# Prevalence of psoriatic arthritis in patients with psoriasis: A systematic review and meta-analysis of observational and clinical studies

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***Background:*** Wide-ranging prevalence estimates of psoriatic arthritis (PsA) in patients with psoriasis have been reported.

***Objectives:*** To assess the prevalence and incidence of PsA in patients with psoriasis.

***Methods:*** Two authors independently searched 3 databases for studies reporting on the prevalence or incidence of PsA in patients with psoriasis. A proportion meta-analysis was performed to calculate the pooled proportion estimates of PsA in patients with psoriasis.

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***Results:*** A total of 266 studies examining 976,408 patients with psoriasis were included. Overall, the pooled proportion (95% confidence interval [CI]) of PsA among patients with psoriasis was 19.7% (95% CI, 18.5%-20.9%). In children and adolescents (<18 years of age), the pooled prevalence was 3.3% (95% CI, 2.1%-4.9%). The PsA prevalence was 22.7% (95% CI, 20.6%-25.0%) in European patients with psoriasis, 21.5% (95% CI, 15.4%-28.2%) in South American patients with psoriasis, 19.5% (95% CI, 17.1%-22.1%) in North American patients with psoriasis, 15.5% (95% CI, 0.009%-51.5%) in African patients with psoriasis, and 14.0% (95% CI, 95% CI, 11.7%-16.3%) in Asian patients with psoriasis. The prevalence of PsA was 23.8% (95% CI, 20.1%-27.6%) in studies in which the Classification Criteria for Psoriatic Arthritis were applied. The incidence of PsA among patients with psoriasis ranged from 0.27 to 2.7 per 100 person-years.

***Limitations:*** Between-study heterogeneity may have affected the estimates.

***Conclusions:*** We found that 1 in 4 patients with psoriasis have PsA. With the growing recognition of the Classification Criteria for Psoriatic Arthritis, more homogenous and comparable prevalence estimates are expected to be reported. (J Am Acad Dermatol 2019;80:251-65.)

***Key words:*** arthritis; arthropathy; incidence; prevalence; psoriasis; psoriatic.

**CAPSULE SUMMARY**

- Wide-ranging estimates have been reported for the occurrence of psoriatic arthritis in patients with psoriasis.
- We found an overall pooled prevalence of 19.7% for psoriatic arthritis in patients with psoriasis and 24.6% in patients with moderate-to-severe disease.
- Screening patients with psoriasis for psoriatic arthritis may be warranted, especially for those with moderate-to-severe disease.

Psoriatic arthritis (PsA), which is classified as a seronegative spondyloarthropathy, is strongly associated with cutaneous psoriasis; dactylitis and enthesitis are the hallmarks of the disease.[1] Since its formal acceptance as a distinct entity, several attempts have been made to devise the most sensitive and specific set of diagnostic criteria.[2-10] In 1973, Moll and Wright defined PsA as the presence of inflammatory arthritis with the concurrent existence of psoriasis and seronegativity for rheumatoid factor,[2] and in 2006 the Classification Criteria for Psoriatic Arthritis (CASPAR) were introduced.[10]

Despite the increasing recognition of PsA as a distinct disease, the lack of a widely accepted and validated case definition has yielded considerable variability in estimates of the prevalence of PsA.[11-15] Several observational studies have investigated the latter issue,[16,17] but no meta-analysis has yet been performed to estimate the exact prevalence in patients with psoriasis. Applying a broad and inclusive search strategy, we examined the occurrence of PsA in patients with psoriasis in a systematic review and meta-analysis.

## METHODS

### Literature search

This study was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses, and a study protocol was developed a priori.

All articles from inception of the databases through November 2017 were potentially eligible for inclusion. Two authors independently screened the 3 databases (PubMed, Web of Science, and EMBASE) using the following search terms: (*psoriasis*) AND (*psoriatic* OR *arthritis* OR *arthropathy* OR *incidence* OR *prevalence*).

### Inclusion and exclusion criteria

To qualify for inclusion, studies had to (1) be original, (2) be written in English and available in full text, (3) have a source population of patients with psoriasis, and (4) include absolute numbers or the percentage of PsA cases to calculate a prevalence of PsA among patients with psoriasis. Studies were excluded if they reported the occurrence of arthritis without distinctly specifying the type of arthritis. Studies of juvenile idiopathic arthritis (JIA) were not included because the term might comprise several different types of arthritis. Furthermore, we distinguished PsA from psoriatic arthropathy, as the latter is a vague term referring to musculoskeletal pain and complaints in general that may be unrelated to PsA.

### Data extraction and quality assessment

Records were screened according to the title and abstract. The relevant abstracts, or articles without an

*Abbreviations used:*

| | |
|---|---|
| CASPAR: | Classification Criteria for Psoriatic Arthritis |
| CI: | confidence interval |
| HLA: | human leukocyte antigen |
| JIA: | juvenile idiopathic arthritis |
| PsA: | psoriatic arthritis |

abstract, were selected for full-text review. References from the included studies were also screened for additional studies not identified through the initial search strategy. The extracted data from each study are presented as a supplemental data set on Mendeley and can be accessed at http://dx.doi.org/10.17632/48xm3bwkdr.1. Quality assessment was performed by using the Newcastle-Ottawa Scale.[18] An adapted version was used for cross-sectional studies, in which case a maximum score of either 8 or 10 could be achieved. Thus, studies receiving a score of 6 or higher and 7 or higher, respectively, were considered of high quality. For case-control studies and cohort studies, those receiving a score of 7 or higher were considered of high quality.

### Data analysis

All statistical analyses were performed with StatsDirect software (version 3.1.4, StatsDirect Ltd, Cheshire, UK). The Freeman-Tukey double arcsine method was applied to transform proportions,[19] and an inverse-variance weighted random effects meta-analysis was performed by using the DerSimonian and Laird method.[20] A priori, we opted for the DerSimonian-Laird random effects methods because we expected to find significant between-study heterogeneity. A proportion meta-analysis was completed to obtain pooled proportions with 95% confidence intervals (CIs) of PsA in patients with psoriasis. The heterogeneity of the included studies was assessed using the Cochran Q test and $I^2$ statistics, and forest plots were constructed. Furthermore, we calculated the prevalence of PsA in patients with psoriasis for the following stratifications: all studies, sex, period published (before 2000, 2000-2009, and 2010-2017), child and adolescent populations only (ie, those <18 years), studies of adults only (those ≥18 years), diagnosis according to CASPAR, diagnosis according to the Moll and Wright criteria, population size (<500, 500-1000, and ≥1000), study type (clinical, register-based, population-based, and observational studies), geographic area and country, Newcastle Ottawa Scale score (good quality or fair/poor quality), and severity of psoriasis disease defined as moderate-to-severe disease (Psoriasis Area Severity Index score ≥10 or body surface area ≥10) and mild disease (Psoriasis Area Severity Index score <10 or body surface area <10).

## RESULTS

We identified 6331 records through database searching (2139 in PubMed, 1217 in Web of Science, and 2975 in EMBASE); 4323 nonduplicate records were screened by title and abstract, yielding 1302 articles for full-text assessment. Counting the additional 41 studies identified by screening references, 287 studies were included for data extraction and 266 studies were selected for quantitative analysis (Fig 1); together, these studies included 976,408 patients with psoriasis (12,884 children and adolescents). The results of all analyses performed are summarized in Table I.

### Prevalence of PsA in patients with psoriasis

Overall, quantitative analysis of 266 studies yielded a pooled PsA prevalence of 19.7% (95% CI, 18.5%-20.9%) in patients with psoriasis (Supplemental Fig 1; available at http://www.jaad.org). A total of 21 studies[21-41] reported data on children and/or adolescents, yielding a pooled prevalence of 3.3% (95% CI, 2.1%-4.9%) (Supplemental Fig 2; available at http://www.jaad.org), and a total of 245 studies[11-17,42-279] reported data for PsA in adults with psoriasis with a pooled prevalence of 21.6% (95% CI, 20.3%-22.9%) (Supplemental Fig 3; available at http://www.jaad.org). A total of 36 studies* reported data on PsA stratified by sex (Supplemental Figs 4 and 5; available at http://www.jaad.org), with the prevalences for men and women being 23.3% (95% CI, 19.4%-27.5%) and 24.0% (95% CI, 20.1%-28.1%), respectively. A total of 45 studies† used CASPAR as the underlying diagnostic approach for assessment of PsA, with a pooled prevalence of 23.8% (95% CI, 20.1%-27.6%) (Supplemental Fig 6; available at http://www.jaad.org). Similarly, 20 studies‡ used the Moll and Wright criteria, yielding a prevalence of 24.1% (95% CI, 15.0%-34.5%) (Supplemental Fig 7; available at http://www.jaad.org).

*11,14,22,42,44,48,49,52,57,63,64,69,70,80,91,99,100,112,117,140,156,159,169,177,179,188,189,200,208,214,217,223,239,241,245,275.

†11,14,90,99,119,129,130,135,137,141,142,146-148,155,156,159,163,164,174,177,180,186,197,198,200,208-210,217,218,229,231,233,235,241,245,247,249,257-259,271,273,275.

‡43,44,47,49,57,63,75,80,87,88,92,93,102,157,199,219,239,240,276,280.

### Variations in PsA prevalence by geographic region and country

There were 119 studies[§] from Europe, with a resultant pooled prevalence of 22.7% (95% CI, 20.6%-25.0%). From Asia there were 59 studies[¶] included for analysis, yielding a pooled prevalence of 14.0% (11.7%-16.3%). Furthermore, 47 studies[‖] were included from North America, with a pooled prevalence of 19.5% (95% CI, 17.1%-22.1%). There were 10 studies[#] from South America, resulting in a pooled estimate of 21.5% (95% CI, 15.4%-28.2%). We included 3 studies[40,43,119] from Africa; the pooled prevalence was 15.5% (95% CI, 0.009%-51.5%).

