The Epidemiology of Psoriatic Arthritis

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KEYWORDS

• Psoriatic arthritis • Juvenile psoriatic arthritis • Epidemiology • Classification criteria • Screening tools • Risk factors • Comorbidity

KEY POINTS

- Psoriatic arthritis (PsA) is a clinically heterogeneous inflammatory arthritis that is common among patients with psoriasis.
- PsA remains underdiagnosed.
- Early identification of PsA is important in order to improve long-term outcomes.
- Knowledge of risk factors for PsA and use of screening tools may improve recognition of PsA among patients with psoriasis.

INTRODUCTION

Psoriatic arthritis (PsA) is a chronic, progressive inflammatory arthritis that is common among patients with psoriasis and may result in permanent joint damage and disability. PsA was once considered a relatively benign disease; however, research over the past 20 years has significantly changed this notion. It is now known that PsA is a systemic inflammatory disorder with health consequences beyond joint function, such as cardiovascular disease, and similar outcomes to rheumatoid arthritis (RA), including the prevalence of erosions and joint destruction.[1,2] In addition, it has been learned that patients with PsA have highly heterogeneous disease courses.[3] In this review, current knowledge is discussed about the epidemiology of PsA, including prevalence of disease characteristics, classification of adult and pediatric PsA, and the importance of early diagnosis of PsA, including methods for screening and knowledge regarding risk factors for the development of PsA. Finally, medical comorbidities associated with PsA are discussed.

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METHODS

The authors performed a systematic review by combining "psoriasis or psoriatic arthritis" with the following MeSH terms: epidemiology, classification, diagnosis, complications, mortality in Ovid Medline. This review resulted in 8936 citations. After limiting to English papers, humans, and 2006 to current, 3515 citations remained. Titles and abstracts were reviewed for these remaining papers. Papers were excluded if they did not refer to psoriasis or PsA (N = 288), were case reports (N = 644), reviews or editorials (N = 383), or focused on basic science or immunology topics (N = 210). Finally, 1698 papers were excluded because they focused on skin psoriasis exclusively or were not relevant to the topics of interest. The authors also included articles before 2006 if cited within articles retrieved by the Medline search and if they were considered highly relevant. Abstracts from meeting conferences were not included.

PREVALENCE AND INCIDENCE OF PSORIATIC ARTHRITIS IN THE POPULATION

Several studies have examined the prevalence of PsA in countries all over the world. Prevalence estimates in the United States range from 0.06% to 0.25% with the lowest estimate derived from a paper that used International Classification of Disease, ninth edition (ICD-9), codes to identify cases and the highest from articles using patient self-report of diagnosis of PsA.[4–6] Prevalence estimates in Europe range from 0.05% in Turkey[7] and the Czech Republic[8] to 0.21% in Sweden.[9–12] Only a few reports of the prevalence of PsA in South America and Asia exist and suggest that the prevalence is lower in these regions (0.07% in Buenos Aires and 0.02% in China).[13,14] The low prevalence of PsA in China may be due to underdiagnosis, as suggested in a study by Yang and colleagues.[15] Discrepancies in the prevalence of PsA among these studies is often related to differing definitions of PsA (eg, use of ICD-9 or medical codes vs use of clinical classification criteria). The incidence of PsA in the general population has been examined by relatively few studies. The reported incidence of PsA in recent publications ranges from 3.6 to 7.2 per 100,000 person-years.[8,13,16,17] However, publications in 2001 to 2003 reported a much wider incidence range (0.1–23.1).[18]

PREVALENCE AND INCIDENCE OF PSORIATIC ARTHRITIS AMONG PATIENTS WITH PSORIASIS

Although PsA has a low prevalence in the general population, it is common among patients with psoriasis. Again, prevalence estimates vary considerably (range 6%–41%) depending on the definitions used (ie, diagnostic codes, rheumatologist diagnosis, classification criteria, diagnostic codes, and the populations measured).[10,11,14,15,19–28] Wilson and colleagues examined the cumulative incidence of PsA over time in patients with psoriasis and reported 1.7%, 3.1%, and 5.1%, respectively, had developed PsA at 5, 10, and 20 years after their diagnosis of psoriasis.[17] Eder and colleagues[29] reported an annual incidence of 1.87% in a prospective cohort of 313 patients with psoriasis.

