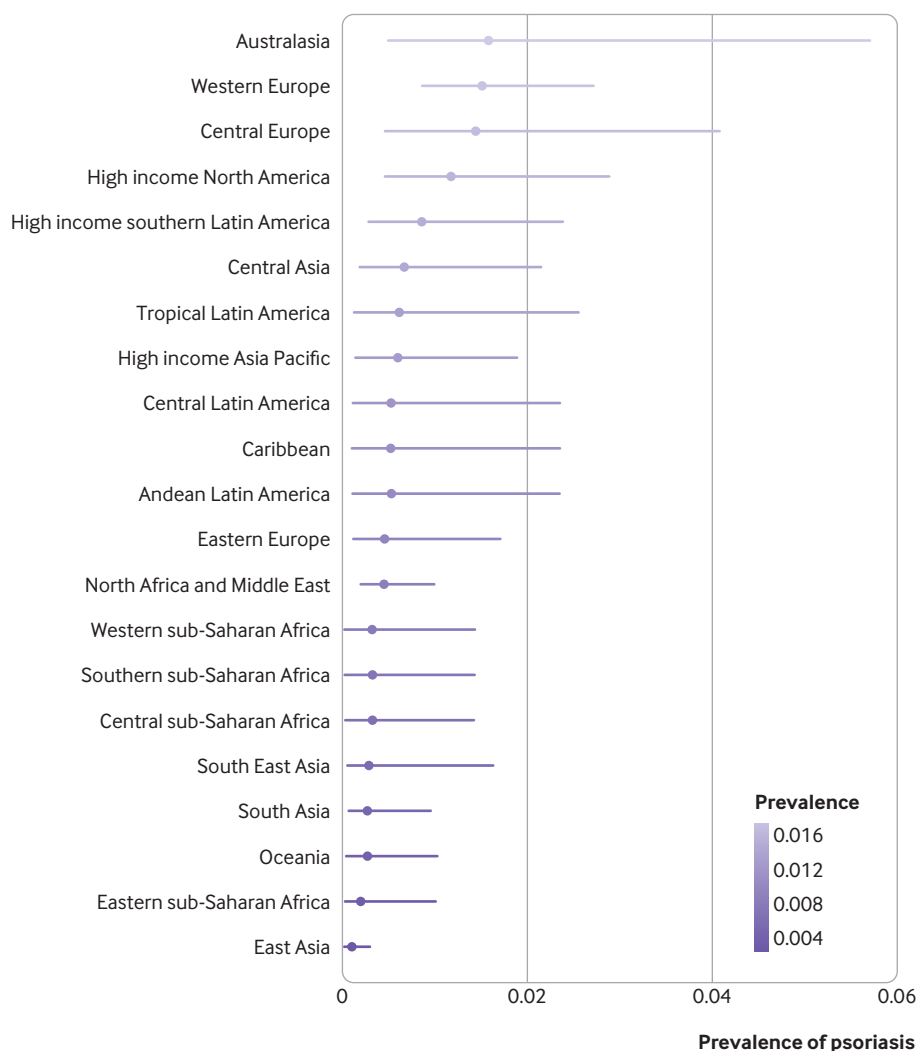


Fig 2 | Crude lifetime (physician or dermatologist diagnosed) prevalence of psoriasis for overall population according to world regions. Regions with observed data: Australasia, central Europe, east Asia, eastern Europe, eastern sub-Saharan Africa, high income Asia Pacific, high income North America, North Africa and the Middle East, south Asia, South East Asia, tropical Latin America, western Europe. Regions with extrapolated data: central Asia, high income southern Latin America, Caribbean, Andean Latin America, central Latin America, Oceania, central sub-Saharan Africa, southern sub-Saharan Africa, western sub-Saharan Africa

with caution. In particular, these estimates might underestimate or overestimate the true values because they have been extrapolated from the regions or super regions the countries are nested in. Nevertheless, given the long term plan of the Global Psoriasis Atlas, future iterations of the model will include new data that will lead to more accurate estimates of the prevalence of psoriasis, particularly in countries with no observed data currently.

