# Global Epidemiology of Psoriasis: A Systematic Review of Incidence and Prevalence

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The worldwide incidence and prevalence of psoriasis is poorly understood. To better understand this, we performed a systematic review of published population-based studies on the incidence and prevalence of psoriasis. Three electronic databases were searched from their inception dates to July 2011. A total of 385 papers were critically appraised; 53 studies reported on the prevalence and incidence of psoriasis in the general population. The prevalence in children ranged from 0% (Taiwan) to 2.1% (Italy), and in adults it varied from 0.91% (United States) to 8.5% (Norway). In children, the incidence estimate reported (United States) was 40.8/100,000 person-years. In adults, it varied from 78.9/100,000 person-years (United States) to 230/100,000 person-years (Italy). The data indicated that the occurrence of psoriasis varied according to age and geographic region, being more frequent in countries more distant from the equator. Prevalence estimates also varied in relation to demographic characteristics in that studies confined to adults reported higher estimates of psoriasis compared with those involving all age groups. Studies on the prevalence and incidence of psoriasis have contributed to a better understanding of the burden of the disease. However, further research is required to fill existing gaps in understanding the epidemiology of psoriasis and trends in incidence over time.

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## INTRODUCTION

Psoriasis is a chronic, immune-mediated inflammatory skin disease. It ranges in severity from a few scattered red, scaly plaques to involvement of almost the entire body surface. It may progressively worsen with age, or wax and wane in its severity; the degree of severity depends on inheritance and environmental factors (Lebwohl, 2003). Psoriasis causes considerable psychosocial disability and has a major impact on patients' quality of life (Rapp *et al.*, 1999). The cost to both patients and health-care systems is high (Javitz *et al.*, 2002). Psoriasis is associated with cardiovascular disease, depressive illness, and psoriatic arthritis (Griffiths and Barker, 2007). The causes of psoriasis are not fully understood, but a number of risk factors are recognized, including family history and environmental risk factors, such as smoking, stress, obesity, and alcohol consumption (Huerta *et al.*, 2007).

Psoriasis is estimated to affect about 2–4% of the population in western countries (Stern *et al.*, 2004; Gelfand *et al.*, 2005b; Kurd and Gelfand, 2009). Important factors in the variation of the prevalence of psoriasis include age, gender, geography, and ethnicity, probably due to genetic and environmental factors. Higher prevalence rates have been reported at higher latitudes, and in Caucasians compared with other ethnic groups (Farber and Nall, 1998). In addition, the wide variation in prevalence estimates may be influenced by aspects of psoriasis such as its remitting–relapsing course, diversity of clinical presentations (Griffiths *et al.*, 2007), and variation in severity (Griffiths and Barker, 2007). Aspects of study design may also be important. These include different definitions of prevalence, case definitions (Gelfand *et al.*, 2005b), sampling frames and methods, and age groups studied.

Although several studies, dating back to the 1960s–1970s, have reported the prevalence of psoriasis (Lomholt, 1964; Hellgren, 1967; Rea *et al.*, 1976; Johnson and Roberts, 1978), incidence studies are few, probably because of the difficulty in accurately identifying and documenting such cases.

Despite a number of narrative reviews of the epidemiology of psoriasis (Farber and Nall, 1998; Plunkett and Marks, 1998; Christophers, 2001; Naldi, 2004; Neimann *et al.*, 2006; Gudjonsson and Elder, 2007; Chandran and Raychaudhuri, 2010), a systematic review has not been performed. Furthermore, many of the earlier reviews included studies that combined data from general population, hospital, or dermatology clinics with no clear distinction in the results, and no review has looked at the variation of psoriasis according to age and method of case definition. Therefore, the aim of this systematic review was to evaluate the

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*Abbreviation: CI, confidence interval*

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prevalence and incidence of psoriasis from studies in the general population and to explore variations in epidemiology on the basis of geographical location, age, and, where possible, on study design (survey, primary-care data, or other registries), case definition (self-reported, physician's, or dermatologist's diagnosis), and definition of prevalence (lifetime, period, or point prevalence).

## RESULTS

Supplementary Figure S1 online summarizes the results of the search strategy. Papers were mainly excluded from the search because (i) they did not provide any measure of prevalence or incidence of psoriasis, (ii) subjects were identified from dermatology clinics, and (iii) the study focused on specific subgroups of the population. In all, we identified 46 studies that reported on the prevalence of psoriasis (Supplementary Tables S1–S3 online) and 7 studies that focused on the incidence of psoriasis in the general population (Table 1).