ALTERNATIVE DIAGNOSES, MISSED DIAGNOSES, AND MISCLASSIFICATION IN STUDIES OF PSORIATIC ARTHRITIS

Studying the epidemiology of PsA is challenging given the absence of definitive, gold-standard diagnostic tests for PsA and the heterogeneous manifestations of the disease. In addition, patients with psoriasis often have other common reasons for joint

pain, such as osteoarthritis, gout, and fibromyalgia, which can easily be mistaken for PsA.[30–34] When using diagnosis codes to define PsA, there is often a concern for misclassification given that patients with psoriasis could have one of these alternate diagnoses. Unfortunately, without examination, this issue is difficult to resolve, and this is often a tradeoff for the large sample sizes and rich outcome data afforded by administrative and medical record data. Similarly, studies examining outcomes in patients with PsA compared with psoriasis alone, even within a clinic-based population, may suffer from misclassification of patients with psoriasis and undiagnosed PsA. Studies examining the prevalence of PsA among patients with psoriasis have found that underdiagnosis is common.[15,21,25] Mease and colleagues[25] found a prevalence of PsA of 30% among patients with psoriasis, and among the 285 patients with PsA, 117 (41%) were not previously diagnosed, suggesting a high prevalence of underdiagnosis.

DEFINING AND CLASSIFYING PSORIATIC ARTHRITIS

Classification criteria are designed to create more homogenous populations for research.[35] Several sets of classification criteria for PsA have been created since the original Moll and Wright criteria in 1973.[36] These criteria include the Amor criteria, European Spondylarthropathy Study Group criteria, Vasey and Espinoza criteria, and Classification of Psoriatic Arthritis (CASPAR) criteria.[3,37–42] There is a great deal of variability among the criteria components and test performance of each (sensitivity and specificity). Rheumatologist diagnosis is most commonly used as the reference standard.[43,44] The CASPAR criteria are the most widely used criteria, and their high sensitivity and specificity (both 90% or better in most studies but sensitivity as low as 77.3% in D'Angelo and colleagues[45]) have been demonstrated in many settings, including dermatology and rheumatology clinics, family practice clinics, and among early arthritis cohorts (despite early suggestions that CASPAR criteria were not ideal for early disease).[42,46–50] Most recently, the Assessment of SpondyloArthritis International Society (ASAS) developed peripheral and axial spondyloarthropathy (AxSpA) criteria. PsA could be classified under either of these criteria depending on whether axial involvement is present (**Table 1**).[51,52] In a recent study by Van den Berg and colleagues,[46] the peripheral spondyloarthropathy criteria were found to have much lower sensitivity for early PsA compared with CASPAR criteria using the diagnosis from the treating rheumatologist as the gold standard. It is unclear what role the new peripheral ASAS criteria will play in studies of PsA.[53]

PSORIATIC ARTHRITIS IS A HETEROGENEOUS DISEASE

PsA is a clinically heterogeneous disorder. Five subtypes of psoriatic arthritis were initially defined by Moll and Wright: monoarthritis or oligoarthritis, polyarthritis, distal interphalangeal (DIP) joint predominant disease, psoriatic spondylitis or sacroiliitis, and arthritis mutilans.[36] It is now recognized that patients can have any combination of the disease features: peripheral arthritis (monoarticular, oligoarticular, or polyarticular with or without DIP involvement), enthesitis, dactylitis, spondylitis or sacroiliitis, as well as psoriatic nail disease.[3] Peripheral arthritis (either oligoarticular or polyarticular depending on the cohort examined) is the most common disease manifestation. Arthritis mutilans, although one of the original 5 subtypes of PsA identified by Moll and Wright, is thought to be overall quite rare. However, the prevalence of arthritis mutilans is difficult to determine given the varied definitions.[54] As noted, the relative prevalence of the various manifestations varies considerably by site and study (**Fig. 1**).[10,15–17,28,55–60] This variation is in particular due to the highly varied definitions