By country, the following estimates were calculated: 30.5% (95% CI, 24.8%-36.4%) from Italy,[**] 18.7% (95% CI, 15.0%-22.7%) from Spain,[††] 20.5% (95% CI, 17.6%-23.5%) from Germany,[‡‡] 19.2% (95% CI, 9.2%-31.8%) from the Netherlands,[§§] 22.4% (95% CI, 16.4%-29.0%) from Sweden,[16,33,55,57,66,140,188,265] 24.1% (95% CI, 9.2%-43.2%) from Denmark,[16,42,189,203,260] 18.2% (95% CI, 3.6%-40.6%) from Greece,[31,45,131,239,276] 17.0% (95% CI, 6.2%-31.7%) from Poland,[62,151,268,272] 30.0% (95% CI, 25.3%-35.0%) from Finland,[16,48] 27.1% (95% CI, 13.3%-43.7%) from Norway,[16,51] 16.3% (95% CI, 7.9%-26.9%) from France,[34,41,78,189,202,226,253] 19.4% (95% CI, 12.5%-27.6%) from the United Kingdom,[¶¶] 22.0% (95% CI, 10.7%-35.9%) from Iceland,[16,68] 14.2% (95% CI, 8.6%-21.0%) from Turkey,[‖‖] 13.5% (95% CI, 7.8%-20.6%) from India,[##] 8.3% (95% CI, 1.6%-19.6%) from Japan,[13,60,94,273,275] 4.9% (95% CI, 1.9%-9.3%) from China,[15,73,130,132,146] 35.5% (95% CI, 11.8%-64.0%) from Thailand,[14,184,222,240] 18.5% (95% CI, 5.8%-36.3%) from Taiwan,[206,255,267] 10.4% (95% CI, 8.3%-12.8%) from South Korea,[54,217,245] 13.0% (95% CI, 5.5%-23.0%) from Iran,[80,117] 41.8% (95% CI, 35.8%-48.0%) from Pakistan,[88,246] 19.0% (95% CI, 16.3%-21.8%) from the United States,[***] 24.6% (95% CI, 17.3%-32.7%) from Canada,[91,95,99,189,196,218,236] 25.2% (95% CI, 18.6%-32.3%) from Brazil,[†††] and 17.8% (95% CI, 12.4%-24.0%) from Argentina[145,177] (Fig 2 and Supplemental Table I [available at http://www.jaad.org]).

### Prevalence estimates by population size

The population size per study ranged from 25 to 198,366 patients with psoriasis.

There were 173 studies[‡‡‡] with a population of fewer than 500 patients with psoriasis, with a pooled prevalence of 22.2% (95% CI, 20.0%-24.4%). A total of 35 studies[§§§] had a study population between 500 and 1000 patients, with a pooled prevalence of 18.5% (95% CI, 15.0%-22.3%), and 57 studies[¶¶¶] had a study population of 1000 or more, resulting in a prevalence of 14.4% (95% CI, 12.5%-16.3%).

### Prevalence of PsA by publication year and study design

Stratified by year of publication, there were 13 studies[21,42-53] from before 2000, resulting in a pooled prevalence estimate of 22.0% (95% CI, 16.1%-28.5%). There were 51 studies[12,16,17,22-25,54-97] and 202 studies[‖‖‖] published between 2000-2009 and 2010-2017, respectively. The respective pooled prevalence estimates were 16.5% (95% CI, 13.1%-20.3%) and 20.4% (95% CI, 19.1%-21.8%).

There were 34 clinical studies,[###] resulting in a pooled prevalence of 22.9% (95% CI, 20.7%-25.2%). Moreover, there were 160 observational studies,[****] yielding a pooled prevalence of 20.7% (95% CI, 18.3%-23.2%). With regard to the register-

§11,16,17,21,31-36,41,42,44,45,48,49,51,52,55,57,58,62,65,66,68-71,74,78,90,93,100,104,106,107,111-113,115,116,123,127,129,131,133,135,136,139-142,149-153,156-159,162-164,167,168,170,171,173-176,178-180,188,191,192,194,197,199,200,202-205,211,215,220,223-227,229-231,234,235,237-239,242,249-251,253,254,260,261,264,265,268-270,272,276,277,279.

¶12-15,22-24,27,37,39,54,59,60,63,72,73,80,88,94,102,103,105,108,110,117,128,130,132,138,146,147,155,160,184,186,198,206,216,217,221,222,233,240,241,244-248,255,257,258,263,266,267,271,273-275.

‖25,28,29,46,47,50,53,56,61,64,75,76,79,81,86,87,91,95-99,109,118,120,121,125,134,143,144,148,154,161,169,183,193,196,201,212,214,218,232,236,243,252,259,262.

#126,137,145,172,177,190,208,209,219,228.

**11,21,35,44,49,52,65,69,71,74,112,115,116,135,136,139,141,142,150,158,163,164,173,174,178,179,191,197,199,211,220,225,229,230,238,253.

††58,113,123,133,149,170,175,176,192,194,200,205,215,224,250,253,254.

‡‡17,36,70,93,107,129,171,180,189,231,237,253.

§§26,32,104,127,152,162,167,168,235,261,279.

¶¶90,153,156,204,223,227,242,253,270,277.

‖‖12,23,27,39,59,63,72,102,103,138,160,198,241,248,258.

##22,105,108,110,128,147,186,216,233,244,247,257,263,266,271.

***28,29,46,47,50,53,56,61,64,75,79,86,87,96-98,109,118,120,121,125,134,144,148,154,169,183,189,193,201,212,214,232,243,252,262.

†††137,172,190,208,209,219,228.

‡‡‡11,12,21-26,29,30,32-34,36-45,47,50-55,57,59,62,63,66,67,69,72,74-76,78-81,85-88,90,92,98,99,102-105,107,108,110,113,115-119,122-129,131,136-142,144-147,149-153,155-160,163-170,172-181,184,185,190,191,194,196-200,205,229,230,233,234,236,238-248,250,257-259,263,266-268,271-273,275-277,279.

§§§27,31,49,61,64,65,70,73,77,82,91,94,95,101,106,109,111,114,121,133,189,193,195,208,211,213-215,218,249,251,253,264,270,274.

¶¶¶13,15,17,28,46,48,56,58,60,68,71,83,84,89,93,96,97,100,112,120,130,132,134,135,143,148,154,161,162,171,182,183,186-188,192,201,203,204,207,212,221,227,231,232,235,237,252,254-256,260-262,265,269,278.

‖‖‖‖11,13-15,26-41,98-279.

###25,42,61,67,76-78,81-85,101,111,114,118,121,122,124,125,143,161,165,166,181,185,187,195,207,213,256,264,273,278.

****11-15,21,23,24,26,27,29-31,33-41,43-47,49,50,52,54,55,62,63,65,66,69,70,72-75,79,80,87,88,92,98-100,102-108,110,113,116,117,119,123,126-133,135-142,145,147,149-151,153,155,157-160,163,164,167,169,170,172-180,184,186,189-191,194,195,197-200,205,206,208-211,214-220,222,224,225,228-230,233,238-241,243-248,253,257-259,263,266-268,270-273,275-277.

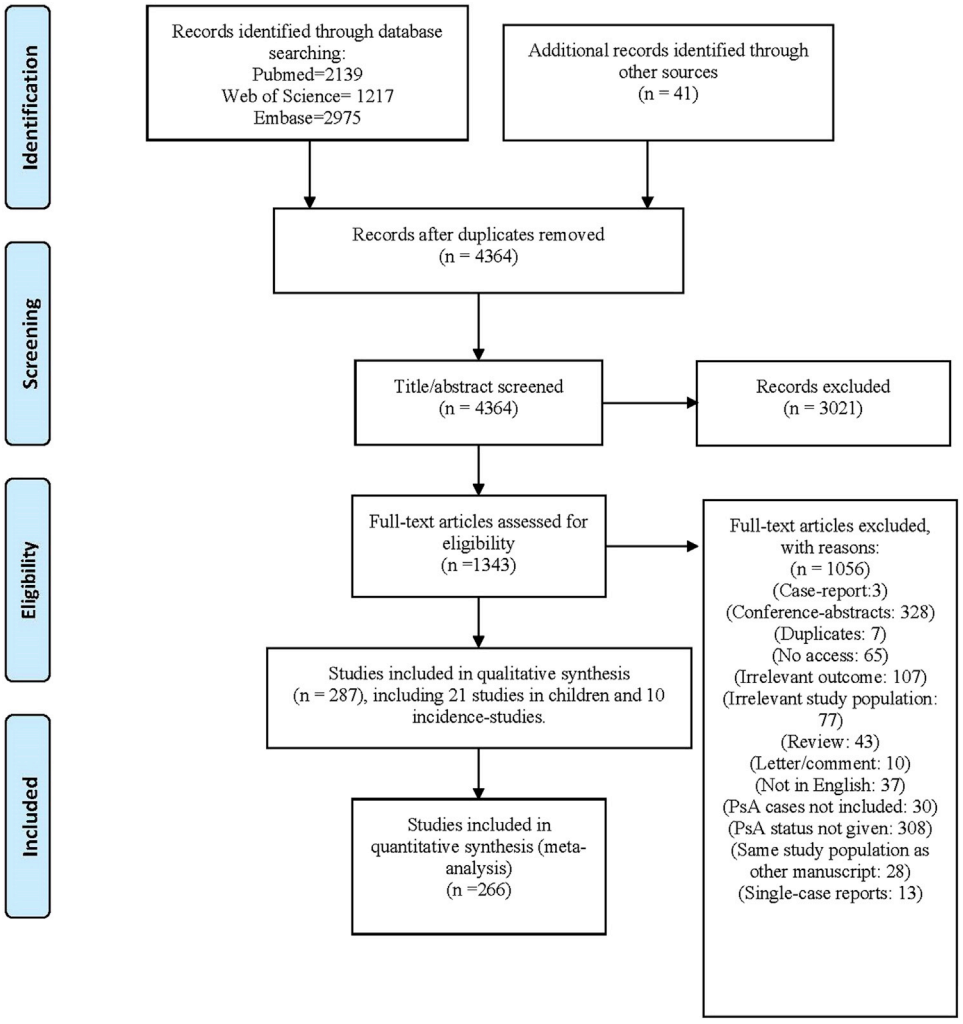


**Fig 1.** PRISMA flow chart.

based studies, 48 such studies[††††] were included in the analysis, with a pooled prevalence of 15.1% (95% CI, 13.3%-17.1%). Finally, 46 population-based studies[‡‡‡‡] were included, yielding a pooled prevalence estimate of 15.6% (95% CI, 13.7%-17.7%).

## Prevalence of PsA by severity of disease

There were 122 studies[§§§§] that included patients with moderate-to-severe psoriasis, resulting in a pooled prevalence of 24.6% (95% CI, 22.9%-26.4). Furthermore, there were 58 studies[¶¶¶¶] with mild disease, resulting in a pooled estimate of 15.8% (95% CI, 14.3%-17.2%).

## Study quality and bias assessment

A total of 134 studies[‖‖‖‖‖‖] had good quality according to the Newcastle-Ottawa Scale, with a pooled prevalence of 18.1% (95% CI, 16.6%-19.6%). Furthermore, there were 84 studies[####] categorized

††††22,28,32,35,53,56,57,59,86,90,94-97,112,115,120,144,148,152,154,168,171,182,188,201,203,204,212,221,223,226,227,232,234-236,250,252,254,255,260-262,265,269,274,279.

‡‡‡‡16,17,48,51,56-58,60,64,68,71,86,89-91,93,95-97,109,112,120,134,146,148,154,156,162,183,188,192,193,201,202,212,221,223,227,231,235,237,242,249,251,260,262.

§§§§17,25,32,35,36,38,42,46,47,61,67,69,70,74,76-78,80-85,87,88,91-93,95,100,101,104,106,107,109,111-119,121-125,127,129,136,138,141,143,152,153,157,161-163,165,166,168,171,173-175,178,179,181,182,184,185,187,191,192,194-197,201,203-207,210,211,213,214,216,217,220,222,224,226,229,230,233,234,236,241,243,250,252-254,256-258,264-269,273,274,277-279.