### Prevalence of psoriasis

Most studies of the prevalence of psoriasis were conducted in Europe or United States, but there were also studies from Australia, China, Egypt, Latin America, Sri Lanka, Taiwan, and Tanzania. Key differences in prevalence rates depended on whether the study population included only children, only adults, or individuals of all ages, as well as on the underlying age and sex structure of the whole population. Further variation was related to the following: the definition of prevalence, such as point (15 studies), period (9 studies), or lifetime (19 studies); methodology used, such as survey (30 studies), administrative database (11 studies), or insurance database (4 studies); and case definition, such as self-report, physician's, or dermatologist's diagnosis.

### Prevalence of psoriasis in children

Six studies reported the prevalence of psoriasis in children (defined as those aged <18 years) in Europe or Asia (Figure 1). In general, the prevalence of psoriasis in children was up to 0.71% in Europe (Augustin *et al.*, 2010) and almost absent in Asia (Yang *et al.*, 2007; Chen *et al.*, 2008). One exception was a study of 13- to 14-year-old children in Italy that found a lifetime prevalence of dermatologist diagnosed psoriasis of 2.15% (95% confidence interval (CI): 1.59–2.61) (Naldi *et al.*, 2009). A German study, based on an insurance database and confined to those aged under 18 years, reported a low overall prevalence of psoriasis in children (0.71% (95% CI: 0.68–0.74)) and an increasing prevalence with age (0.37% for 0–9 years and 1.01% for 10–18 years) (Augustin *et al.*, 2010) (Supplementary Table S1 online). Not surprisingly, studies based on lifetime prevalence generally yielded higher estimates than those based on point prevalence.

### Prevalence of psoriasis in adults

Studies of the prevalence of psoriasis in adults (Figure 2) yielded higher prevalence estimates than studies in children. However, there appeared to be little consistency within or between countries. In Europe, the United Kingdom had one of the lowest and most consistent estimates, probably due to the same methodology (primary-care database). Here, prevalence of psoriasis in adults was estimated as 1.30% (95% CI:1.21–1.39) (O'Neill and Kelly, 1996), 2.60% (95% CI: 2.47–2.78) (Kay *et al.*, 1999), and 2.20% (95% CI: 2.19–2.21) (Seminara *et al.*, 2011), respectively. A study from Croatia in the late 1980s reported a psoriasis prevalence (1.21% (95% CI: 0.95–1.47)) similar to that of the United Kingdom (Barisic-Drusko *et al.*, 1989). Other countries, in North-East and South Europe, reported higher values than the United Kingdom, specifically of 3.73% (95% CI: 3.13–4.32) in Denmark (Brandrup and Green, 1981), 4.82% (95% CI: 4.47–5.17) (Kavli *et al.*, 1985) and 8.50% (95% CI: 8.03–8.97) in Norway (Bo *et al.*, 2008), 3.10% (95% CI: 2.54–3.66) in Italy (Naldi *et al.*, 2004), and 5.20% (95% CI: 4.68–5.72) in France (Wolkenstein *et al.*, 2009).

Estimates of prevalence of psoriasis in Australia ranged from 2.30% (95% CI: 1.39–3.21) to 6.6% (95% CI: 5.4–7.9) (Quirk, 1979; Kilkenny *et al.*, 1998; Plunkett *et al.*, 1999), whereas rates in United States ranged from 2.2% (95% CI: 2.0–2.4) to 3.15% (95% CI: 2.60–3.70) (Stern *et al.*, 2004; Kurd and Gelfand, 2009) and were similar to those from United Kingdom. Exceptions were two studies in the United States, one collecting data on African Americans and the other study from two medical insurance databases, which reported a prevalence of 1.3% (95% CI: 0.7–1.8) (Gelfand *et al.*, 2005a) and 0.91% (95% CI: 0.90–0.92) and 1.06% (95% CI: 1.05–1.07), respectively (Robinson *et al.*, 2006). Qureshi *et al.* (2009) reported a prevalence of psoriasis (2.58% (95% CI: 2.47–2.69)) only in women, which was consistent with other studies conducted in the United States (Stern *et al.*, 2004; Kurd and Gelfand, 2009).

Only in the reports from Europe it appeared that studies based on self-reported diagnoses had higher prevalence rates than physicians' diagnoses ((Brandrup and Green, 1981; Kavli *et al.*, 1985; O'Neill and Kelly, 1996; Kay *et al.*, 1999; Naldi *et al.*, 2004; Bo *et al.*, 2008; Wolkenstein *et al.*, 2009; Seminara *et al.*, 2011); Supplementary Table S2 online).