Table 1
Commonly used classification criteria for psoriatic arthritis[a] and new Assessment of SpondyloArthritis International Society criteria for peripheral and axial SpA

Moll and Wright	CASPAR	Peripheral SpA		Axial SpA	
All 3 of the following:	Inflammatory articular disease (joint, spine, or entheseal) with ≥3 points from the following 5 categories:	Arthritis or enthesitis or dactylitls plus either:		Sacroiliitis on imaging plus ≥1 SpA feature	HLA-B27 plus ≥2 SpA features
1. Inflammatory arthritis (peripheral arthritis or sacroiliitis or spondylitis) 2. Psoriasis 3. Negative RF (usually)	1. Current psoriasis (2 pts), personal history of psoriasis or family history of psoriasis (1 pt) 2. Psoriatic nail dystrophy (onycholysis, pitting, or hyperkeratosis) on exam (1 pt) 3. Negative RF (1 pt) 4. Current dactylitis or history of dactylitis recorded by rheumatologist (1 pt) 5. Evidence of juxta-articular new bone formation (excluding osteophytes) on plain radiographs of the hand or foot (1 pt)	≥1 SpA feature: Uveitis Psoriasis Crohn's/ulcerative colitis Preceding infection HLA-B27 Sacroiliitis on imaging	≥2 other SpA features: Arthritis Enthesitis Dactylitis Inflammatory back pain ever Family history of SpA	SpA features: Inflammatory back pain Arthritis Enthesitis Dactylitis Psoriasis Crohn's/ulcerative colitis Good response to nonsteroidal anti-inflammatory drugs Family history of SpA HLA-B27 Elevated CRP	

[a] See Table 1 from Eder L, Gladman DD. Psoriatic arthritis: phenotypic variance and nosology. Curr Rheumatol Rep 2013;15:316 for comparison of additional classification criteria.

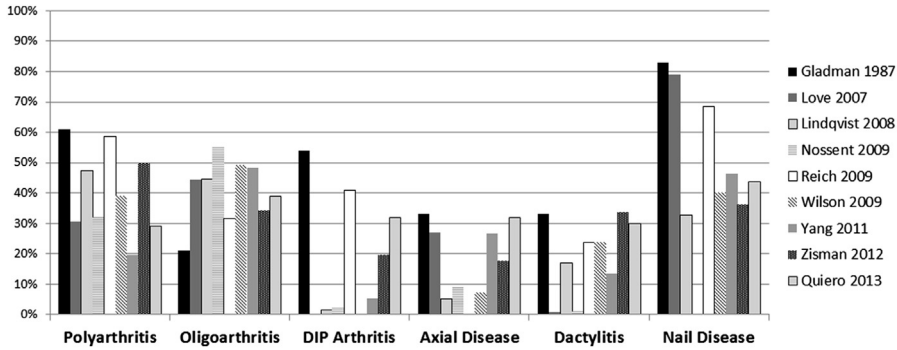

Fig. 1. Variability of disease characteristics by study. The prevalence of oligoarthritis, polyarthritis, axial disease, dactylitis, and nail disease in a handful of studies is shown. These manifestations of PsA, the definitions of the manifestations, and the populations included vary considerably by study. For example, Gladman, Lindqvist, and Love present data for patients at the first visit, whereas Wilson and Reich report data at incident diagnosis. Lindqvist represents a population of patients with early disease (<2 years' duration). Axial disease is particularly defined quite differently by study. Lindqvist used the original Moll and Wright subgroups to classify patients. Therefore, in that particular study, axial disease as represented here only refers to patients without peripheral arthritis (those patients are classified as oligoarthritis or polyarthritis). In Love and colleagues, axial disease represents patients with inflammatory back pain.

