Advances in Rheumatology

REVIEW Open Access

Prevalence, demographics, and clinical characteristics of Latin American patients with spondyloarthritis

Gustavo Citera[1*], Wilson Bautista-Molano[2], Ingris Peláez-Ballestas[3], Valderilio F. Azevedo[4], Risto A. Perich[5], José A. Méndez-Rodríguez[6], Mariel S. Cutri[7] and Cecilia E. Borlenghi[7]

Abstract

Large epidemiologic and clinical estimates of spondyloarthritis (SpA) in Latin America are not available. In this narrative review, our goal was to descriptively summarize the prevalence and features of SpA in Latin America, based on available small studies. A review of peer-reviewed literature identified 41 relevant publications. Of these, 11 (mostly based on Mexican data) estimated the prevalence of SpA and its subtypes, which varied from 0.28 to 0.9% (SpA), 0.02 to 0.8% (ankylosing spondylitis), 0.2 to 0.9% (axial SpA), and 0.004 to 0.08% (psoriatic arthritis). Demographic and/or clinical characteristics were reported in 31 of the 41 publications, deriving data from 3 multinational studies, as well as individual studies from Argentina, Brazil, Chile, Colombia, Costa Rica, Mexico, Peru, Uruguay, and Venezuela. Data relating to treatment, disease manifestations (articular and extra-articular), and comorbidities were summarized across the countries. Available data suggest that there is a variability in prevalence, manifestations, and comorbidities of SpA across Latin America. Basic epidemiologic and clinical data are required from several countries not currently represented. Data relating to current treatment approaches, patient outcomes, and socioeconomic impact within this large geographic region are also needed.

Keywords: Prevalence, Spondyloarthropathy, Ankylosing spondylitis, Psoriatic arthritis, Latin America

Introduction

Spondyloarthritis (SpA) comprises a group of inflammatory diseases of the sacroiliac and spinal joints. The Assessment in Spondyloarthritis International Society (ASAS) classification criteria [1] defines the clinical manifestations of SpA as axial, peripheral, and extra-articular. The group of interrelated diseases considered subtypes of SpA include ankylosing spondylitis (AS), psoriatic arthritis (PsA), reactive arthritis (ReA), inflammatory bowel disease (IBD)-related SpA (IBD-SpA), and undifferentiated SpA (uSpA) [1, 2]. Juvenile-onset SpA (JSpA) also falls under the same umbrella categorization [1], but as JSpA has its own distinct set of challenges [3], it is out of the scope of this review. These diseases are all associated with the presence of the HLA-B27 antigen and share a number of features, including inflammatory back pain, peripheral arthritis, enthesitis, and dactylitis. Other shared features include uveitis, psoriasis, and IBD [4].

In 2016, the regional pooled prevalence of SpA around the world was estimated to range from 0.20% (95% confidence interval [CI]: 0.00–0.66) in South-East Asia to 1.61% (95% CI: 1.27–2.00) in the Northern Arctic communities [2]. In South/Latin America, the prevalence of SpA was estimated at 0.52% (95% CI: 0.10–1.25), which was similar to Europe (0.54%; 95% CI: 0.36–0.78) [2]. However, the estimates for South/Latin America were based on a limited number of available data for SpA, AS, and PsA (2, 4, and 4 studies, respectively) [2]. Several of

* Correspondence: gustavocitera@gmail.com
[1]Instituto de Rehabilitación Psicofísica, Echeverría 955, Buenos Aires, Argentina
Full list of author information is available at the end of the article

those studies were based on data from the 2 large Latin American SpA registries: Registro Ibero-Americano de Espondiloartritis (RESPONDIA, The Ibero-American Registry of Spondyloarthritis) and Registro Brasileiro de Espondiloartrites (RBE, Brazilian Registry of Spondyloarthritis). RESPONDIA represents the largest series of patients with SpA in the Americas (> 100 university centers from 8 Latin American countries [Argentina, Brazil, Chile, Costa Rica, Ecuador, Mexico, Peru, Uruguay, and Venezuela], plus Portugal and Spain), and the RBE covers the 5 Brazilian geographic macro-regions [5].

The objective of this narrative review is to summarize the available SpA prevalence data from Latin America. Specifically, we aimed to assess the demographic and clinical characteristics of Latin American patients with SpA, and to identify major gaps in the literature that could be the subject of further investigation.