### Prevalence of psoriasis for individuals of all ages

On examining individuals of all ages, in Europe, prevalence rates varied between 0.73% (in Scotland) and 2.9% (in Italy). However, although most of the studies reported a prevalence above 1%; specifically 2.00% (95% CI: 1.86–2.14) in Sweden (Hellgren, 1967), 1.10% (95% CI: 0.11–2.09), 1.40% (95% CI: 0.94–1.86), and 1.40% (95% CI: 1.18–1.62) in Norway (Braathen *et al.*, 1989; Falk and Vandbakk, 1993), 2.84% (95% CI: 2.53–3.15) in Denmark (Lomholt, 1964), 1.58% (95% CI: 0.00–3.35) in Yugoslavia (Arzensek *et al.*, 1984), 1.48% (95% CI: 1.20–1.80), 1.52% (95% CI: 1.51–1.53), and 1.87% (95% CI: 1.89–1.91) in United Kingdom (Nevitt and Hutchinson, 1996; Gelfand *et al.*, 2005b; Seminara *et al.*, 2011), 1.43% (95% CI: 1.23–1.63) in Spain (Ferrandiz *et al.*, 2001), 2.90% (95% CI: 2.39–3.41) in Italy (Saraceno *et al.*, 2008), and 2.00% (95% CI: 1.98–2.20) and 2.53% (95% CI: 2.50–2.56) in Germany (Schlander *et al.*, 2008; Augustin *et al.*, 2010), two studies from Scotland and United Kingdom showed lower estimates of psoriasis equal to 0.73% (95% CI: 0.69–0.76) (Simpson *et al.*, 2002) and

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

| Study | Country | Time | 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 | N/D | <18 | 357 | 40.8 (36.6–45.1)[1,2] | 43.9 (37.6–50.2)[1,2] | 37.9 (32.2–43.6)[1,2] |
| | | 1970–1974 | | | | 29.6 (20.9–38.3) | | |
| | | 1975–1979 | | | | 35.7 (25.9–45.5) | | |
| | | 1980–1984 | | | | 31.4 (22.0–40.8) | | |
| | | 1985–1989 | | | | 42.7 (31.8–53.7) | | |
| | | 1990–1994 | | | | 40.0 (29.7–50.3) | | |
| | | 1995–1999 | | | | 62.7 (50.4–65.0) | | |
| *Adult* | | | | | | | | |
| Icen *et al.* (2009); Shbeeb *et al.* (1995) | USA | 1970–2000 | D/Ph | ⩾18 | 1,633 | 78.9 (75.0–82.9)[1,3] | 73.2 (68.0–78.4)[1,3] | 85.5 (79.5–91.6)[1,3] |
| | | 1970–1974 | | | | 50.8 (41.9–59.6) | | |
| | | 1975–1979 | | | | 53.2 (44.8–61.6) | | |
| | | 1980–1984 | | | | 80.9 (70.8–91.1) | | |
| | | 1985–1989 | | | | 78.9 (69.5–88.4) | | |
| | | 1990–1994 | | | | 88.7 (79.1–98.3) | | |
| | | 1995–1999 | | | | 100.5 (90.8–110.2) | | |
| Setty *et al.* (2007) | USA | 1991–2005 | SR | 25–42 | 892 | | 82 (77–89)[1] | |
| Vena *et al.* (2010) | Italy | 2001–2005 | Ph | ⩾18 | 5,792 | | | |
| | | 2001 | | | | 321[1] | 291[1] | 357[1] |
| | | 2005 | | | | 230[1] | 207[1] | 254[1] |
| *All ages* | | | | | | | | |
| Bell *et al.* (1991) | USA | 1980–1983 | D/Ph | <20–70+ | 132 | 59.9 (49.5–70.3)[1,2] | 63.6 (48.9–78.3)[1,2] | 58.4 (42.8–74.1)[1,2] |
| Donker *et al.* (1998) | The Netherlands | 1987–1988 | Ph | 0–65+ | 106 | 130 (120–140)[1,2] | | |
| Donker *et al.* (1998) | The Netherlands | 1995 | Ph | 0–65+ | 24 | 120 (70–190)[1,2] | | |
| Huerta *et al.* (2007) | UK | 1996–1997 | Ph | 0–80+ | 3,994 | 140[1] | | |

Abbreviations: CI, confidence interval; Ps, psoriasis; diagnostic methods: D, dermatologist; N, nurse; Ph, physician; SR, self-reported diagnosis.
[1]Value reported from the study.
[2]Age and/or sex adjusted.
[3]Rate adjusted with linear interpolation between census years.