¶¶¶¶11,12,16,28,31,33,52,53,59,64,65,79,90,99,102,103,105,120,130,135,139,140,142,144,145,147,149,155,156,160,164,167,170,172,183,186,198,200,212,215,223,225,227,228,235,237,238,240,242,245,247,248,251,259,260,263,270,272.

‖‖‖‖‖‖15-17,21,22,27-34,36,38,39,41,54,56,57,62,63,65,68-71,74,79,80,92-95,97,98,100,103,104,106,107,112,115,117,119,120,127-132,134,136,137,141,142,144,147-149,154,156-160,162-164,167,170-173,175-178,180,182-184,186,188-192,194,197,199,201-204,206,209,211,212,215,218-221,226,227,229,231,232,235,237,240,242,243,246-248,250-252,254,255,260,262,263,265,268-270,274-276,279.

####11-14,23,24,40,43-53,55,58-60,64,66,72,73,75,86-91,99,102,105,108,110,113,116,125,126,133,135,138-140,145,146,151,153,155,169,174,193,198,200,205,208,210,214,216,217,223,225,228,230,233,234,236,238,239,241,244,245,249,253,257,258,261,266,267,271,272.

**Table I.** Prevalence estimates according to different population characteristics

| Group | Number of studies | Prevalence | 95% CI |
|---|---|---|---|
| All studies | 266 | 19.7% | 18.5%-20.9% |
| Men | 36 | 23.3% | 19.4%-27.5% |
| Women | 36 | 24.0% | 20.1%-28.1% |
| Children | 21 | 3.3% | 2.1%-4.9% |
| Adults | 245 | 21.6% | 20.3%-22.9% |
| Studies using CASPAR | 45 | 23.8% | 20.1%-27.6% |
| Studies using Moll and Wright | 20 | 24.1% | 15.0%-34.5% |
| Mild disease* | 58 | 15.8% | 14.3%-17.2% |
| Moderate-to-severe disease** | 122 | 24.6% | 22.9%-26.4% |
| Population size: < 500 | 173 | 22.2% | 20.0%-24.4% |
| Population size: 500-1000 | 35 | 18.5% | 15.0%-22.3% |
| Population size: ≥ 1000 | 57 | 14.4% | 12.5%-16.3% |
| Publication year (pre-2000) | 13 | 22.0% | 16.1%-28.5% |
| Publication year (2000-2009) | 51 | 16.5% | 13.1%-20.3% |
| Publication year (2010-2017) | 202 | 20.4% | 19.1%-21.8% |
| Study design (clinical) | 34 | 22.9% | 20.7%-25.2% |
| Study design (observational) | 160 | 20.7% | 18.3%-23.2% |
| Study design (register-based) | 48 | 15.1% | 13.3%-17.1% |
| Study design (population-based) | 46 | 15.6% | 13.7%-17.7% |
| Continent (Europe) | 119 | 22.7% | 20.6%-25.0% |
| Continent (Asia) | 59 | 14.0% | 11.7%-16.3% |
| Continent (North America) | 47 | 19.5% | 17.1%-22.1% |
| Continent (South America) | 10 | 21.5% | 15.4%-28.2% |
| Continent (Africa) | 3 | 15.5% | 0.009%-51.5% |

*BSA/PASI < 10
**BSA/PASI ≥ 10

as being of fair or poor quality, with a pooled prevalence of 21.5% (95% CI, 17.7%-25.6%). The studies categorized as being of fair or poor quality scored a maximum of 2 with regard to representativeness of the study population. Correspondingly, of the 134 studies with good quality, 66 scored at least 4, with a minimum score of 3 for all the studies (Supplemental Table II; available at http://www.jaad.org).

Furthermore, the Egger test indicated a significant risk of bias for all the studies included ($P < .0001$). There was a very high level of heterogeneity between all studies included (given by the $I^2$ of 99.5% [95% CI, 99.5% to 99.5%]). The high level of heterogeneity persisted in all subgroups except for studies from Pakistan, South Korea, and Argentina from the subgrouping by country, in which case the Cochran Q test result was not significant (Supplemental Table III; available at http://www.jaad.org).

## Incidence of PsA among patients with psoriasis

A total of 10 studies reported incidence estimates of PsA among patients with psoriasis. Wilson et al[96] conducted a population-based retrospective cohort study based on review of the medical charts of 1593 patients with psoriasis from the United States. Patients were followed for up to 30 years (1970-1999) and the incidence rate was 2.7 per 1000 person-years. Furthermore, cumulative incidences of 1.7%, 3.1%, and 5.1% were reported at 5-, 10-, and 20-years' follow-up, respectively. Li et al[281] reported an annual incidence of 2.1% during 15-years of follow-up (1991-2005) in a US population–based setting of women from the Nurses' Health Study. Furthermore, in a population-based cohort study from the United Kingdom[282] an incidence rate of 26.5 per 10,000 person-years was reported during 15-years of follow-up (1995-2010). In a European study enrolling patients from the United Kingdom, Italy, France, Spain, and Germany, Christophers et al[100] followed 1560 patients with plaque psoriasis from secondary care units for a total of 30 years. The cumulative incidence of PsA was 13% at 20-years' follow-up. Eder et al[283] followed 313 Canadian patients with psoriasis for 4 years (2006-2010), most of whom were enrolled from secondary care clinics, and reported an incidence rate of 1.9 per 100 person-years.

In a study from Italy[139] an annual mean incidence of 1.7% was reported at the 3-year follow-up (2008-2011) for patients with psoriasis who were being seen at an outpatient dermatology clinic. Also from

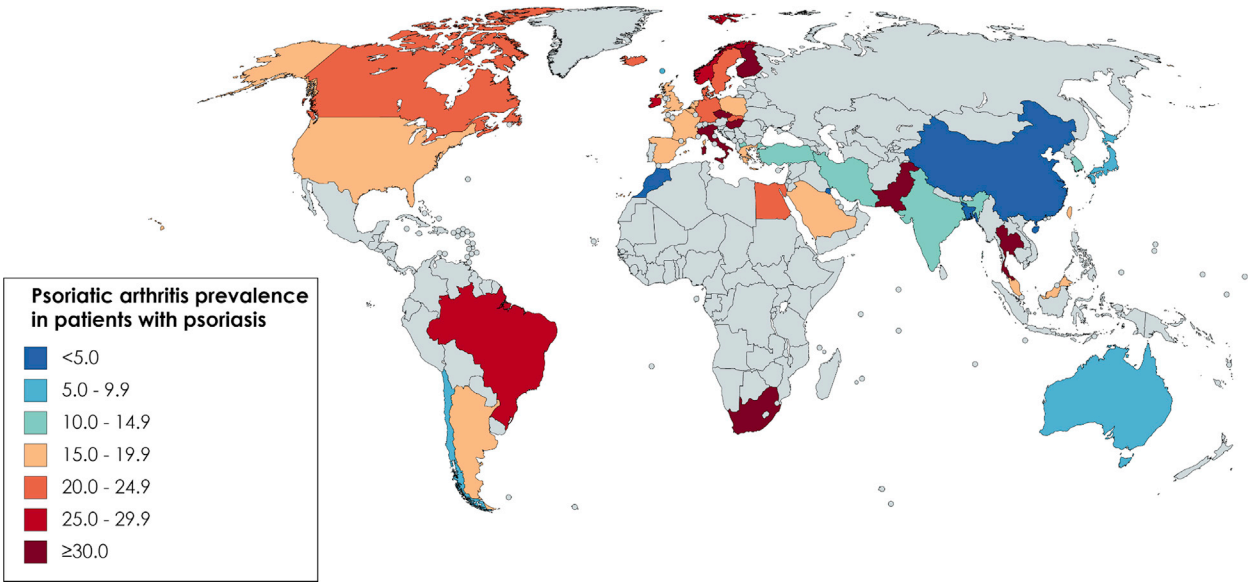


**Fig 2.** Worldwide prevalence of psoriatic arthritis among patients with psoriasis. Number of studies included per country: Argentina (n = 2), Australia (n = 1), Bangladesh (n = 1), Belgium (n = 1), Brazil (n = 7), Canada (n = 8), Chile (n = 1), China (n = 5), Czech Republic (n = 1), Denmark (n = 5), Egypt (n =1), Faroe Islands (n = 1), Finland (n = 2), France (n = 7), Germany (n = 12), Greece (n = 5), Hungary (n = 1), Iceland (n = 2), India (n = 15), Iran (n = 2), Ireland (n = 1), Israel (n = 1), Italy (n = 36), Japan (n = 5), Kuwait (n = 1), Macedonia (n = 1), Malaysia (n = 1), Morocco (n = 1), Netherlands (n = 11), Norway (n = 2), Pakistan (n = 2), Poland (n=4), Saudi Arabia (n = 1), Scotland (n = 1), Slovakia (n = 1), South Africa (n = 1), South Korea (n = 3), Spain (n = 17), Sweden (n = 8), Taiwan (n = 3), Thailand (n = 4), Turkey (n = 15), United Kingdom (n = 10), United States (n = 36).

Italy, Tinazzi et al[11] reported a cumulative incidence of 8.4% at 12-months' follow-up in a study that enrolled patients with severe psoriasis, and Brunasso et al[115] reported an incidence rate of 22.7 per 1000 person-years during a mean follow-up of 39 months for 55 patients with psoriasis who were treated with efalizumab. In a study from Canada[218] a cumulative incidence of 8.4% was reported during 8-years of follow-up (2006-2014). In another prospective cohort study from Canada[284] the incidence rate was reported to be 2.7 per 100 person-years at 8-years' follow-up (2006-2014).

## DISCUSSION

Quantitative analysis of 266 studies yielded a PsA prevalence of 19.7% among 976,408 patients with psoriasis. The prevalence of PsA was markedly lower in children and adolescents than in adults but equally frequent in both sexes. Notably, higher estimates were found in patients with moderate-to-severe psoriasis than in patients with mild psoriasis, suggesting that increased attention among this group of patients is warranted.

The prevalence of PsA among patients with psoriasis was lowest in Asia. Previously, Tam et al[285] reported a prevalence range of 1% to 9% in patients with psoriasis from Asia. Moreover, our data show congruence in the estimates from Europe and North America, which is supported by previous findings. Furthermore, the pooled estimate for South America was unexpectedly high in light of a previous review that reported complete absence of psoriasis in the Andean region.[286] Studies have shown that both psoriasis and PsA have strong genetic components.[99,287] Accordingly, human leukocyte antigen (HLA)-C*06 positivity in patients with psoriasis is generally higher in whites than in Asians.[288] Moreover, strong genetic associations have linked HLA-B7, HLA-B27, and HLA-B39 with PsA in particular,[289] and data have shown higher occurrence of HLA-B27 in non-Hispanic whites.