Methods

A search of the literature from 2008 onwards was conducted on June 6, 2019. PubMed, the ACR and EULAR abstract archives, and the online PANLAR abstracts (from the 2018 and 2016 meetings), were searched using pre-defined search terms. PubMed searches used the thread: *(spondyloarthritis OR spondyloarthropath* OR ankylosing spondylitis OR psoriatic arthritis) AND (latin america* OR argentin* OR bolivia* OR brazil* OR chile* OR colombia* OR costa rica* OR cuba* OR dominica* OR dominican republic OR ecuador* OR guatemala* OR hondura* OR mexic* OR nicaragua* OR panama* OR peru* OR urugua* OR venezuela*) AND (population OR prevalen* OR epidemiolog* OR inciden*).* This search was repeated using the Latin American and Caribbean Health Sciences Literature (LILACS) platform. Online abstract archives and published abstracts were searched using the terms "population", "prevalen*" "epidemiolog*" and "inciden*" and any abstract titles containing these terms were hand-searched for relevant data (disease and geographical location).

Publications were excluded for the following reasons: 1) no data on either prevalence of SpA in Latin America, or patient demographics, or only provided for subpopulations (e.g., male vs. female); 2) not including patients with non-radiographic axSpA (nr-axSpA), AS, or PsA; 3) unidentified patient nationality (author affiliation was not taken as indicative of patient nationality); 4) SpA was not primary diagnosis, or was reported in combination with other inflammatory conditions (e.g., rheumatoid arthritis); 5) focused exclusively on JSpA; 6) combined patients from Latin America with non-Latin American countries as a single group; or 7) review of previously published data. Congress abstracts that were superseded by a journal article were excluded in favor of the article. No language restrictions were imposed.

Selected publications were manually searched for data regarding prevalence and incidence of SpA, patient demographics and clinical characteristics, HLA-B27, disease manifestations, comorbidities, patient quality of life and impact of illness on work, and treatments and medication used. Data were summarized and presented descriptively; no quantitative data analysis was performed.

Results

Studies included in the analysis

A total of 228 full-length publications and 5 congress abstracts were identified using the search criteria above. Following manual review, 41 publications were selected for inclusion. Eleven publications estimated the prevalence of SpA in Latin American countries (Table 1) [6–16]. Thirty-one publications reported demographic or clinical characteristics (Tables 2 and 3) [12, 17–46].

Prevalence of SpA

Latin American prevalence estimates were summarized from epidemiology studies conducted in Mexico [9–15], Colombia [6, 7], Cuba [8], and Venezuela [16], and ranged from 0.28 to 0.9% (SpA), 0.02 to 0.8% (AS), 0.2 to 0.9% (axSpA), and 0.004 to 0.08% (PsA) (Table 1).

Demographics and clinical characteristics

Publications from Latin American countries with demographic and clinical characteristics fitting the search criteria included Argentina, Brazil, Chile, Colombia, Costa Rica, Mexico, Peru, Uruguay, and Venezuela; the majority were from Argentina and Brazil. There were also 3 multinational studies reporting data from multiple Latin American countries. Of these 31 studies, only 6 encompassed > 1000 patients: 5 were conducted in Brazil [26–30] and the other was a multinational study comparing Latin American patients with those from Europe [45].

In 23 of the studies, the majority (> 50%) of patients were men (Table 2). Mean or median patient age was < 50 years, except in 1 study conducted in Brazil [33], in which the mean patient age was 56 years. In 9 of the 14 studies that recorded race, more than half of the patients (57.7–96%) with SpA were white. At least 1 study from each country reported the proportion of patients with a family history of SpA (Table 2).

Most studies enrolled patients with various SpA subtypes. One study from Argentina [17] enrolled patients with AS only. Three studies from Argentina [20, 21, 24] and 1 from Brazil [33] enrolled only patients with PsA (Table 2). Of the studies that enrolled patients with multiple SpA subtypes, AS was the most common subtype in most of the studies. Mean age at disease onset ranged from 28 to 40 years (Table 2), which suggests that some studies included patients with JSpA [18, 19, 26, 27, 29,