0.80% (95% CI: 0.78–0.82) (Gillard and Finlay, 2005), respectively. The only study from European Russia reported a prevalence of 0.72% (95% CI: 0.70–0.74) (Osmanova, 1985). Rates in United States varied from 0.7% to 2.6%. However, whereas Johnson and Roberts (1978) and Koo (1996) reported rates similar to those of Europe (1.43% (95% CI: 1.27–1.59) and 2.60% (95% CI: 2.43–2.77) respectively), Javitz *et al.* (2002) showed a prevalence of 0.70% (95% CI: 0.67–0.73). The prevalence rates reported in Latin Americans-Indians, from Africa (Egypt and Tanzania) and Asia (China, Sri Lanka and Taiwan) varied from no cases detected to estimates below 0.5% (Convit, 1963; Yip, 1984; Cooperative Psoriasis Study Group, 1986; Gibbs, 1996; Perera *et al.*, 2000; Abdel-Hafez *et al.*, 2003; Tsai *et al.*, 2011).

### Prevalence of psoriasis by gender

There was no agreement about whether the prevalence of psoriasis differed between men and women (Supplementary Tables S1–S4 online). No differences in the frequency of psoriasis between genders were found in Taiwanese children (Yang *et al.*, 2007; Tsai *et al.*, 2011), in the United States and Norway in adults (Kavli *et al.*, 1985; Bo *et al.*, 2008; Kurd and Gelfand, 2009), and in the United States, United Kingdom, Norway, Spain, Scotland, and Taiwan in individuals of all ages

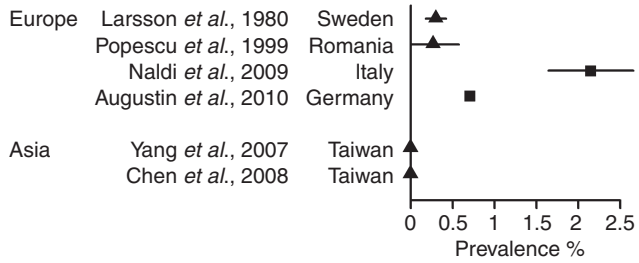


**Figure 1. Studies providing information on the prevalence of psoriasis in children.** Square, lifetime prevalence; triangle, point prevalence.

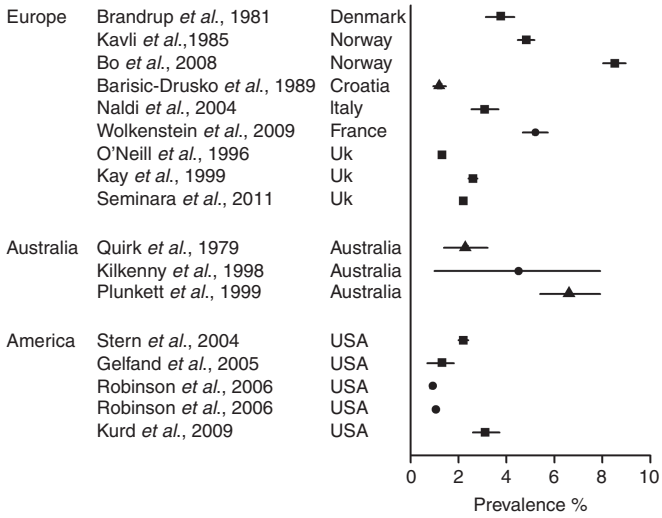


**Figure 2. Studies providing information on prevalence of psoriasis in adults.** The study by Qureshi *et al.* (2009) has been removed because data were collected on women only, whereas Gelfand *et al.* (2005a) examined African Americans in the United States. Circle, period prevalence; square, lifetime prevalence; triangle, point prevalence.