of subtypes (eg, allowing for more than one manifestation or exclusive classification) but also may reflect different subtypes in different populations, the duration of PsA in the population studied, the duration of psoriasis before PsA onset, or age and gender distribution of the population.[3,59,61] Recognizing the patient's disease features at onset and when selecting therapies may be important to understanding disease and treatment outcomes.[62] For example, polyarticular disease has been associated with more erosive disease,[63] and dactylitis may not respond as well to traditional oral disease-modifying antirheumatic drugs (DMARDs).[64]

Axial Spondyloarthropathy

Axial disease or psoriatic spondylitis is present in 7% to 32% of patients with PsA and may be asymptomatic.[10,15,58,65] Among patients with PsA without axial disease at presentation, nail dystrophy, number of radiographically damaged joints, periostitis, and elevated erythrocyte sedimentation rate increased the risk of developing AxSpA over time.[65] Among patients with psoriatic spondylitis, younger age of disease onset was associated with HLAB-27 positivity, family history of SpA, enthesitis, and an isolated axial pattern (without peripheral arthritis). Later, onset axial disease was more likely to be associated with polyarthritis and absence of inflammatory back pain. However, despite these differences, the 2 groups had similar patient-reported outcomes including the Bath Ankylosing Spondylitis Disease Activity Index, Bath Ankylosing Spondylitis Functional Index, Bath Ankylosing Spondylitis Metrology Index, and Bath Ankylosing Spondylitis Radiology Index.[66] Recognition of AxSpA is important given differing treatment approaches and prognosis.[67,68]

Enthesitis

Enthesitis, present in approximately half of patients, is hypothesized to be the site of disease initiation.[69] Enthesitis is generally more often found in the lower extremities

with the Achilles and plantar aponeurosis the most commonly involved sites.[70] Unfortunately, examination of the entheses is often subjective; there is low interrater reliability even when standardized examination techniques are used, and tenderness on examination is often discordant with findings of inflammation on ultrasound or other imaging techniques.[71–73] Thus, enthesitis is difficult to follow in studies of therapy effectiveness. The Leeds Enthesitis Index (LEI) is the most commonly used index in studies of PsA, but others exist as well.[70,74] The LEI includes assessment of the lateral epicondyles, proximal Achilles, and medial femoral condyles.[74] Ultrasound and MRI examination of the enthesis have improved the understanding of enthesitis and may provide a more objective method to assess and quantify enthesitis.[75,76]

Dactylitis

Dactylitis is a common feature in PsA, present in approximately 40% of patients at some point in their disease course, and can occur in either the feet or the hands.[64,70,77] About half of the patients that have dactylitis have it in more than one digit.[70] MRI studies suggest that dactylitis is circumferential soft tissue edema in addition to synovitis and tenosynovitis.[78] However, in a recent radiographic and histologic evaluation of dactylitis in a child, radiographic features included enhanced signal at digital entheses in the absence of synovitis and tenosynovitis.[79] Histologically, there was increased vascularity of the tenosynovium and fibromyxoid expansion of fibrous tissue with perivascular lymphocytic inflammation.

Nail Disease

Features of nail psoriasis include pitting, onycholysis, oil spots, linear pitting, and splinter hemorrhages.[24,80–82] Nail psoriasis can be quite painful and result in decreased functional ability and quality of life.[83] The prevalence of nail disease among patients with PsA ranges from 41% to 93%. In fact, most studies have found that nail disease is more common in patients with PsA than patients with psoriasis alone. The prevalence of nail disease in PsO is around 15% to 50%.[10,80,82,84–87] Nail disease (pitting and onycholysis in particular) has been associated with inflammation at the enthesis where the extensor tendon connects to the nail unit[88] and is often correlated with DIP joint involvement.[89,90] Furthermore, thickening of the entheses of the extensor tendon on ultrasound was more common in patients with clinical nail changes.[91] Nail psoriasis is a risk factor for the development of PsA among patients with PsA, possibly because it is an early sign of entheseal inflammation.[17]