Table 1 Prevalence of SpA in Latin American countries

Country	Study	Setting/Population	*N*	Diagnosis	Diagnostic criteria	*n*	Prevalence (%)	95% CI
Colombia	Londoño et al., 2018 [6]	6 Colombian cities	6693	uSpA	ESSG	n/r	0.28	0.13–0.61
				AS	n/r	n/r	0.11	0.03–0.36
	Fernández-Ávila et al., 2018 (CA) [7]	Colombia	n/r	AS	n/r	84,356	0.18	n/r
				PsA	n/r	1670	0.004	n/r
Cuba	Reyes-Llerena et al., 2009 [8]	Havana	3155	AS	n/r	6	0.1	0.07–0.4
		Male	1238	AS	n/r	4	0.3	n/r
		Female	1917	AS	n/r	2	0.1	n/r
Mexico	Peláez-Ballestas et al., 2011 [9]	5 Mexican regions	19,213	AS	mNYC	n/r	0.1	0.1–0.2
		Mexico City	4059	AS	mNYC	n/r	0.09	0.02–0.2
		Nuevo León	4712	AS	mNYC	n/r	0.04	0.05–0.10
		Yucatán	3195	AS	mNYC	n/r	0.04	0.05–0.10
		Sinaloa	4879	AS	mNYC	n/r	0.2	0.1–0.40
		Chihuahua	1647	AS	mNYC	n/r	0.6	0.2–1.1
		Adjusted point prevalence, total	19,213	AS	mNYC	n/r	0.15	0.09–0.20
		Male	7611	AS	mNYC	n/r	0.18	0.09–0.28
		Female	11,602	AS	mNYC	n/r	0.11	0.05–0.17
	Rodriguez-Amado et al., 2011 [10]	Nuevo León	4713	PsA	n/r	4	0.08	0.02–0.2
				AS	mNYC	2	0.04	0.05–0.1
	Alvarez-Nemegyei et al., 2011 [11]	Yucatán	3195	AS	mNYC	1	0.02	–
				PsA	Surveying physician	1	0.02	–
	Peláez-Ballestas et al., 2013 [12]	Mexico City	4059	SpA	ESSG	28	0.6	0.4–0.9
				AS	mNYC	4	0.09	0.02–0.2
	Del Río Nájera et al., 2016 [13]	Raramuri community	380	AS	mNYC	3	0.8	0.0–1.8
	Julián-Santiago et al., 2016 [14]	Mixtec & Chontal communities	1061	AS	mNYC	1	0.09	0.002–0.5
		Mixtec	937	AS	mNYC	1	0.1	0.002–0.5
		Chontal	124	AS	mNYC	–	–	–
	Peláez-Ballestas et al., 2009 (CA) [15]	Mexico City	9269	SpA	ESSG	36	0.9	0.6–1.3
				axSpA	ASAS–1	39	0.9	0.7–1.3
				axSpA	ASAS–2	10	0.2	0.1–0.4
Venezuela	Granados et al., 2016 [16]	Warao, Kari'ña, and Chaima communities	1537	SpA	mNYC	7	0.4	0.1–0.9
		Warao	583	SpA	mNYC	–	–	–

Table 1 Prevalence of SpA in Latin American countries *(Continued)*

Country	Study	Setting/Population	*N*	Diagnosis	Diagnostic criteria	*n*	Prevalence (%)	95% CI
		Kari'ña	262	SpA	mNYC	2	0.7	0.09–2.7
		Chaima	692	SpA	mNYC	5	0.7	0.2–1.6

References are articles unless indicated as conference abstracts (CA)
AS ankylosing spondylitis, *ASAS* Assessment in Spondyloarthritis International Society, *CA* conference abstract, *CI* confidence interval, *ESSG* European Spondyloarthropathy Study Group, *mNYC* modified New York criteria, *N* number of patients in study, *n* number of patients with specified condition, *n/r* not reported, *SpA* spondyloarthritis, *uSpA* undifferentiated spondyloarthritis

34, 39, 41–43]. Mean disease duration ranged from 18 months [24] to 17 years [31] (Table 2).

The proportions of patients in single-country studies who were HLA-B27-positive ranged from 5% [21] to 71% [45] (Table 3). Only 3 such studies reported < 20% patients as HLA-B27-positive [12, 21, 24], which likely reflects procedural differences within practice. For example, the HLA-B27 positivity being 4% suggests that the HLA-B27 test was not performed in a representative subset of the study population (the number of patients who were tested for HLA-B27 in that study was not reported) [44]. None of the studies reporting low HLA-B27 rates reported patient race (Table 3). Eleven studies reported mean C-reactive protein levels but most did not specify measurement units (mg/dL or mg/L), which limits data interpretation.