combined (Braathen *et al.*, 1989; Ferrandiz *et al.*, 2001; Javitz *et al.*, 2002; Simpson *et al.*, 2002; Gelfand *et al.*, 2005b; Chang *et al.*, 2009; Seminara *et al.*, 2011; Tsai *et al.*, 2011). Other studies reported a slightly higher prevalence of psoriasis in female subjects than male subjects in Swedish children (0.5% vs 0.1%) (Larsson and Liden, 1980) and in Germany (0.76% vs 0.66%) (Augustin *et al.*, 2010); in the United States (2.5% vs 1.9% with an odds ratio = 1.37 (95% CI: 1.14–1.64)) (Stern *et al.*, 2004) and in Norway (1.6% vs 1.2% (Lapps) and 1.4% vs 0.9% (non-Lapps)) (Falk and Vandbakk, 1993) in adults and in all ages, respectively. In contrast, psoriasis was more frequent in men than in women in Denmark (4.2% vs 3.3%, not significant) (Brandrup and Green, 1981) and in Australia, where it was reported to be almost twice as high in men as in women (8.9% vs 4.5% (Plunkett *et al.*, 1999), and in individuals of all ages in Sweden (2.3% vs 1.5%) (Hellgren, 1967) and China (0.17% vs 0.12%) (Cooperative Psoriasis Study Group, 1986).

### Prevalence of psoriasis by age group

Fourteen studies examined the prevalence (mostly lifetime prevalence) of psoriasis by age. As one would expect, there was an increasing trend with age (Figure 3, Supplementary Table S4 online).

Psoriasis was uncommon before the age of 9 years, varying from 0% (Norway) to 0.55% (United Kingdom).

In adults (Supplementary Table S4 online), studies from Norway, Scotland, Spain, and Taiwan showed a first peak of psoriasis at either 20–29 or 30–39 years of age (Brandrup and Green, 1981; Kavli *et al.*, 1985; Braathen *et al.*, 1989; Falk and Vandbakk, 1993; Ferrandiz *et al.*, 2001; Simpson *et al.*, 2002; Tsai *et al.*, 2011), whereas in the remaining studies from the United Kingdom, Germany, Russia, and United States there was an increasing trend with age until around 60 years, after which the prevalence reduced (Osmanova, 1985; Javitz *et al.*, 2002; Stern *et al.*, 2004; Gelfand *et al.*, 2005b; Schlander *et al.*, 2008; Seminara *et al.*, 2011; Tsai *et al.*, 2011).

### Incidence of psoriasis

Seven studies examined the incidence of psoriasis in the general population. These studies were conducted in the United States, the Netherlands, United Kingdom, and Italy. All the studies in the United States, except Setty *et al.* (2007), used the Rochester Epidemiology Project database, often looking at different groups of the population (children or adults or all ages) and different time periods.

### Incidence of psoriasis in children

There was only one study of the incidence of psoriasis in children; this was conducted in the United States over a 30-year period (Tollefson *et al.*, 2010) (Table 1). It found that the incidence of psoriasis was slightly higher in girls than in boys (43.9/100,000 person-years (95% CI: 37.6–50.2) vs 37.9/100,000 person-years (95% CI: 32.2–43.6)), although it was not statistically significant. The data showed a rise in the incidence of psoriasis between 1970 and 2000.

### Incidence of psoriasis in adults

Three studies reported the incidence of psoriasis in adults (Table 1)—two from the United States and one from Italy. The two estimates in the United States were similar (78.9/100,000 person-years (95% CI: 75.0–82.9; Icen *et al.*, 2009) and 82/100,000 person-years (95% CI: 77–89; Setty *et al.*, 2007), the last one being confined to women). Icen *et al.* (2009) found a higher incidence of psoriasis in men than in women (85.5/100,000 person-years vs 73.2/100,000 person-years). Combining the two studies from the United States, which both used the Rochester Epidemiology Project database, it appeared that whereas the incidence was higher in girls than in boys until 18 years of age, thereafter psoriasis affected men more frequently than women. In the same study, data showed an increasing trend in the incidence of psoriasis in adults over a 30-year period (Table 1) (Icen *et al.*, 2009). The Italian study reported a much higher incidence rate of 230/100,000 person-years in 2005 (Vena *et al.*, 2010).

### Incidence of psoriasis in all ages combined

Finally, three studies examined the incidence of psoriasis in all ages. Bell *et al.* (1991), using the Rochester Epidemiology Project database, reported an overall incidence of 59.9/100,000 person-years (95% CI: 49.5–70.3). The two