Imaging Features and Distinguishing Characteristics from Rheumatoid Arthritis

PsA is associated with both bone erosions and new bone formation (ie, juxta-articular bony proliferation). Erosions occur commonly and often very early in the disease course.[60,92] Kane and colleagues[92] found the prevalence of erosions was 27% within the first 5 months of disease onset and nearly 50% within 2 years of disease onset. Interestingly, Finzel and colleagues[2] reported the number of erosions were similar among patients with RA and PsA, although the shape and location of the erosions were different between the 2 groups. In this study, osteophytes were more commonly seen among patients with PsA than RA. The number of erosions in PsA was correlated with disease duration and the osteophyte count was correlated with age but not disease duration.[2] Juxta-articular bony proliferation (not including osteophytes) is among the most specific radiographic features of PsA (as are tuft osteolysis and interphalangeal bony ankylosis).[42,93] However, DIP erosions, periosteal new bone formation, and diffuse soft tissue swelling may help distinguish RA from PsA.[93] Studies using MRI[94,95] and ultrasound[96] examined differences among patients with RA and PsA. Findings

from these studies have corroborated the differential locations of erosions between RA and PsA and the increased entheseal disease and periosteal involvement in PsA. In addition, imaging studies have demonstrated that there is more disease activity present on imaging than noted on physical examination (nearly 75% in one study by Freeston and colleagues[97]), although the clinical significance of this is not well understood.[91,98,99]

PSORIATIC ARTHRITIS IN CHILDREN

Psoriasis and PsA are not limited to adults. Juvenile psoriasis has a prevalence of approximately 0.7% increasing from 0.12% at age 1% to 1.2% at age 18.[100,101] Juvenile PsA (JPsA) accounts for approximately 6% to 8% of all cases of juvenile arthritis.[73,102,103] Unlike adult PsA, inflammatory arthritis precedes skin psoriasis in about half of children with JPsA,[104] often making the diagnosis and classification of JPsA quite challenging. Two sets of classification criteria for JPsA exist: the Vancouver criteria for PsA and the International League of Associations for Rheumatology (ILAR) criteria (**Table 2**). The ILAR criteria are the widely used criteria for classifying juvenile idiopathic arthritis (JIA) and include the following categories: oligoarticular, rheumatoid factor (RF)-positive polyarticular, RF-negative polyarticular, systemic, enthesitis-related arthritis (ERA), JPsA, and undifferentiated arthritis.[105,106] As shown in **Table 2**, the ILAR criteria include many restrictions on the diagnosis of JPsA, placing as many as 40% of children who meet Vancouver criteria into the undifferentiated category of JIA (children who meet criteria for more than 1 JIA category). Thus, there is some debate about how to best define JPsA.[104,107] An improved definition for JPsA

Table 2
Comparison of Vancouver criteria for juvenile psoriatic arthritis and International League of Associations for Rheumatology criteria for juvenile psoriatic arthritis

	Vancouver	ILAR
Inclusion	Arthritis plus psoriasis OR Arthritis plus at least 2 of the following: Dactylitis, nail pits, family history of first- or second-degree relative, psoriasis-like rash	Arthritis plus psoriasis OR Arthritis plus at least 2 of the following: Dactylitis, nail pits or onycholysis, family history of first-degree relative
Exclusion	None	Arthritis in HLA-B27 positive male ≥6-y-old AS, ERA, sacroilitis with IBD, reactive arthritis, or acute anterior uveitis, OR history of one of these disorders in a first-degree relative Presence of IgM RF on at least 2 occasions at least 3 mo apart The presence of systemic JIA Arthritis fulfilling ≥2 JIA categories

Arthritis must be of unknown cause, begin before the 16th birthday, and persist for at least 6 weeks.

Under the Vancouver criteria, definite JPsA is arthritis plus psoriasis or arthritis plus 3 minor criteria. Presence of 2 minor criteria is considered probable JPsA.

Abbreviations: AS, ankylosing spondylitis; IBD, inflammatory bowel disease.