Mean scores for Bath Ankylosing Spondylitis Disease Activity Index (BASDAI) and Bath Ankylosing Spondylitis Functional Index (BASFI) ranged from 3.3 to 6.1 and from 3.2 to 5.2, respectively (Table 3). Ankylosing Spondylitis Quality of Life (ASQoL) scores ranged from 6.5 to 8.7 (mean) and 5 to 10 (median). One study reported an ASAS Health Index score of 10 [35].

Disease manifestations

Disease manifestations were reported in 21 manuscripts [5, 12, 18, 24–27, 29–32, 34, 37, 39–46], 2 of which reported data from 3 and 4 Latin American countries [44, 46], resulting in 26 assessments of disease manifestations from 11 countries. At the country level, Brazil had the highest number of studies reporting disease manifestation ($n = 5$). Across all studies, 12 articular and 13 extra-articular manifestations (from 11 and 9 Latin American countries, respectively) were identified (Fig. 1 and Supplementary Tables 1 and 2).

Articular manifestations

The most commonly reported disease manifestations were enthesitis (24 publications), dactylitis (17 publications), inflammatory lumbar pain (15 publications), and peripheral arthritis (14). Those with the highest occurrence among patients with SpA within any 1 study were inflammatory lumbar pain (100%, Mexico) [12], and axial arthritis (100%, El Salvador) [44], followed by bilateral sacroiliitis (88%, El Salvador [44]), peripheral arthritis (83%, Guatemala [44]), and enthesitis and lower limb arthritis (both 79%, Mexico [40]). However, the occurrence of most articular manifestations varied substantially from study to study, ranging from 42% [42] to 79% [40] for lower limb arthritis and from 9% [24] to 100% [44] for axial arthritis.

Extra-articular manifestations

Uveitis was the most commonly reported extra-articular disease manifestation (20 publications), followed by nail involvement (13 publications), psoriasis (10 publications), and IBD (9 publications). The extra-articular manifestations most frequently experienced by patients with SpA within any 1 study were nail involvement (49%, Argentina [24]), psoriasis (33%, Argentina [46]), and uveitis (26%, Brazil [31] and Argentina [25]). All other extra-articular manifestations occurred at a rate of < 10%, regardless of study or country.

Comorbidities

Three studies reported SpA comorbidities [22, 33, 46], while 2 reported a history of infection without specifying the cause [27, 37]. The largest of the 3 studies reporting SpA comorbidities ($N = 390$), which was conducted in Argentina, Colombia, and Mexico, found that the most common comorbidities were arterial hypertension (25%), hypercholesterolemia (22%), osteoporosis (9%), and gastrointestinal ulcer (8%). Arterial hypertension in Colombia and Mexico occurred at a higher rate than was seen in the general population of those countries (21% vs. 13%). Prevalence of tuberculosis (TB), defined as historic or currently active TB, was 3%, which was 10 times that observed in the general population (0.3%). Prevalence of malignancies was 2.8%, which was similar to that observed in the general population (2.6%) [46]. The other 2 studies enrolled approximately 80 patients each. In the Argentinian study [22], the most common comorbidities reported in patients with axSpA were arterial hypertension (27%), gastritis (26%), dyslipidemia (24%), gallstone disease (13%), and nephrolithiasis (12%). Of these, only nephrolithiasis occurred at a higher frequency than that seen in the general population (4%). Mean age and disease duration were significantly greater