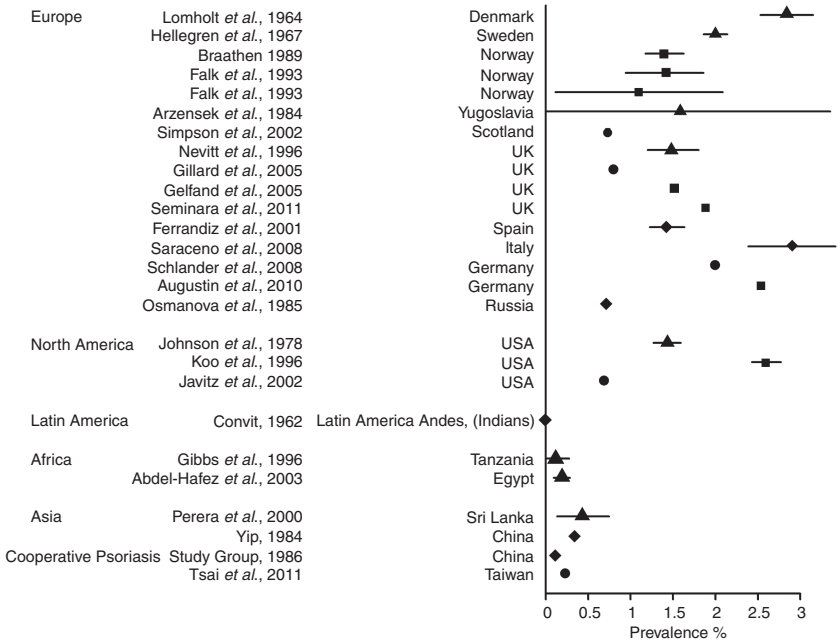


**Figure 3. Studies providing information on the prevalence of psoriasis in all ages.** Circle, period prevalence; diamond, not specified; square, lifetime prevalence; triangle, point prevalence.

European studies used data from primary-care databases. They reported incidences of 120–130/100,000 person-years (the Netherlands) (Donker *et al.*, 1998) and 140/100,000 person-years (United Kingdom) (Huerta *et al.*, 2007) (Table 1).

### Variation by age and gender

The incidence of psoriasis in children increased with age (from 13.5/100,000 person-years (0–3 years old) to 53.1/100,000 person-years (14–18 years old) (Tollefson *et al.*, 2010); Table 2).

Table 2 summarizes the remaining studies of the incidence of psoriasis by age. Despite higher estimates of psoriasis incidence from the United Kingdom (Huerta *et al.*, 2007) than the United States (Bell *et al.*, 1991; Icen *et al.*, 2009), all these studies showed a similar trend of increasing psoriasis incidence with age up to 39 years. The incidence of psoriasis then reduced at 40–49 years of age before increasing again with a second peak at around 50–59 years of age in the United Kingdom (Huerta *et al.*, 2007) and around 60–69 years of age in the two studies in United States (Bell *et al.*, 1991; Icen *et al.*, 2009). Age-specific estimates of incidence decreased toward the end of life.

There was a lack of agreement in the published studies about variation by gender for incidence rates. Although the reported overall incidence was slightly higher in girls compared with boys aged under 18 years (43.9/100,000 person-years vs 37.9/100,000 person-years), this pattern was not constant across all age bands (Tollefson *et al.*, 2010). Some studies showed a higher incidence in women than in men (Bell *et al.*, 1991; Vena *et al.*, 2010), whereas others presented the opposite results (Icen *et al.*, 2009; Vena *et al.*, 2010). When looking at gender by age bands, the two peaks for age at onset in women were more frequently around 20–29 and 50–59 years of age, whereas in men they occurred around 30–39 and 60–69/70–79 years of age (Huerta *et al.*, 2007; Icen *et al.*, 2009).

## DISCUSSION

This systematic review provides a detailed critique of the existing data on the worldwide incidence and prevalence of psoriasis. Comparison between studies was attempted in relation to geography, age, and gender. In addition, we investigated whether observed differences in disease occurrence might have been due to varying study methodologies used, such as types of measure, case definition, and study design.

The results from the systematic review confirmed that psoriasis is a common disease, less common in children and more common in adults; prevalence rates showed a worldwide geographic variation that probably reflects the fact that psoriasis is a complex disease influenced by both genetic and environmental factors. Worldwide, on examining the North and South hemispheres, variation in prevalence of psoriasis appeared to depend on the distance from the equator, with populations located closer to the equator (Egypt, Tanzania, Sri Lanka, Taiwan) being less affected by psoriasis compared with countries more distant from it (Europe and Australia). The higher reported prevalence of psoriasis in Australia was also likely to be influenced by other factors such as European migration and the resulting population genetic case-mix. Within Europe, North-East (Norway, Denmark) and Southern (Italy and France) countries showed higher prevalence estimates compared with the United Kingdom; however, the differences between these studies may relate to different case definition (self-reported vs physician's diagnosis) rather than solely geographic variation. There were no clear conclusions about whether the disease varied according to gender.