Adapted from Stoll M, Lio P, Sundel RP, et al. Comparison of Vancouver and International League of Associations for rheumatology classification criteria for juvenile psoriatic arthritis. Arthritis Rheum 2008;59(10):52; with permission.

may be important as long-term outcomes are potentially different among patients with JPsA compared with other forms of JIA. Among patients with JPsA, 33% still required DMARDs or biological DMARDs after 15 years of follow-up compared with 8% to 13% of patients in other JIA groups.[108]

Similar to adult PsA, JPsA is a highly heterogeneous disease.[109] The prevalence of nail disease and dactylitis (approximately 50% each) is similar to adult PsA, and enthesitis is also common (present in 27% in one study).[109] Forty percent to 88% have an affected first- or second-degree relative, and axial involvement affects 10% to 40%.[108,110] However, disease manifestations seem to differ by age. Stoll and colleagues[101,109,111] described 2 peaks in onset with the first in toddlers (1–2 years) and the second in early adolescence (age 8–12 years). Younger children (age <5) were more likely to be girls and to have dactylitis, small joint involvement, and a positive antinuclear antibody (ANA), whereas older children were more likely to have persistent oligoarthritis, spondylitis, and enthesitis. Development of asymptomatic anterior uveitis is associated with ANA positivity and younger age of disease onset.[112] Also, similar to adult psoriasis, juvenile psoriasis is associated with an increased prevalence of obesity and comorbidities (including hyperlipidemia, diabetes, hypertension, and Crohn disease).[100] This relationship has not been examined specifically in JPsA.

RECOGNITION OF EARLY PSORIATIC ARTHRITIS

Early PsA is generally considered within the first 2 years of symptom onset.[113] Increasing evidence supports the early diagnosis and treatment of PsA in order to improve long-term outcomes.[113–116] Gladman and colleagues[114] found patients presenting within 2 years of symptom onset had significantly less disease progression after adjusting for baseline characteristics, including start of DMARD therapy at the first visit. Treatment outcomes may also be different among patients with early PsA.[117] A cohort study within the Swedish Early Psoriatic Arthritis Register found that shorter symptom duration at diagnosis and start of therapy was a predictor of minimal disease activity at 5 years, again suggesting that the earlier disease is identified, the better the outcomes.[118] Sørensen and colleagues[119] recently reported an improvement in the delay from symptoms to diagnosis among patients with PsA and RA in Denmark. However, underdiagnosis still remains a significant problem.[25]

SUBCLINICAL DISEASE IN PATIENTS WITH PSORIASIS

Given that early initiation of therapy may decrease joint damage and improve long-term outcomes, how early should therapy be initiated? It has long been recognized that patients may not report symptoms of joint pain or may not be aware of joint inflammation. Several studies demonstrate that patients with psoriasis often have "subclinical" joint and entheseal inflammation.[120,121] The prevalence of subclinical synovitis and enthesopathy among patients with psoriasis ranges from 3% to 46% and 7% to 33%, respectively. In most studies, the frequency of these findings is significantly higher in patients with psoriasis than in healthy controls.[91,122–127] The meaning of subclinical joint inflammation remains unclear. However, some patients with subclinical inflammation go on to develop symptomatic PsA.[128]

IMPROVING DETECTION OF PSORIATIC ARTHRITIS AMONG PATIENTS WITH PSORIASIS

How can one better identify PsA? Understanding risk factors for PsA among patients with psoriasis could help identify patients with psoriasis who are more likely to develop

the disease.[129] In addition, the use of screening tools for PsA in dermatology clinics could facilitate improved recognition of existing disease.

Risk Factors for Psoriatic Arthritis

A handful of studies have examined risk factors for PsA among patients with psoriasis (**Box 1**). Most of the risk factors identified have not been replicated in additional studies with the exception of obesity, family history of PsA, and injuries or trauma.[130,131] Smoking is generally considered to be a risk factor for psoriasis.[132–134] However, studies of smoking as a risk factor for PsA are mixed with one suggesting an inverse association and one suggesting a positive association.[133,135]

Screening for Psoriatic Arthritis

Screening for PsA can be as simple as asking about the presence of arthralgias or performed using validated screening tools.[145–147] Several groups have developed questionnaires to assist in the identification of psoriasis patients with PsA (**Table 3**). These questionnaires each have a cut-off value that suggests a high likelihood of having inflammatory arthritis, prompting subsequent rheumatology evaluation.[147] Screening tools generally should have high sensitivity,[148] but given the difficulty with access to rheumatology in many countries, screening for PsA should ideally also have high specificity. Most of the screening tools developed have relatively high sensitivity and specificity in the initial validation studies. However, subsequent studies have noted decreased sensitivity or specificity when applied in new populations.[23,149–151] No studies have examined the effectiveness of a screening tool versus usual care in capturing patients with PsA and the overall impact of screening on health care utilization.