Comparison with other studies

Research performing similar analyses is limited.^{11 12} Hay and colleagues¹¹ provided estimates of the prevalence of psoriasis for 21 regions of the world. Our estimates are lower than their findings, with the main differences 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, our estimate of the global prevalence of psoriasis would be similar.¹² A major strength of our research compared with Hay and colleagues¹¹ and James and colleagues¹² is that we were able to provide a measure of the prevalence of psoriasis for 189 countries. Importantly, data included in our study cover the most comprehensive existing scientific literature identified from 11 electronic and regional databases compared with two electronic databases searched in the studies by Hay and colleagues¹¹ and James and colleagues.¹²

In contrast to previous suggestions,³⁸ we did not find any clear north-south gradient. Conversely, it appeared that the prevalence of psoriasis varied with income, which is similar to the distribution of the disease burden measured as disability adjusted life years (DALYs) by Karimkhani and colleagues.²⁹

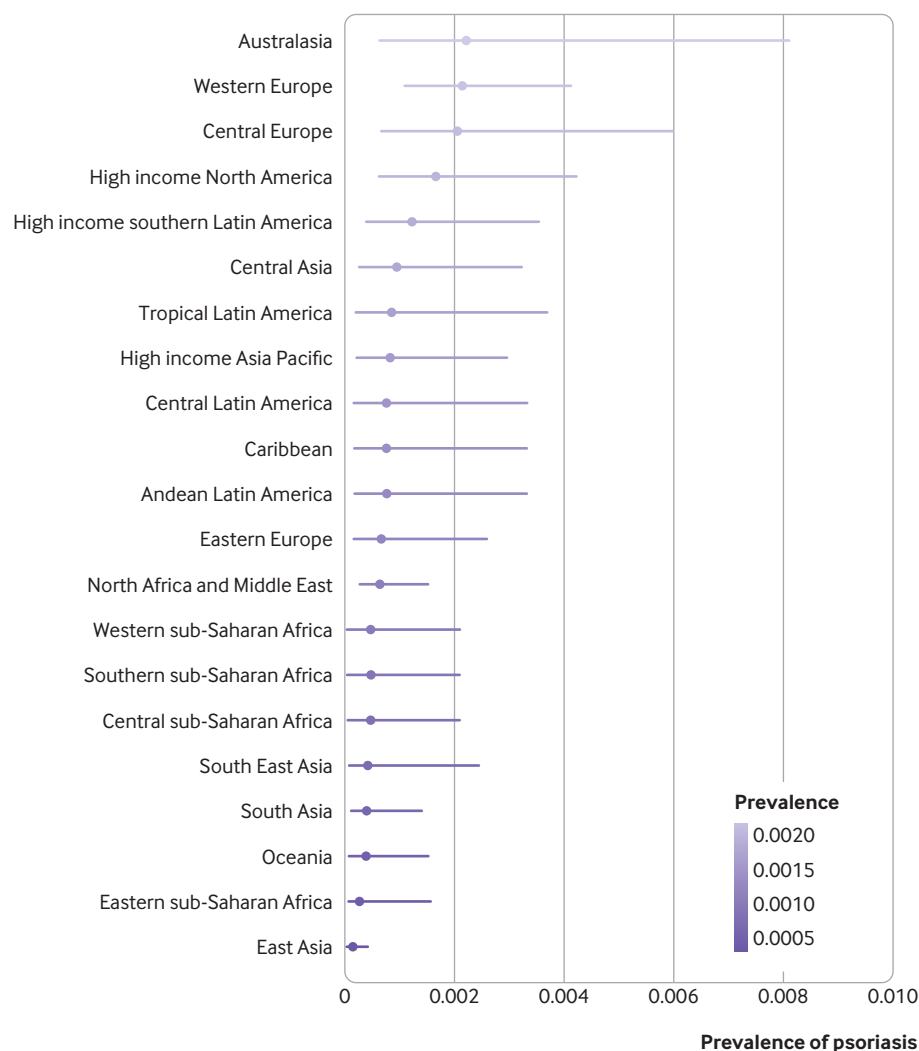


Fig 3 | Crude lifetime (physician or dermatologist diagnosed) prevalence of psoriasis in children according to world regions. Regions with observed data: Australasia, central Europe, east Asia, eastern Europe, eastern sub-Saharan Africa, high income Asia Pacific, high income North America, North Africa and the Middle East, south Asia, South East Asia, tropical Latin America, western Europe. **Regions with extrapolated data:** central Asia, high income southern Latin America, central Latin America, Oceania, central sub-Saharan Africa, southern sub-Saharan Africa, western sub-Saharan Africa