**Table 2. Incidence rates by gender and age group**

| Study | *N* people with incident Ps | Gender | Incidence of Ps (per 100,000 person-years) by age bands | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Children* | | | | | | | | | | | | | |
| Tollefson *et al.* (2010) | 357 | | 0–3 | 4–7 | 8–10 | 11–13 | 14–18 | | | | | | |
| | | T | 13.5 | 42.2 | 44 | 52.2 | 53.1 | | | | | | |
| USA | | F | 13.2 | 40.2 | 55.7 | 49.6 | 61.9 | | | | | | |
| | | M | 13.7 | 44.1 | 33.2 | 54.6 | 44.7 | | | | | | |
| *Adults* | | | | | | | | | | | | | |
| Icen *et al.* (2009) | 1,633 | | | | | | | 18–29 | 30–39 | 40–49 | 50–59 | 60–69 | 70–79 | 80+ |
| | | T | | | | | | 77.4 | 81.1 | 71.3 | 88.0 | 94.2 | 73.8 | 51.4 |
| USA | | F | | | | | | 75.6 | 69.2 | 69 | 90.7 | 76.2 | 71.2 | 39.8 |
| | | M | | | | | | 79.4 | 93.3 | 73.6 | 85.2 | 115.3 | 77.9 | 80 |
| *All ages* | | | | | | | | | | | | | | |
| Bell *et al.* (1991) | 132 | | | | | | <20 | 20–29 | 30–39 | 40–49 | 50–59 | 60–69 | 70+ | |
| | | T | | | | | 30.9 | 49.1 | 71.7 | 51.4 | 94.6 | 112.6 | 77.4 | |
| USA | | F | | | | | 47.1 | 41.3 | 61.2 | 58.6 | 109.1 | 126.5 | 54.9 | |
| | | M | | | | | 14.8 | 59.5 | 82.9 | 43.8 | 78.3 | 93.8 | 130.6 | |
| Huerta *et al.* (2007) | 3,994 | | | | | | 0–19 | 20–29 | 30–39 | 40–49 | 50–59 | 60–69 | 70–79 | 80+ |
| | | T | | | | | 116 | 134 | 155 | 116 | 167 | 164 | 163 | 100 |
| UK | | F | | | | | 121 | 155 | 131 | 105 | 172 | 144 | 118 | 82 |
| | | M | | | | | 110 | 111 | 174 | 128 | 161 | 186 | 224 | 173 |

Abbreviations: F, female; M, male; Ps, psoriasis; T, total.

The main purpose of this investigation, and also the main difference from other reviews, was to analyze only data from the general population and to cluster studies on whether their focus was children, adults, or individuals of all ages. We found that psoriasis was less common in children than in adults; therefore, studies estimating prevalence for all ages showed a much lower rate compared with those calculating the prevalence in adults especially in countries with a high proportion of children and young people.

Other sources of heterogeneity in the results were likely to be due to different methodologies, namely types of measure (point, period, or lifetime prevalence) and case definition (self-reported, physician's, or dermatologist's diagnosis). Point, period, or lifetime prevalence may give different rates, as psoriasis is subject to periods of remission and relapse; however, the variation among studies according to this criterion was present only in the United Kingdom, Germany, and the United States. In contrast, the findings consistently showed differences according to case definition. Specifically, self-reported diagnosis gave higher rates compared with physician's and dermatologist's diagnoses.

Prevalence estimates using data from insurance databases were generally lower than studies based on registries or primary-care databases. This may be because insurance databases likely represented only a proportion of the general population (e.g., employed), but underrepresented other subgroups (e.g., unemployed, retired, and disabled people).

Although there were a number of studies on the prevalence of psoriasis, research on incidence was limited. Incidence appeared to be higher in Europe than in the United States and increased with age. Studies reporting age-specific incidence rates showed a dual peak of psoriasis around 30–39 years of age and a second peak around 50–59 or 60–69 years of age (Bell *et al.*, 1991; Huerta *et al.*, 2007; Icen *et al.*, 2009). It is believed that the bimodal distribution of psoriasis incidence represents two clinical presentations of the disease, type I (early-onset) and type II (late-onset), which are defined as presenting at $\leqslant 40$ and $>40$ years of age, respectively (Henseler and Christophers, 1985). Furthermore, on combining the results of the two studies using the Rochester Epidemiology Project database, it appeared that the incidence of psoriasis was higher in females $<18$ years old, but was higher in males $\geqslant 18$ years old (Icen *et al.*, 2009; Tollefson *et al.*, 2010). The same studies reported an increasing incidence in children and adults over a 30-year period (Icen *et al.*, 2009; Tollefson *et al.*, 2010). However, it was unclear whether this represented a real increase, probably because of a concomitant increase in risk factors (obesity, stress, psychological conditions) for psoriasis, or improved diagnostic methods, better collection of data, and more

awareness of the disease (Tollefson *et al.*, 2010). Nevertheless, the findings from these two studies cannot be confirmed because of the lack of similar research. It is recommended that future studies focus on the incidence of psoriasis over a long period of time.