Box 1
Potential risk factors for psoriatic arthritis

- Nail dystrophy[17]
- Injury/trauma/bone fracture[136,137]
- Family history of psoriatic arthritis[138,139]
- Obesity[140,141]
- Elevated body mass index at age 18[142]
- Smoking[133,135,137], *
- Lifting cumulative loads of greater than 100 pounds/h[137]
- Severe psoriasis[138]
- Psoriasis location: scalp lesions, intergluteal/perianal lesions[17]
- Corticosteroids in the 2 years before psoriasis onset (through PsA onset)[143]
- Rubella vaccinations[136]
- Recurrent oral ulcers[136]
- Moving to a new house[136]
- Infections requiring antibiotics[137]
- Hypercholesterolemia[144]

* refers to conflicting studies on the association between smoking and PsA.

Table 3
Available screening tools

Screening Tool	Publication(s)	Description and Caveats	Validation Population	Test Characteristics in Initial Studies	Test Characteristics in Subsequent Studies
Psoriatic Arthritis Screening and Evaluation (PASE)	Husni 2007[152] Dominquez 2009[153] Ferreyra 2013[154]	Total of 15 questions with score range 15–75 Has been translated into Spanish. Captures disease activity so use of concomitant therapy may change results[155,156]	Patients with psoriasis, PsA before therapy, and osteoarthritis. The reference standard was rheumatologist's diagnosis and Moll and Wright criteria	Cut-off 47/75 Sensitivity 82% Specificity 73% Cut-off 44/75 Sensitivity 76% Specificity 76% Spanish version: Cut-off 34/75 Sensitivity 76% Specificity 74%	Haroon 2013: Sensitivity 24% Specificity 94% Coates 2013: Sensitivity 75% Specificity 39% Walsh 2013: Cut-off 44 Sensitivity 76% Specificity 41% Cut-off 47 Sensitivity 63% Specificity 52%
Toronto Psoriatic Arthritis Screen (ToPAS)	Gladman 2009[157]	12 questions This questionnaire is unique in its inclusion of photographs of inflamed joints and dactylitis	Patients with PsA, psoriasis, general dermatology, general rheumatology, and family medicine. The reference standard was a rheumatologist diagnosis of PsA	Cut-off 8/12 Psoriasis 89.1%, 86.3% dermatology 91.9%, 95.2% rheumatology 92.6%, 85.7% family medicine 90.4%, 100%	Mease 2014: Sensitivity 77% Specificity 72% Haroon 2013: Sensitivity 41% Specificity 90% Coates 2013: Sensitivity 77% Specificity 30% Walsh 2013: Sensitivity 60% Specificity 55%

Psoriasis Epidemiology Screening Tool (PEST)	Ibrahim 2009[158]	5 questions (swollen joints, history of arthritis, heel pain, nail pitting, dactylitis) and a manikin. The manikin does not add to the discriminative ability or scoring but may be helpful to the clinician	Patients with psoriasis identified by medical codes, mailed questionnaire, and 55% of the respondents were examined. The reference standard was a rheumatologist diagnosis	Cut-off 3/5 Sensitivity 92% Specificity 78%	Mease 2014: Sensitivity 84% Specificity 75% Haroon 2013: Sensitivity 28% Specificity 98% Coates 2013: Sensitivity 77% Specificity 37% Walsh 2013: Cutoff 44 Sensitivity 69% Specificity 47%
Electronic Psoriasis and Arthritis Screening Questionnaire (ePASQ)	Khraishi 2011[159]	Ten yes or no questions plus 2 follow-up questions with weighted scoring for each and a diagram to mark painful joints, which is also weighted	Patients with suspected early PsA. The reference standard was CASPAR criteria	Cut-off 7/15 Sensitivity 98% Specificity 75% Cut-off 8/15 Sensitivity 88% Specificity 75%	Mease 2014: Sensitivity 67% Specificity 64%
Early Arthritis for Psoriatic Patients (EARP)	Tinazzi 2012[160]	Ten-item questionnaires with yes or no answers asking about joint and/or tendon pain, swelling and stiffness	Patients with psoriasis but not systemic therapy. Patients with existing arthritis were excluded. The reference standard was CASPAR criteria applied by a rheumatologist	Cut-off 3/10 Sensitivity 85% Specificity 92%	N/A