Countries located in high income regions had a higher prevalence of psoriasis compared with low income countries and regions. There are several possible explanations for this observed pattern. Firstly, the results might be because high income countries have better healthcare systems, increased awareness of the disease, better data quality, and studies from these countries report data from large population based and nationally representative databases. Secondly, the structure of the hierarchical model used was mainly based on geography and income, which might have exacerbated the income related patterns of the findings. Thirdly, high income countries have a larger proportion of older people in the population, which means life expectancy is higher and so there is an increased prevalence of psoriasis.³ Finally, 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

Our study revealed a high country specific variation in the prevalence of psoriasis. Figures were relatively low in regions with young populations, such as south Asia and sub-Saharan Africa, and figures were relatively high in regions with older populations, such as the high income regions. This finding was because of the strong association between the prevalence of psoriasis and age.

Our main analysis reported estimates of the lifetime prevalence of psoriasis according to physician or dermatologist diagnosis. However, these figures might be underestimates of the true prevalence of the disease because most of the data came from studies using databases that only reflect people with psoriasis who sought healthcare; they might not reflect the underdiagnosed population. Conversely, when the analyses reported lifetime prevalence estimates of self-reported psoriasis, the figures were higher in

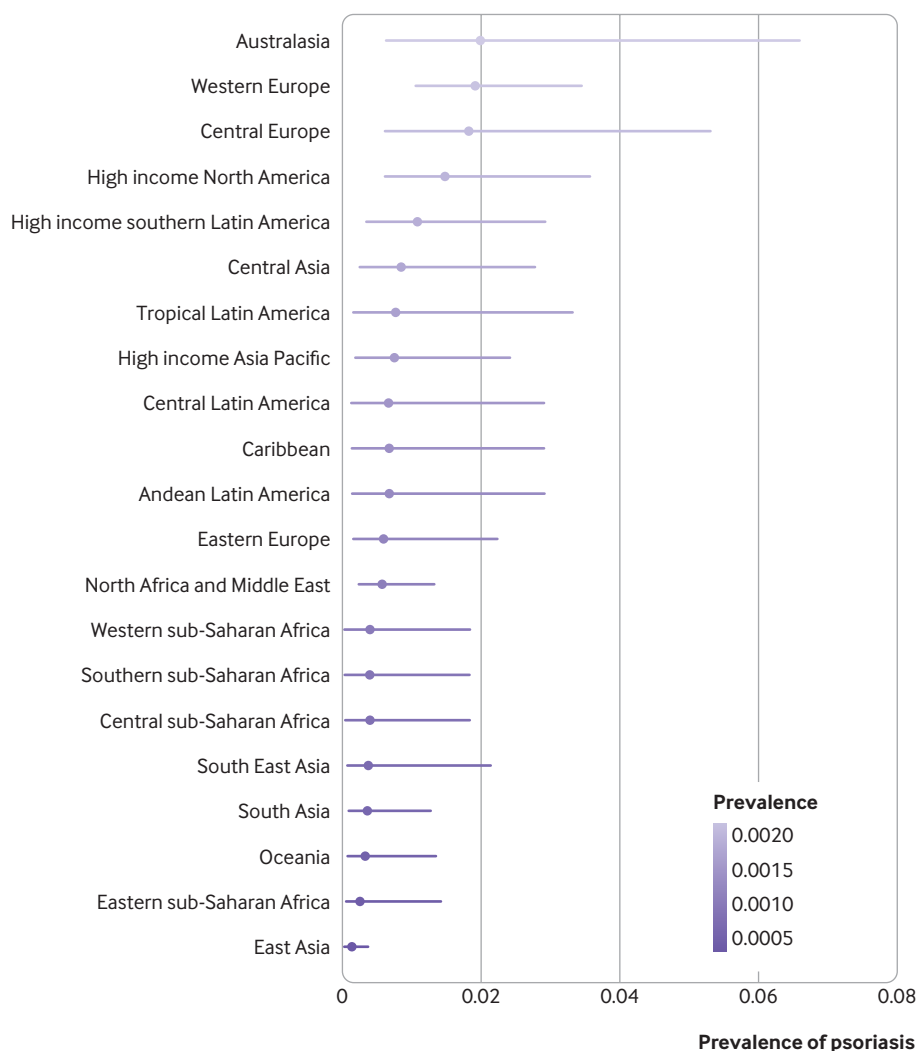


Fig 4 | Crude lifetime (physician or dermatologist diagnosed) prevalence of psoriasis in adults according to world regions. Regions with observed data: Australasia, central Europe, east Asia, eastern Europe, eastern sub-Saharan Africa, high income Asia Pacific, high income North America, North Africa and the Middle East, south Asia, South East Asia, tropical Latin America, western Europe. Regions with extrapolated data: central Asia, high income southern Latin America, Caribbean, Andean Latin America, central Latin America, Oceania, central sub-Saharan Africa, southern sub-Saharan Africa, western sub-Saharan Africa