Unfortunately, we were unable to compare age-standardized prevalence and incidence rates from the studies included in this systematic review, as this level of data was not included in many of the original studies. Comparison of unadjusted rates within countries over time and between countries should be interpreted cautiously if the underlying age composition is likely to differ. Future studies examining the epidemiology of psoriasis should routinely provide information on the prevalence and incidence of psoriasis by age bands and gender in a standardized way to facilitate the comparison of results between different studies.

Studies on the occurrence of psoriasis have contributed to a greater appreciation of its burden and recognition of the role of geography and ethnicity on the likelihood of developing the disease. Epidemiological studies are an important contributor to our understanding of psoriasis, and there is a need for future international research collaborations using standardized methodology to address knowledge gaps that still exist on the disease and potential trends in prevalence and incidence over time.

## MATERIALS AND METHODS

### Search strategy

Three electronic databases (MEDLINE, EMBASE, and Web of Science) were systematically searched from their respective inception dates to July 2011. The main keywords used were ''psoriasis'' (''psoriases'', ''psorias?s'', ''psoriatic skin'', ''pustulosis''), ''psoriatic arthritis'' (''arthritis, psoriatic'', ''psoriatic arthritis'', ''arthritis psoriatica'', ''psoriatic arthropathy'', ''psoriatic rheumatism'', ''psoriatic polyarthritis''), ''incidence'' (''incident studies'' or ''cohort studies''), and ''prevalence'' (''prevalent studies'' or ''cross-sectional studies''). In the final selection, studies only focusing on psoriatic arthritis were excluded. There were no language restrictions and studies were limited to humans.

### Inclusion and exclusion criteria

Inclusion criteria were that all studies collected empirical data on cases of psoriasis from a sample of the general population. Studies estimating prevalence or/and incidence of other skin or autoimmune diseases, but also providing data on psoriasis epidemiology, were included. Conversely, exclusion criteria included studies not carried out on the general population (such as dermatology clinics, data collected from hospital admissions/visits or specific subgroups of the population) and studies not providing sufficient information to calculate prevalence or/and incidence rates for psoriasis.

### Data extraction

In the first stage, all study titles and abstracts obtained from the database searches were reviewed for eligibility by one of the authors (RP); papers successfully passing through into the second stage were appraised and those meeting the inclusion criteria were selected for data extraction. The references of all included studies and review articles identified were also screened to identify any additional eligible studies.

Information extracted from each study included citation data (authors, publication year), study design (study-period and setting), population (country, age group), study methods (case definition, case validation), type of prevalence (point, period, or lifetime), and findings (number of patients with psoriasis, number of people at risk, values of the prevalence and/or incidence reported and their 95% CIs). All extracted data were double-checked by a coauthor (DMA) to ensure its accuracy.

### Data analysis

Measures of prevalence and/or incidence presented are those reported in the individual studies; however, rates are presented as percentage values for prevalence and rate/100,000 person-years for incidence. Values were checked for potential errors (when possible) on the basis of the number of cases of psoriasis and population sample size. Missing information, such as prevalence and/or incidence rate and CIs were calculated when not reported in the study. However, it was not possible to estimate CIs for some studies because of lack of sufficient information. In addition, negative lower bounds of CIs were replaced by zero.

Results were analyzed by country and age category (children, adult, or all ages). Children were defined as being in the age group $<18$ years old. Within each country and category, study design (case definition (self-reported vs dermatologist vs general practitioner diagnosis) and type of prevalence (point vs period vs lifetime prevalence)) were explored for possible differences. When multiple studies collected data from the same data set and time period, only the most recent or the most complete articles were reported. When the same study presented measures of prevalence and/or incidence of psoriasis from different databases or populations, all results were reported.

## CONFLICT OF INTEREST

The authors state no conflict of interest.

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## SUPPLEMENTARY MATERIAL

Supplementary material is linked to the online version of the paper at http://www.nature.com/jid

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