It is generally accepted that PsA is uncommon in children, which is supported by the pooled prevalence of 3.3%. This low estimate might, at least in part, be explained by lack of clear segregation of PsA from JIA. However, juvenile PsA accounts for approximately 5% of patients with JIA, emphasizing the importance of discerning it from JIA as a distinct entity.[290] Moreover, PsA in children often presents before psoriasis.[291] We examined studies of only

those children with psoriasis, and thus children with PsA who developed cutaneous manifestations later on could have been missed in our study. Furthermore, we observed decreasing proportion estimates as the population size increased. This observation might partly be explained by more thorough examination of patients with psoriasis in smaller studies and underdiagnosis of PsA in larger ones (eg, in register-based studies in which assessment of PsA is based on diagnostic codes), as such studies may tend to predominantly capture those patients with more severe joint symptoms.

The reported incidence rates ranged from 0.27 per 100 person-years, as reported by Wilson et al[96] and Love et al,[282] to 2.7 per 100 person-years, as reported in a prospective setting by Eder et al.[284] Interestingly, both studies reporting the lowest estimates were conducted in a nonselected population–based setting. However, the higher incidence rates could also be explained by improving diagnostic abilities, as there seems to be a link between more recent studies and higher incidence rates.

High levels of heterogeneity were observed between studies both overall and across subgroups. Such heterogeneity may be attributed to the lack of widely accepted diagnostic criteria in the past, different study designs, geographic variations, ethnicity, the remitting and relapsing nature of the disease, and different study inclusion criteria (eg, whether patients with psoriasis were selected from primary, secondary, or tertiary care settings).

In 2015, Villani et al. reported a 15.5% prevalence of undiagnosed PsA among patients with psoriasis in a systematic review and meta-analysis.[292] However, the focus was directed only on the occurrence of newly diagnosed PsA among patients with cutaneous psoriasis. Few review articles have examined the prevalence of PsA among patients with plaque psoriasis,[292-294] and they have generally applied a narrow search strategy, thus excluding a vast number of relevant studies.

Strengths of this study include the sheer number of studies, the focused inclusion of patients with PsA rather than any type of arthritis, the liberal inclusion of various types of study populations and designs, and lastly the inclusion of all types of diagnostic methods for PsA. On the other hand, our study was limited by the few studies from Africa and Australia, thus complicating an accurate assessment of the prevalence of PsA among patients with psoriasis in these regions. The exclusion of studies written in languages other than English and a significant risk of publication bias may also have affected our estimates. Furthermore, because of a lack of available data, we were not able to assess whether severity of psoriasis could explain the lower prevalence of PsA observed in children and in patients from Asia and Africa.

In conclusion, this meta-analysis showed that 1 in 5 patients with psoriasis have PsA, with very consistent results across numerous strata. However, high levels of heterogeneity were observed between the included studies, which may have affected interpretation.

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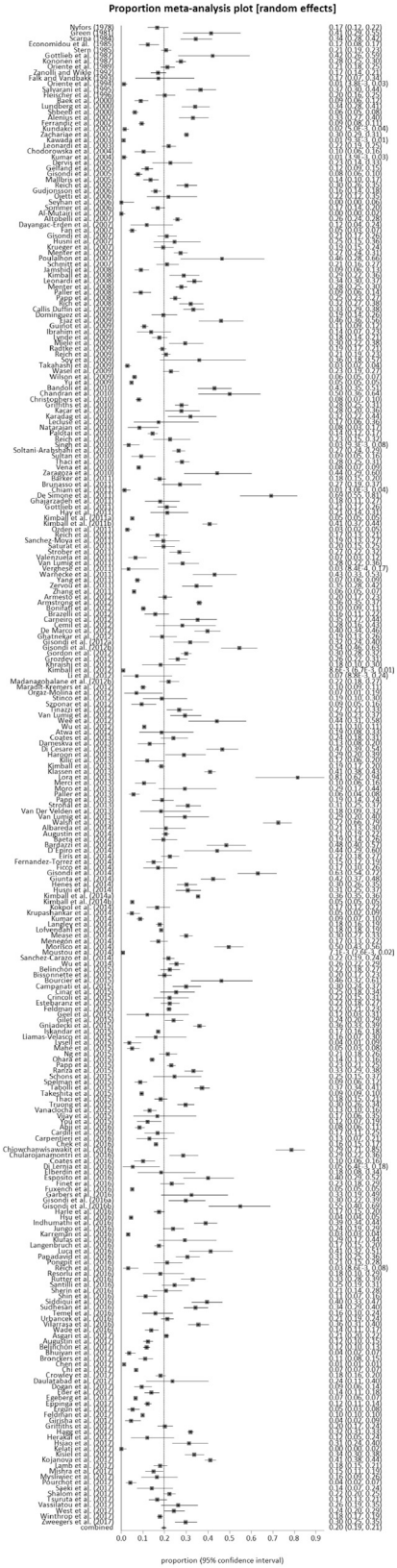
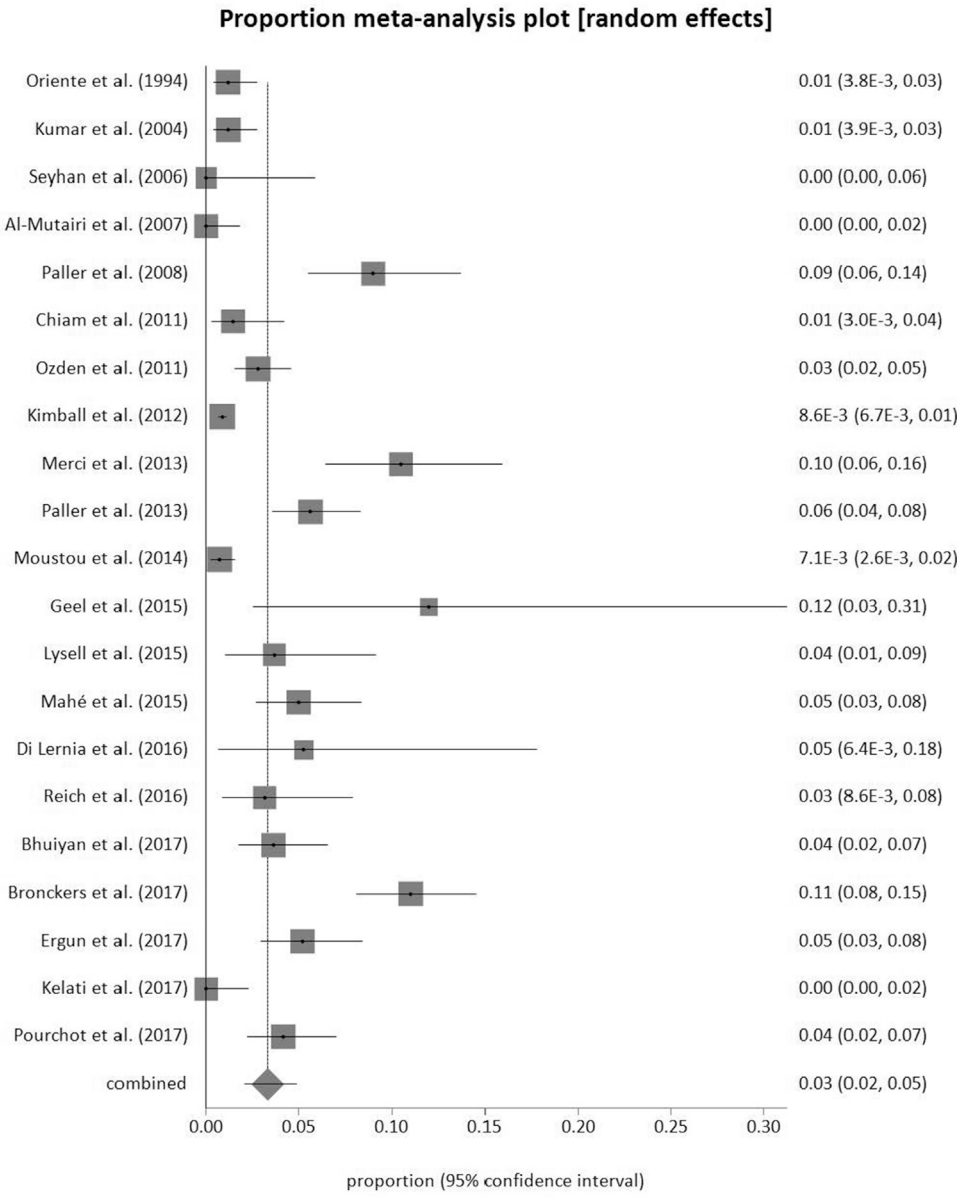
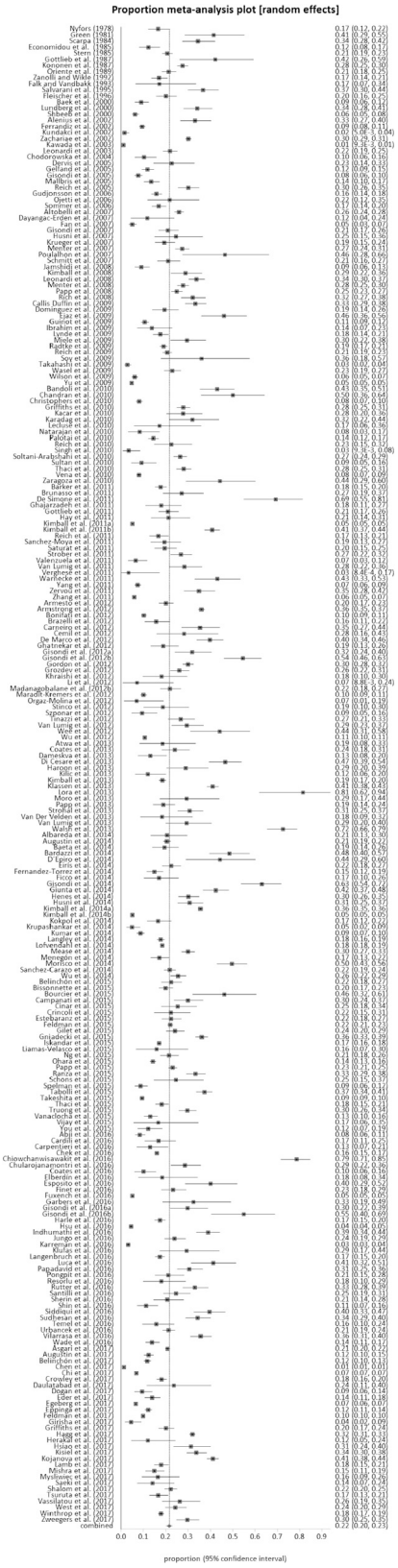