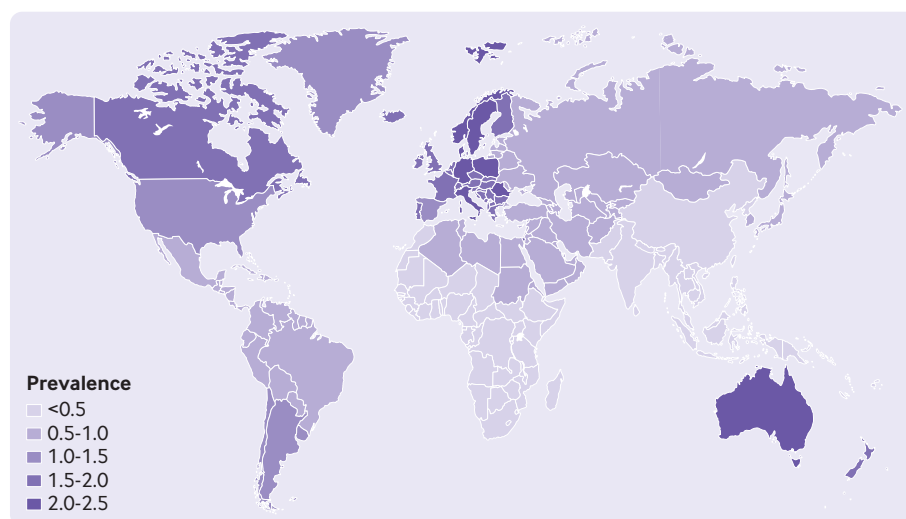


Fig 5 | Lifetime (physician or dermatologist diagnosed) prevalence of psoriasis in adults by country. Details about countries with observed or extrapolated data are given in fig 1 and supplementary material 2 (eTables 6-11)

comparison, but there was a risk of misdiagnosis of the disease. This finding 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

Data on the incidence and prevalence of psoriasis have increased in recent years. However, considerable gaps exist in the geographical areas that report this information, particularly from low and middle income countries.

Psoriasis is recognised as a chronic and disabling non-communicable disease, and people affected have a highly visible condition that can be stigmatising. Accounting for population growth and ageing, and the fact that psoriasis mainly affects the adult population, the burden associated with psoriasis could continue to rise.

A clear need exists to improve the quality and increase the amount of data on the epidemiology of psoriasis. Methods, diagnostic criteria, and reporting of the incidence and prevalence of the disease should be standardised. An improved understanding of the epidemiology of psoriasis is important so that resources can be allocated to reduce morbidity, disability, and mortality associated with the disease.

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Contributors: RP and IYKI are joint first authors. IYKI, RP, DMA, and CEMG 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. RP and IYKI contributed equally to the study. 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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The lead author 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.

Dissemination to participants and related patient and public communities: Findings of the study will be disseminated to patient organisations, specialist and non-specialist audience at international conferences and through the Global Psoriasis Atlas website.

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Web appendix: Supplementary material 1

Web appendix: Supplementary material 2

Web appendix: Supplementary material 3

Web appendix: Supplementary material 4