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Table 3
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Screening Tool	Publication(s)	Description and Caveats	Validation Population	Test Characteristics in Initial Studies	Test Characteristics in Subsequent Studies
CEPPA screening tool	Garg 2014[161]	5 questions inquiring about history of joint pain or swelling, morning stiffness, diagnosis of PsA, history of joint radiographs, and presence of nail changes	All adults presenting for psoriasis evaluation within dermatology (with or without PsA). Only patients reporting joint pain were examined. The reference standard was a rheumatologist's diagnosis	Cut-off 3/5 Sensitivity 86.9% Specificity 71.3%	N/A
CONTEST and CONTESTjt	Coates 2014[162]	Developed from combinations of questions from PASE, PEST, and TOPAS. Validated within Dublin and Utah cohorts using data from Haroon et al and Walsh et al	Patients with psoriasis. Patients reaching the previously published cut-off for either PASE, PEST, or ToPAS were invited for physical exam. The reference standard was CASPAR criteria	CONTEST: Cut-off 4/8 Sensitivity 38%–86% Specificity 35%–89% CONTESTjw: Cut-off 5/8 Sensitivity 57%–89% Specificity 37%–71%	N/A

The sensitivity and specificity used for the subsequent studies were for the cohort of patients with psoriasis but without previous diagnoses of psoriatic arthritis.

Box 2
Comorbidities associated with psoriatic arthritis

Hypertension[60,180–182]

Dyslipidemia[60,180–182]

Diabetes/insulin resistance[183,184,a]

Metabolic syndrome[185–187]

Obesity[11,185,186]

Cardiovascular disease including myocardial infarction and cerebrovascular disease[1,165,188–190,a]

Depression and anxiety[191]

Crohn disease[192,193,a]

Ulcerative colitis[192]

Keratoconjunctivitis sicca[194]

Hypothyroidism[195]

Giant cell arteritis[192]

Pulmonary fibrosis[192]

[a] Denotes an increased risk of incident comorbidity.

COMORBIDITIES IN PSORIATIC ARTHRITIS

Over the past decade, the understanding of PsA as systemic disease has significantly expanded.[163] Approximately 40% of patients with PsA had 3 or more comorbid conditions, and the presence of a comorbidity was associated with decreased quality of life.[164] Comorbidities reported to have an increased prevalence or incidence in PsA are reported in **Box 2**. The increased risk for metabolic abnormalities including cardiovascular disease and diabetes have been the most striking and of greatest importance to management of patients with PsA.[165] Although one study has suggested a risk of malignancy similar to RA, population-based studies have not suggested an increased risk of cancer, including lymphoma, compared with controls.[166–168] Osteoporosis is similarly debated; however, most studies do not suggest an increased prevalence of osteoporosis.[169–171] Increased prevalence of diffuse skeletal hyperostosis,[172] monoclonal gammopathy,[173] and iridocyclitis[174] compared with general population statistics have also been reported. Despite the increased prevalence of comorbidities, recent studies have not found an increased risk of mortality among patients with PsA.[5,175–179]

SUMMARY

PsA is a chronic inflammatory arthritis with potentially significant functional disability and poor outcomes, including cardiovascular disease. Early detection of PsA is important for improvement in long-term outcomes. Use of screening tools and improved knowledge of risk factors could improve early detection.

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