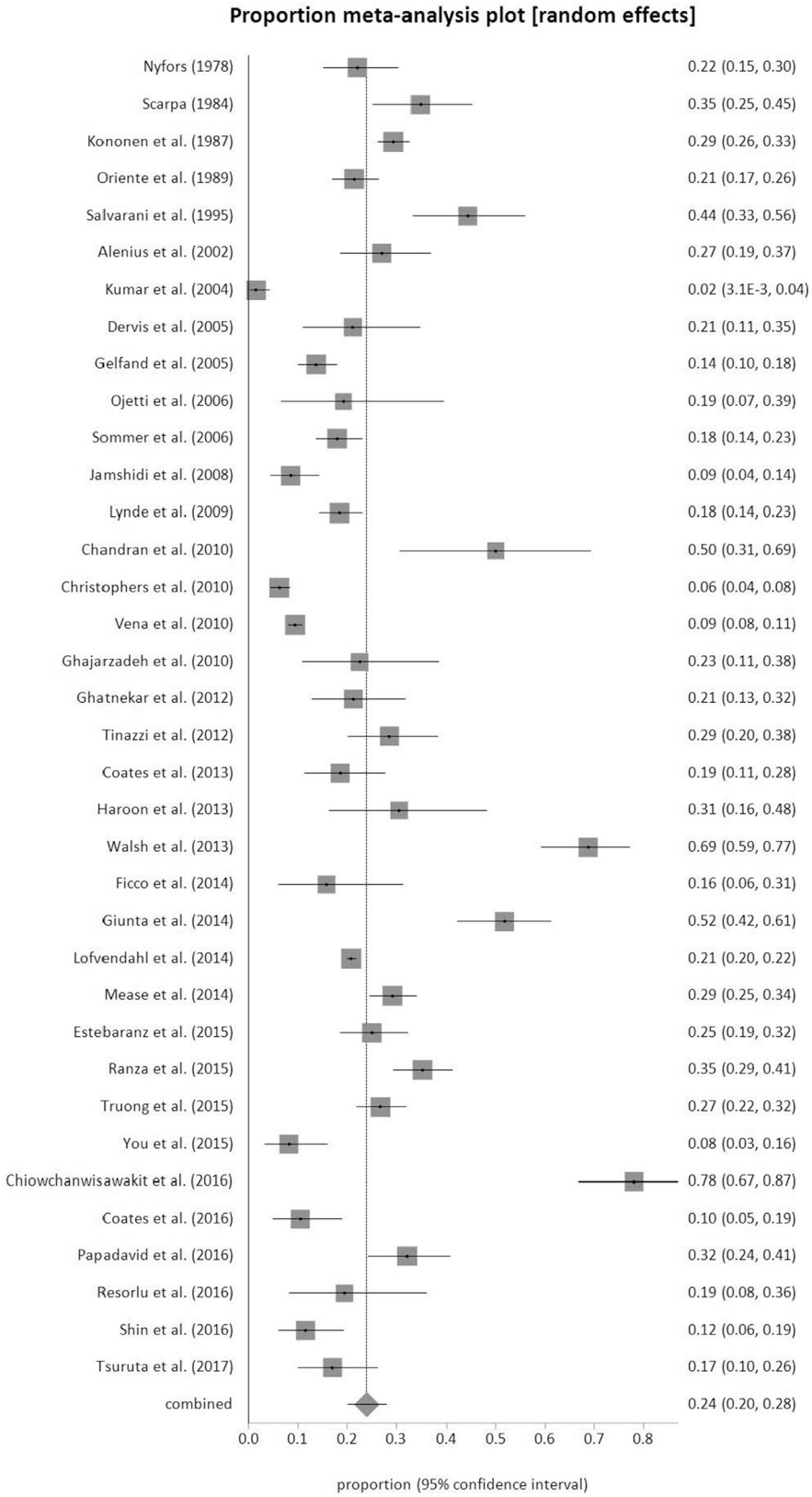

**Supplemental Fig 1.** Psoriatic arthritis in patients with psoriasis (all studies).



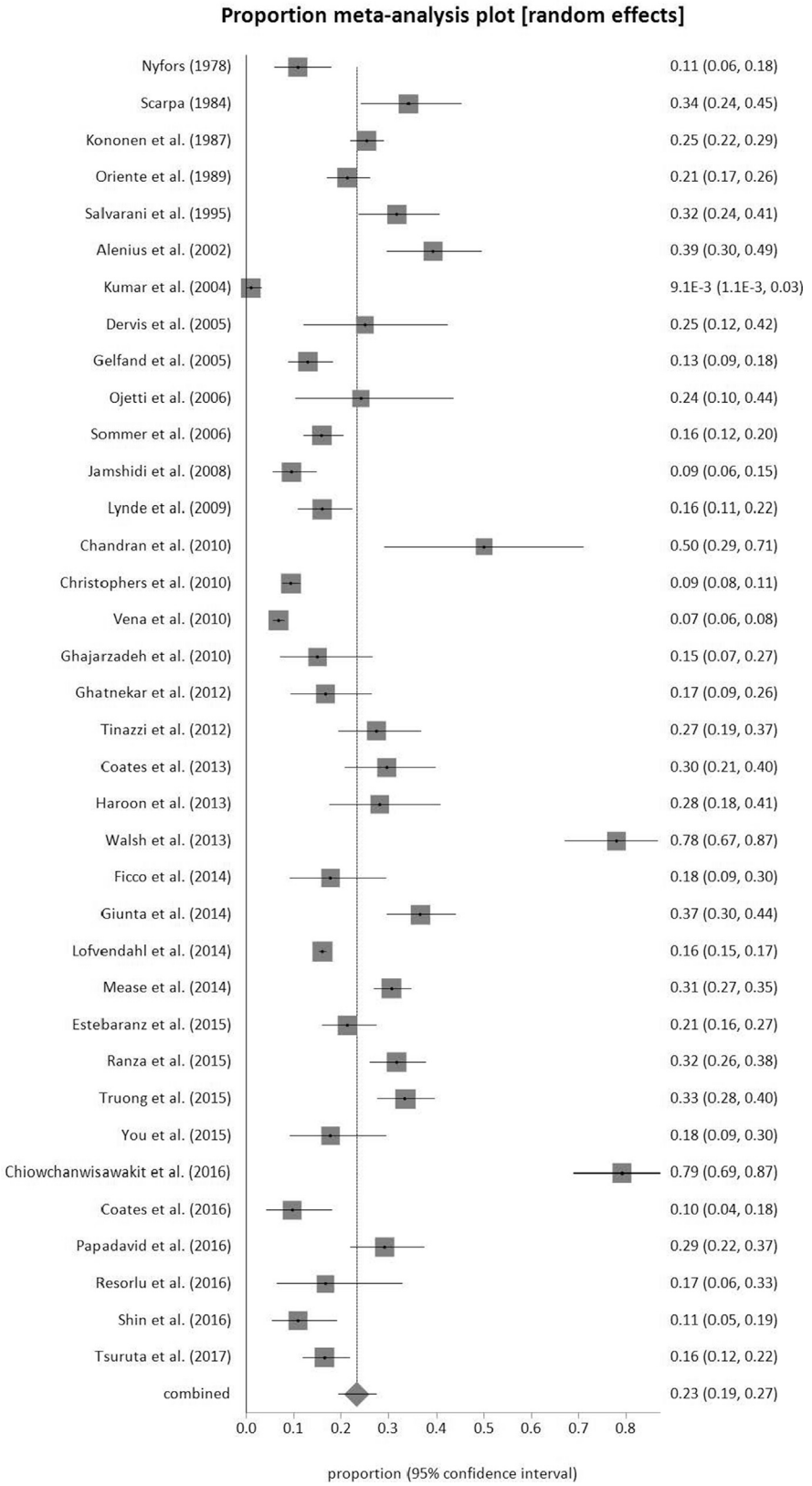

**Supplemental Fig 2.** Psoriatic arthritis in children with psoriasis.



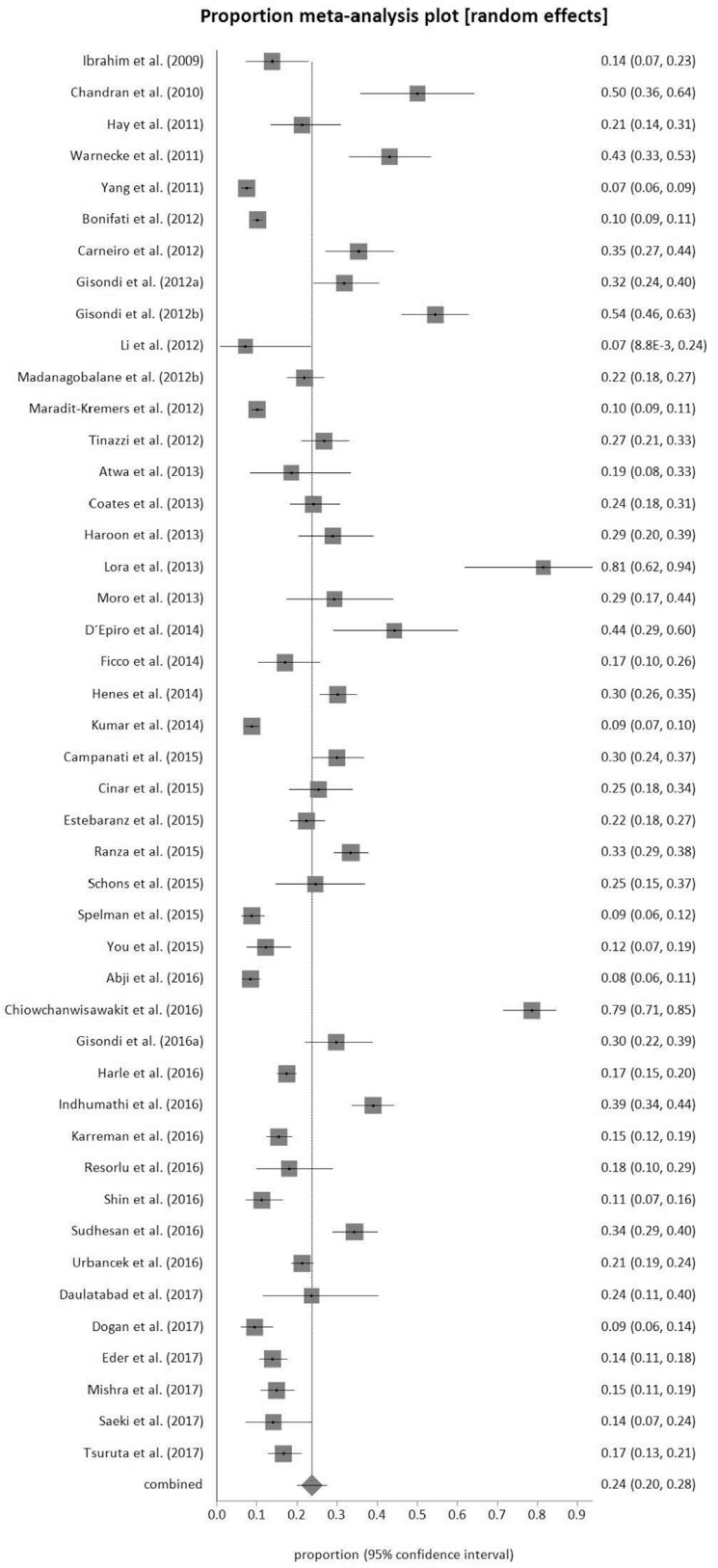

**Supplemental Fig 3.** Psoriatic arthritis in adults with psoriasis.



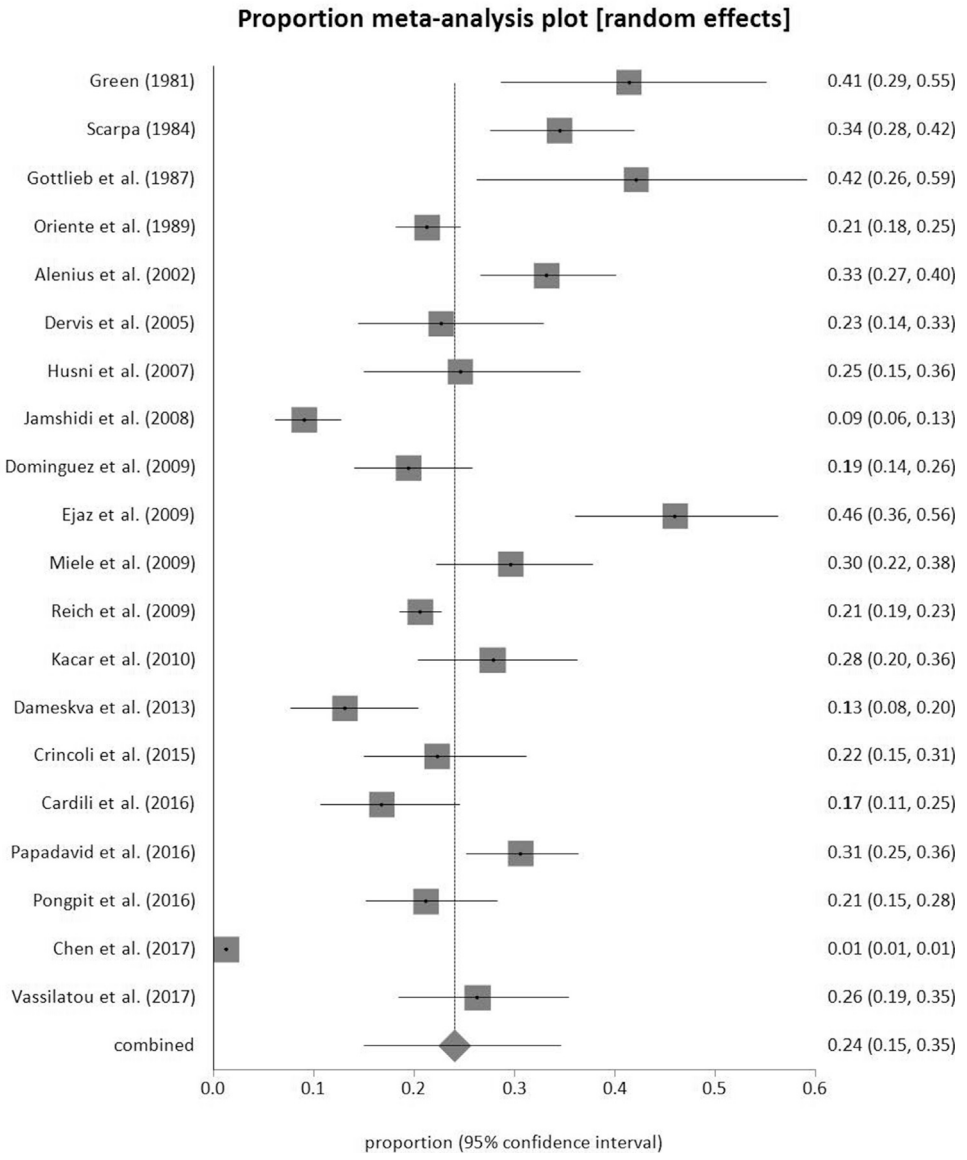

**Supplemental Fig 4.** Psoriatic arthritis in men with psoriasis.




**Supplemental Fig 5.** Psoriatic arthritis in women with psoriasis.




**Supplemental Fig 6.** Psoriatic arthritis according to CASPAR.




**Supplemental Fig 7.** Psoriatic arthritis according to Moll and Wright.

**Supplemental Table I.** Prevalence of PsA in patients with psoriasis by geographic region and country

| Region/country | Prevalence | 95% CI |
|---|---|---|
| Australia | 8.7% | Not applicable |
| Africa | 15.5% | (0.009%-51.5%) |
| Egypt | 21.3% | Not applicable |
| Morocco | 0% | Not applicable |
| South Africa | 41.6% | Not applicable |
| Asia | 14.0% | (11.7%-16.3%) |
| Bangladesh | 3.6% | Not applicable |
| China | 4.9% | (1.9%-9.3%) |
| India | 13.5% | (7.8%-20.6%) |
| Iran | 13.0% | (5.5%-23.0%) |
| Israel | 22.3% | Not applicable |
| Japan | 8.3% | (1.6%-19.6%) |
| Kuwait | 0% | Not applicable |
| Malaysia | 16.0% | Not applicable |
| Pakistan | 41.8% | (35.8%-48.0%) |
| Saudi Arabia | 18.6% | Not applicable |
| South Korea | 10.4% | (8.3%-12.8%) |
| Taiwan | 18.5% | (5.8%-36.3%) |
| Thailand | 35.5% | (11.8%-64.0%) |
| Turkey | 14.2% | (8.6%-21.0%) |
| Europe | 22.7% | (20.6%-25.0%) |
| Belgium | 18.0% | Not applicable |
| Czech Republic | 41.0% | Not applicable |
| Denmark | 24.1% | (9.2%-43.2%) |
| Faroe Islands | 8.8% | Not applicable |
| Finland | 30.0% | (25.3%-35.0%) |
| France | 16.3% | (7.9%-26.9%) |
| Germany | 20.5% | (17.6%-23.5%) |
| Greece | 18.2% | (3.6%-40.6%) |
| Hungary | 37.9% | Not applicable |
| Iceland | 22.0% | (10.7%-35.9%) |
| Ireland | 29.0% | Not applicable |
| Italy | 30.5% | (24.8%-36.4%) |
| Macedonia | 13.1% | Not applicable |
| Norway | 27.1% | (13.3%-43.7%) |
| Poland | 17.0% | (6.2%-31.7%) |
| Scotland | 13.8% | Not applicable |
| Slovakia | 21.3% | Not applicable |
| Spain | 18.7% | (15.0%-22.7%) |
| Sweden | 22.4% | (16.4%-29.0%) |
| The Netherlands | 19.2% | (9.2%-31.8%) |
| United Kingdom | 19.4% | (12.5%-27.6%) |
| North America | 19.5% | (17.1%-22.1%) |
| Canada | 24.6% | (17.3%-32.7%) |
| United States | 19.0% | (16.3%-21.8%) |
| South America | 21.5% | (15.4%-28.2%) |
| Argentina | 17.8% | (12.4%-24.0%) |
| Brazil | 25.2% | (18.6%-32.3%) |
| Chile | 6.5% | Not applicable |

*CI*, Confidence interval; *PsA*, psoriatic arthritis.

**Supplemental Table II.** Results from quality assessment according to the Newcastle-Ottawa Scale

| Author | Selection | Comparability | Outcome/exposure | Total |
|---|---|---|---|---|
| Green et al[S1] (1981) | 2 | 0 | 2 | 4/10 |
| Scarpa et al[S2] (1984) | 2 | — | 2 | 4/8 |
| Economidou et al[S3] (1985) | 1 | 2 | 2 | 5/9 |
| Stern[S4] (1985) | 2 | — | 3 | 5/8 |
| Gottlieb et al[S5] (1987) | 2 | — | 3 | 5/8 |
| Kononen et al[S6] (1987) | 2 | 0 | 2 | 4/10 |
| Oriente et al[S7] (1989) | 2 | — | 2 | 4/8 |
| Zanolli and Wikle[S8] (1992) | 1 | — | 1 | 2/8 |
| Falk and Vandbakk[S9] (1993) | 2 | — | 2 | 4/8 |
| Oriente et al[S10] (1994) | 3 | — | 3 | 6/8 |
| Salvarani et al[S11] (1995) | 2 | 2 | 2 | 6/10 |
| Fleischer et al[S12] (1996) | 2 | — | 3 | 5/8 |
| Baek et al[S13] (2000) | 2 | 2 | 3 | 7/10 |
| Lundberg et al[S14] (2000) | 1 | 2 | 2 | 5/10 |
| Shbeeb et al[S15] (2000) | 5 | — | 3 | 8/8 |
| Alenius et al[S16] (2002) | 3 | — | 3 | 6/8 |
| Ferrandiz et al[S17] (2002) | 2 | — | 3 | 5/8 |
| Kundakci et al[S18] (2002) | 2 | — | 3 | 5/8 |
| Zachariae et al[S19] (2002) | 3 | — | 3 | 6/8 |
| Kawada et al[S20] (2003) | 1 | — | 2 | 3/8 |
| Chodorowska et al[S21] (2004) | 4 | 2 | 2 | 8/9 |
| Kumar et al[S22] (2004) | 3 | — | 3 | 6/8 |
| Dervis[S23] (2005) | 4 | 2 | 2 | 8/9 |
| Gelfand et al[S24] (2005) | 2 | — | 3 | 5/8 |
| Gisondi et al[S25] (2005) | 3 | — | 3 | 6/8 |
| Mallbris et al[S26] (2005) | 2 | — | 3 | 5/8 |
| Gudjonsson et al[S27] (2006) | 3 | — | 3 | 6/8 |
| Ojetti et al[S28] (2006) | 4 | 2 | 2 | 8/9 |
| Seyhan et al[S29] (2006) | 2 | 0 | 3 | 5/10 |
| Sommer et al[S30] (2006) | 4 | 2 | 3 | 9/9 |
| Al-Mutairi et al[S31] (2007) | 2 | — | 3 | 5/8 |
| Altobelli et al[S32] (2007) | 2 | 2 | 3 | 7/10 |
| Dayangac-Erden et al[S33] (2007) | 0 | 2 | 2 | 4/9 |
| Fan et al[S34] (2007) | 2 | — | 3 | 5/8 |
| Gisondi et al[S35] (2007) | 4 | 2 | 2 | 8/9 |
| Husni et al[S36] (2007) | 2 | — | 3 | 5/8 |
| Schmitt and Ford[S37] (2007) | 3 | — | 3 | 6/8 |
| Jamshidi et al[S38] (2008) | 4 | — | 2 | 6/8 |
| Callis Duffin et al[S39] (2009) | 2 | — | 3 | 5/8 |
| Dominguez et al[S40] (2009) | 2 | — | 3 | 5/8 |
| Ejaz et al[S41] (2009) | 2 | — | 3 | 5/8 |
| Guinot et al[S42] (2009) | 2 | — | 3 | 5/8 |
| Ibrahim et al[S43] (2009) | 2 | — | 3 | 5/8 |
| Lynde et al[S44] (2009) | 2 | 2 | 2 | 6/10 |
| Miele et al[S45] (2009) | 4 | 2 | 2 | 8/9 |
| Radtke et al[S46] (2009) | 4 | — | 3 | 7/8 |
| Reich et al[S47] (2009) | 4 | 1 | 3 | 8/10 |
| Soy et al[S48] (2009) | 0 | 2 | 2 | 4/9 |
| Takahashi et al[S49] (2009) | 4 | — | 3 | 7/8 |
| Wasel et al[S50] (2009) | 3 | — | 3 | 6/8 |
| Yu et al[S51] (2009) | 4 | 2 | 3 | 9/9 |
| Bandoli et al[S52] (2010) | 4 | 2 | 2 | 8/9 |
| Chandran and Raychaudhuri[S53] (2010) | 2 | 2 | 2 | 6/9 |
| Christophers et al[S54] (2010) | 4 | 2 | 3 | 9/10 |
| Kacar et al[S55] (2010) | 2 | 0 | 3 | 5/10 |

Continued

**Supplemental Table II.** Cont'd

| Author | Selection | Comparability | Outcome/exposure | Total |
|---|---|---|---|---|
| Karadag et al[S56] (2010) | 4 | 2 | 2 | 8/9 |
| Lecluse et al[S57] (2010) | 4 | 2 | 3 | 9/9 |
| Natarajan et al[S58] (2010) | 2 | — | 2 | 4/8 |
| Palotai et al[S59] (2010) | 4 | — | 3 | 7/8 |
| Reich et al[S60] (2010) | 3 | 2 | 3 | 8/10 |
| Singh and Singh[S61] 2010 | 1 | 2 | 1 | 4/9 |
| Sultan et al[S62] (2010) | 2 | 2 | 2 | 6/9 |
| Vena et al[S63] (2010) | 4 | 2 | 3 | 9/9 |
| Zaragoza et al[S64] (2010) | 2 | — | 3 | 5/8 |
| Brunasso et al[S65] (2011) | 4 | 2 | 2 | 8/9 |
| De Simone et al[S66] (2011) | 2 | 2 | 1 | 5/9 |
| Ghajarzadeh et al[S67] (2011) | 4 | 2 | 2 | 8/9 |
| Hay and Rashed[S68] (2011) | 4 | 2 | 2 | 8/9 |
| Kimball et al[S69] (2011) | 4 | 2 | 3 | 9/9 |
| Ozden et al[S70] (2011) | 4 | 2 | 3 | 9/9 |
| Strober et al[S71] (2011) | 2 | — | 3 | 5/8 |
| Valenzuela et al[S72] (2011) | 3 | 2 | 1 | 6/10 |
| Van Lumig et a[S73] (2011) | 3 | — | 3 | 6/8 |
| Verghese et al[S74] (2011) | 4 | 2 | 2 | 8/9 |
| Warnecke et al[S75] (2011) | 4 | 2 | 2 | 8/9 |
| Yang et al[S76] (2011) | 3 | — | 3 | 6/8 |
| Zervou et al[S77] (2011) | 4 | 2 | 2 | 8/9 |
| Zhang et al[S78] (2011) | 3 | 2 | 2 | 7/9 |
| Armesto et al[S79] (2012) | 2 | 2 | 2 | 6/9 |
| Armstrong et al[S80] (2012) | 2 | 2 | 3 | 7/10 |
| Bonifati et al[S81] (2012) | 2 | — | 3 | 5/8 |
| Brazelli et al[S82] (2012) | 3 | — | 3 | 6/8 |
| Carneiro et al[S83] (2012) | 3 | — | 3 | 6/8 |
| Cemil et al[S84] (2012) | 2 | 2 | 2 | 6/9 |
| De Marco et al[S85] (2012) | 2 | — | 3 | 5/8 |
| Ghatnekar et al[S86] (2012) | 2 | — | 2 | 4/8 |
| Gisondi et al[S87] (2012) | 3 | 2 | 2 | 7/9 |
| Gisondi et al[S88] (2012) | 3 | 2 | 2 | 7/9 |
| Grozdev et al[S89] (2012) | 3 | 2 | 3 | 8/10 |
| Khraishi et al[S90] (2012) | 2 | — | 3 | 5/8 |
| Kimball et al[S91] (2012) | 4 | 2 | 3 | 9/9 |
| Li et al[S92] (2012) | 1 | — | 2 | 3/8 |
| Madanagobalane and Anandan[S93] (2012) | 3 | 2 | 2 | 7/9 |
| Maradit-Kremers et al[S94] (2012) | 4 | 2 | 3 | 9/9 |
| Orgaz-Molina et al[S95] (2012) | 4 | 2 | 3 | 9/9 |
| Szponar et al[S96] (2012) | 2 | 2 | 2 | 6/9 |
| Tinazzi et al[S97] (2012) | 2 | — | 3 | 5/8 |
| Wee et al[S98] (2012) | 2 | 2 | 2 | 6/10 |
| Wu et al[S99] (2012) | 4 | 2 | 3 | 9/9 |
| Atwa et al[S100] (2012) | 2 | 2 | 2 | 6/10 |
| Coates et al[S101] (2013) | 2 | 2 | 3 | 7/10 |
| Dameskva et al[S102] (2013) | 4 | 2 | 2 | 8/9 |
| Di Cesare et al[S103] (2013) | 3 | 2 | 2 | 7/9 |
| Haroon et al[S104] (2013) | 3 | — | 3 | 6/8 |
| Kilic et al[S105] (2013) | 4 | 2 | 2 | 8/9 |
| Klassen et al[S106] (2013) | 3 | — | 3 | 6/8 |
| Lora et al[S107] (2013) | 3 | 2 | 2 | 7/9 |
| Mercy et al[S108] (2013) | 3 | — | 3 | 6/8 |
| Moro et al[S109] (2013) | 3 | 2 | 3 | 8/10 |
| Paller et al[S110] (2013) | 3 | 2 | 3 | 8/10 |

Continued

**Supplemental Table II.** Cont'd

| Author | Selection | Comparability | Outcome/exposure | Total |
|---|---|---|---|---|
| Van Der Velden et al[S111] (2013) | 4 | 2 | 3 | 9/9 |
| Walsh et al[S112] (2013) | 2 | — | 3 | 5/8 |
| Albareda et al[S113] (2014) | 4 | 2 | 2 | 8/9 |
| Augustin et al[S114] (2014) | 4 | — | 3 | 7/8 |
| Baeta et al[S115] (2014) | 2 | 2 | 3 | 7/10 |
| Bardazzi et al[S116] (2014) | 2 | 2 | 3 | 7/10 |
| D'Epiro et al[S117] (2014) | 1 | — | 3 | 4/8 |
| Eirís et al[S118] (2014) | 3 | 2 | 2 | 7/9 |
| Fernandez-Torrez et al[S119] (2014) | 3 | — | 3 | 6/8 |
| Ficco et al[S120] (2014) | 3 | — | 3 | 6/8 |
| Gisondi et al[S121] (2014) | 4 | 2 | 2 | 8/9 |
| Henes et al[S122] (2014) | 2 | 2 | 3 | 7/10 |
| Kimball et al[S123] (2014) | 4 | — | 3 | 7/8 |
| Kimball et al[S124] (2014) | 4 | 2 | 3 | 9/9 |
| Kokpol et al[S125] (2014) | 4 | 2 | 3 | 9/9 |
| Kumar et al[S126] (2014) | 3 | — | 3 | 6/8 |
| Lofvendahl et al[S127] (2014) | 5 | — | 3 | 8/8 |
| Mease et al[S128] (2014) | 5 | — | 3 | 8/8 |
| Menegón et al[S129] (2014) | 4 | 2 | 2 | 8/9 |
| Morisco et al[S130] (2014) | 2 | 2 | 3 | 7/8 |
| Moustou et al[S131] (2014) | 5 | — | 3 | 8/8 |
| Sanchez-Carazo et al[S132] (2014) | 3 | 2 | 2 | 7/8 |
| Wu et al[S133] (2014) | 2 | — | 3 | 5/8 |
| Belinchón et al[S134] (2015) | 4 | 2 | 3 | 9/10 |
| Campanati et al[S135] (2015) | 3 | 2 | 3 | 8/10 |
| Cinar et al[S136] (2015) | 2 | — | 3 | 5/8 |
| Crincoli et al[S137] (2015) | 3 | 2 | 2 | 7/9 |
| Estebaranz et al[S138] (2015) | 2 | 2 | 2 | 6/10 |
| Feldman et al[S139] (2015) | 4 | 2 | 3 | 9/9 |
| Geel et al[S140] (2015) | 4 | — | 3 | 7/8 |
| Gilet et al[S141] (2015) | 4 | — | 3 | 7/8 |
| Gniadecki et al[S142] (2015) | 5 | 2 | 3 | 10/10 |
| Iskandar et al[S143] (2015) | 3 | 2 | 3 | 8/10 |
| Liamas-Velasco et al[S144] (2015) | 2 | 2 | 2 | 6/10 |
| Lysell et al[S145] (2015) | 2 | 2 | 3 | 7/10 |
| Mahé et al[S146] (2015) | 4 | 2 | 2 | 8/9 |
| Ng et al[S147] (2015) | 4 | 2 | 3 | 9/10 |
| Ohara et al[S148] (2015) | 2 | — | 3 | 5/8 |
| Ranza et al[S149] (2015) | 1 | — | 3 | 4/8 |
| Schons et al[S150] (2015) | 2 | 2 | 3 | 7/10 |
| Spelman et al[S151] (2015) | 2 | — | 3 | 5/8 |
| Tabolli et al[S152] (2015) | 4 | 2 | 3 | 9/10 |
| Takeshita et al[S153] (2015) | 5 | 2 | 3 | 10/10 |
| Truong et al[S154] (2015) | 2 | — | 3 | 5/8 |
| Vanaclocha et al[S155] (2015) | 3 | 2 | 3 | 8/10 |
| Vijay[S156] (2015) | 2 | — | 3 | 5/8 |
| You et al[S157] (2015) | 2 | — | 3 | 5/8 |
| Abji et al[S158] (2016) | 3 | 2 | 3 | 8/10 |
| Cardili et al[S159] (2016) | 3 | 2 | 2 | 7/9 |
| Carpentieri et al[S160] (2016) | 4 | 2 | 3 | 9/10 |
| Chek et al[S161] (2016) | 5 | 2 | 3 | 10/10 |
| Chiowchanwisawakit et al[S162] (2016) | 2 | — | 3 | 5/8 |
| Coates et al[S163] (2016) | 2 | 2 | 2 | 6/10 |
| Esposito et al[S164] (2016) | 2 | — | 3 | 5/8 |
| Finet et al[S165] (2016) | 3 | 2 | 3 | 8/10 |

Continued

**Supplemental Table II.** Cont'd

| Author | Selection | Comparability | Outcome/exposure | Total |
|---|---|---|---|---|
| Fuxench et al[S166] (2016) | 4 | 2 | 3 | 9/9 |
| Garbers et al[S167] (2016) | 2 | — | 3 | 5/8 |
| Gisondi et al[S168] (2016) | 3 | 2 | 2 | 8/9 |
| Gisondi and Girolomoni[S169] (2016) | 2 | — | 3 | 5/8 |
| Harle et al[S170] (2016) | 3 | — | 3 | 6/8 |
| Hsu et al[S171] (2016) | 3 | 2 | 3 | 8/10 |
| Indhumathi et al[S172] (2016) | 2 | 2 | 2 | 6/9 |
| Jungo et al[S173] (2016) | 2 | 1 | 2 | 5/10 |
| Karreman et al[S174] (2016) | 3 | — | 3 | 6/8 |
| Klufas et al[S175] (2016) | 1 | — | 3 | 4/8 |
| Langenbruch et al[S176] (2016) | 3 | — | 3 | 6/8 |
| Luca et al[S177] (2016) | 2 | — | 3 | 5/8 |
| Papadavid et al[S178] (2016) | 1 | 2 | 2 | 5/10 |
| Pongpit et al[S179] (2016) | 3 | 2 | 3 | 8/10 |
| Reich et al[S180] (2016) | 3 | — | 3 | 6/8 |
| Resorlu et al[S181] (2016) | 1 | 2 | 2 | 5/10 |
| Rutter et al[S182] (2016) | 3 | 2 | 3 | 8/10 |
| Santilli et al[S183] (2016) | 4 | 2 | 2 | 8/9 |
| Sherin and Udaykumar[S184] (2016) | 2 | — | 3 | 5/8 |
| Shin et al[S185] (2016) | 2 | — | 3 | 5/8 |
| Siddiqui et al[S186] (2016) | 4 | — | 32 | 7/8 |
| Sudhesan et al[S187] (2016) | 3 | 2 | 2 | 7/9 |
| Temel et al[S188] (2016) | 3 | 2 | 3 | 8/9 |
| Urbancek et al[S189] (2016) | 2 | — | 3 | 5/8 |
| Vilarrasa et al[S190] (2016) | 3 | — | 3 | 6/8 |
| Wade et al[S191] (2016) | 4 | — | 3 | 7/8 |
| Asgari et al[S192] (2017) | 4 | 2 | 3 | 9/9 |
| Augustin et al[S193] (2017) | 2 | 2 | 2 | 6/10 |
| Belinchón et al[S194] (2017) | 3 | 2 | 3 | 8/10 |
| Bronckers et al[S195] (2017) | 2 | 2 | 3 | 7/10 |
| Chen et al[S196] (2017) | 4 | 2 | 3 | 9/10 |
| Chi et al[S197] (2017) | 4 | 2 | 3 | 9/9 |
| Daulatabad et al[S198] (2017) | 2 | — | 2 | 4/8 |
| Dogan et al[S199] (2017) | 2 | — | 3 | 5/8 |
| Egeberg et al[S200] (2017) | 4 | 2 | 3 | 9/9 |
| Eppinga et al[S201] (2017) | 1 | 2 | 2 | 5/10 |
| Ergun et al[S202] (2017) | 3 | 2 | 3 | 7/9 |
| Feldman et al[S203] (2017) | 4 | 2 | 3 | 9/9 |
| Girisha and Thomas[S204] (2017) | 3 | 2 | 3 | 8/9 |
| Hagg et al[S205] (2017) | 4 | 2 | 3 | 9/10 |
| Herakal et al[S206] (2017) | 2 | 2 | 2 | 6/9 |
| Hsiao et al[S207] (2017) | 1 | 2 | 1 | 4/10 |
| Kelati et al[S208] (2017) | 2 | — | 3 | 5/8 |
| Kisiel et al[S209] (2017) | 2 | 2 | 3 | 7/9 |
| Kojanova et al[S210] (2017) | 3 | 2 | 2 | 7/10 |
| Lamb et al[S211] (2017) | 3 | 2 | 2 | 7/10 |
| Mishra et al[S212] (2017) | 2 | — | 3 | 5/8 |
| Mysliwiec et al[S213] (2017) | 2 | 2 | 2 | 6/9 |
| Pourchot et al[S214] (2017) | 3 | 2 | 2 | 7/10 |
| Shalom et al[S215] (2017) | 3 | 2 | 3 | 8/10 |
| Tsuruta et al[S216] (2017) | 4 | 2 | 3 | 9/9 |
| Vassilatou et al[S217] (2017) | 4 | 2 | 3 | 9/9 |
| Zweegers et al[S218] (2017) | 3 | 2 | 2 | 7/10 |

**Supplemental Table III.** Results from the heterogeneity assessment analysis

| Analysis | Cochran Q | $I^2$ (inconsistency) |
|---|---|---|
| All studies | 51,353.956365 (df = 265), $P < .0001$ | 99.5% (95% CI = 99.5%-99.5%) |
| Children/adolescents | 257.50413 (df = 20), $P < .0001$ | 92.2% (95% CI = 89.9%-93.8%) |
| Adults | 49,850.155111 (df = 244), $P < .0001$ | 99.5% (95% CI = 99.5%-99.5%) |
| Women | 851.049548 (df = 35), $P < .0001$ | 95.9% (95% CI = 95.3%-96.4%) |
| Men | 944.758517 (df = 35), $P < .0001$ | 96.3% (95% CI = 95.8%-96.7%) |
| CASPAR | 1,375.560066 (df = 44), $P < .0001$ | 96.8% (95% CI = 96.4%-97.1%) |
| Moll and Wright criteria | 2,106.084629 (df = 19), $P < .0001$ | 99.1% (95% CI = 99.0%-99.2%) |
| Europe | 20,268.547922 (df = 118), $P < .0001$ | 99.4% (95% CI = 99.4%-99.4%) |
| Asia | 6,606.785307 (df = 58), $P < .0001$ | 99.1% (95% CI = 99.1%-99.2%) |
| North America | 12,837.963169 (df = 46), $P < .0001$ | 99.6% (95% CI = 99.6%-99.7%) |
| South America | 88.934535 (df = 9), $P < .0001$ | 89.9% (95% CI = 83.9%-92.9%) |
| Africa | 93.720955 (df = 2), $P < .0001$ | 97.9% (95% CI = 96.6%-98.5%) |
| Italy | 1,885.727292 (df = 35), $P < .0001$ | 98.1% (95% CI = 98.0%-98.3%) |
| Spain | 281.89573 (df = 16), $P < .0001$ | 94.3% (95% CI = 92.7%-95.4%) |
| Germany | 128.502938 (df = 11), $P < .0001$ | 91.4% (95% CI = 87.5%-93.7%) |
| The Netherlands | 1,113.346677 (df = 10), $P < .0001$ | 99.1% (95% CI = 99.0%-99.2%) |
| Sweden | 562.515846 (df = 7), $P < .0001$ | 98.8% (95% CI = 98.5%-98.9%) |
| Denmark | 1,287.043367 (df = 4), $P < .0001$ | 99.7% (95% CI = 99.7%-99.7%) |
| Greece | 360.162616 (df = 4), $P < .0001$ | 98.9% (95% CI = 98.6%-99.1%) |
| Poland | 65.734974 (df = 3), $P < .0001$ | 95.4% (95% CI = 91.9%-97.0%) |
| Finland | 7.536024 (df = 1), $P = .006$ | Not available |
| Norway | 4.509611 (df = 1), $P = .0337$ | Not available |
| France | 146.803591 (df = 6), $P < .0001$ | 95.9% (95% CI = 94.2%-96.9%) |
| United Kingdom | 1,827.634289 (df = 9), $P < .0001$ | 99.5% (95% CI = 99.5%-99.5%) |
| Iceland | 28.63972 (df = 1), $P < .0001$ | Not available |
| Turkey | 237.463501 (df = 14), $P < .0001$ | 94.1% (95% CI = 92.3%-95.3%) |
| India | 406.101175 (df = 14), $P < .0001$ | 96.6% (95% CI = 95.8%-97.1%) |
| Japan | 1,022.726575 (df = 4), $P < .0001$ | 99.6% (95% CI = 99.6%-99.7%) |
| China | 330.786131 (df = 4), $P < .0001$ | 98.8% (95% CI = 98.5%-99.0%) |
| Thailand | 186.146537 (df = 3), $P < .0001$ | 98.4% (95% CI = 97.8%-98.8%) |
| Taiwan | 137.701857 (df = 2), $P < .0001$ | 98.5% (95% CI = 97.9%-98.9%) |
| South Korea | 1.489581 (df = 2), $P = .4748$ | 0% (95% CI = 0-72.9%) |
| Iran | 5.514712 (df = 1), $P = .0189$ | Not available |
| Pakistan | 1.152595 (df = 1), $P = .283$ | Not available |
| United States | 11,629.796979 (df = 35), $P < .0001$ | 99.7% (95% CI = 0 to $-\infty$) |
| Canada | 122.287039 (df = 7), $P < .0001$ | 94.3% (95% CI = 91.5%-95.8%) |
| Brazil | 46.80496 (df = 6), $P < .0001$ | 87.2% (95% CI = 74.8%-92.0%) |
| Argentina | 0.047787 (df = 1), $P = .827$ | Not available |
| Population size <500 | 3,980.059445 (df = 172), $P < .0001$ | 95.7% (95% CI = 95.4%-95.9%) |
| Population size 500-1000 | 1,949.067349 (df = 34), $P < .0001$ | 98.3% (95% CI = 98.1%-98.4%) |
| Population size ≥1000 | 35,372.117945 (df = 56), $P < .0001$ | 99.8% (95% CI = 99.8%-99.8%) |
| Published before 2000 | 338.550153 (df = 12), $P < .0001$ | 96.5% (95% CI = 95.6%-97.1%) |
| Published in 2000-2009 | 10,168.059791 (df = 50), $P < .0001$ | 99.5% (95% CI = 99.5%-99.5%) |
| Published in 2010-2017 | 39,582.143547 (df = 201), $P < .0001$ | 99.5% (95% CI = 99.5%-99.5%) |
| Clinical trials | 595.721927 (df = 33), $P < .0001$ | 94.5% (95% CI = 93.5%-95.2%) |
| Observational studies | 9,007.731995 (df = 160), $P < .0001$ | 98.2% (95% CI = 98.1%-98.3%) |
| Register-based studies | 22,975.476167 (df = 47), $P < .0001$ | 99.8% (95% CI = 99.8%-99.8%) |
| Population-based studies | 20,547.466663 (df = 45), $P < .0001$ | 99.8% (95% CI = 0 to $-\infty$) |
| NOS, good quality | 36,374.576652 (df = 133), $P < .0001$ | 99.6% (95% CI = 0 to $-\infty$) |
| NOS, fair or poor quality | 8,789.763402 (df = 83), $P < .0001$ | 99.1% (95% CI = 99.0%-99.1%) |

*CASPAR*, Classification Criteria for Psoriatic Arthritis; *CI*, confidence interval; *df*, degrees of freedom; *NOS*, Newcastle-Ottawa Scale.

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