Table 2 Demographics of patients with SpA across Latin America

Country	Study	Patients with SpA (*n*)	Male (%)	Age (y)	Race (%)	Family history of SpA (%)	Diagnosis (%)					Age at disease onset (y)	Disease duration (y)
							AS	PsA	uSpA	ReA	IBD-SpA		
Argentina	Marengo et al., 2008 [17]	61	90.2	43*	n/r	n/r	100	0	0	0	0	n/r	n/r
	Bellomio et al., 2008 [18]	405	59	48.1	71 (W) 23 (WI)	16.4	30.3	46.7	12.4	6.3	0.7	38.4	9.7[a]
	Buschiazzo et al., 2011 [19]	402	59	48.3*	70.8 (W) 22.8 (WI)	16.8	21.4	60.2	8.2	6.2	2.5	n/r	8*
	Soriano et al., 2011 [20]	65	63.1	n/r	92–96 (W)[b] 2–4 (Asian)[b]	n/r	0	100	0	0	0	40.3	8.5
	Schneeberger et al., 2015 [21]	73	49.3	49*	n/r	n/r	0	100	0	0	0	43*	6*
	Sommerfleck et al., 2018a [22]	86	80	46*	n/r	n/r	n/r [c]	n/r [c]	n/r [c]	n/r [c]	n/r [c]	n/r	19*
	Sommerfleck et al., 2018b [23]	50	80	47*	n/r	n/r	70	28	0	0	0	n/r	13*
	Scarafia et al., 2016 (CA) [24]	92	46.7	47.7	n/r	n/r	0	100	0	0	0	n/r	3
	Capelusnik et al., 2018 (CA) [25]	231	75.3	46*	n/r	n/r	n/r [c]	n/r [c]	n/r [c]	n/r [c]	n/r [c]	n/r [c]	20.5*
Brazil	Sampaio-Barros et al., 2008 [26]	1036	73.6	43.7	59.5 (W) 25.9 (AB)	16.2	72.3	13.7	6.3	3.6	1.0	31	12.7[a]
	Skare et al., 2012a [27]	1318	71.9	n/r	65.0 (W) 31.3 (AB)	15.9	65.1	18.3	6.8	3.5	3.5	n/r	14.2
	Skare et al., 2012b [28]	1424	75.9 (< 40 y) 60.6 (≥40 y)	n/r	n/r	19.2 (< 40 y) 13.1 (≥40 y)	66.3	18	6.7	5.5	3.5	28.6	n/r
	Rodrigues et al., 2012 [29]	1472	n/r	n/r	n/r	n/r	65.4	18.4	6.7	3.3	3.3	n/r	n/r
	Duarte et al., 2014 [30]	1189	70.6	44.5	57.7 (W) 42.3 (NW)	n/r	n/r	n/r	n/r	n/r	n/r	n/r	n/r
	Ribeiro et al., 2018 [31]	202	64.2	48.6	62.4 (W) 37.6 (NW)	19.3	71.3[d]	28.7[d]	0	0	0	n/r	17.2
	Simioni et al., (2019) [32]	85	64.7%	49.3*	76.4% (W) 23.5% (AB)	n/r	61.1	21.1	5.8	1.1	0	n/r	14*
	Henrique et al., 2018 (CA) [33]	82	50	56	n/r	n/r	0	100	0	0	0	n/r	9.4
Chile	Gutiérrez et al., 2008 [34]	109	58.4	42	16.8 (W) 64.6 (WI)	13.3	58.7	25.6	7.3	0.9	5.5	35.3	7.1
	Ibáñez et al., 2019 (CA) [35]	472	36.7	42	n/r	n/r	n/r	n/r	n/r	n/r	n/r	n/r	n/r
Colombia	Valle-Onate et al., 2011 [36]	279	69.9	n/r	n/r	n/r	34.4	3.6	39.1	18.3	0.4	n/r	n/r
	Bautista-Molano et al., 2016 [37]	581	71.7	35	n/r	5.3	29.1	3.6	39.6	26.9	0.9	28	7.3
	Santos et al., 2017 [38]	189	63.8	35.9	n/r	n/r	46.0	0	35.5	18.5	0	n/r	n/r
Costa Rica	Sáenz Castro et al., 2008 [39]	33	57.6	41.3	21.2 (W) 66.7 (WI)	12.2	45.5	6.1	45.5	0	0	34.5	6.8[a]
Mexico	Casasola-Vargas et al.,	172	59.3	38.1	18.5 (W)	18.6	34.9	8.7	11.6	1.7	1.2	28.0	10.1[a]

Table 2 Demographics of patients with SpA across Latin America *(Continued)*

Country	Study	Patients with SpA (*n*)	Male (%)	Age (y)	Race (%)	Family history of SpA (%)	Diagnosis (%)					Age at disease onset (y)	Disease duration (y)
							AS	PsA	uSpA	ReA	IBD-SpA		
	2008 [40]				76.3 (WI)								
	Peláez-Ballestas et al., 2013 [12]	28	50	40.7	n/r	21.4	n/r	n/r	n/r	n/r	n/r	n/r	n/r
Peru	Chávez-Corrales et al., 2008 [41]	60	65	40.3	3.3 (W) 93.3 (WI)	18.6	53	6.7	13.3	1.7	0	30.6	9.7[a]
Uruguay	Palleiro and Spangenberg, 2008 [42]	53	66.0	41.2	86.8 (W) 11.3 (MR)	13.2	53	17	19	0	4	31.0	10.2[a]
Venezuela	Chacón et al., 2008 [43]	69	62.3	40.9	31.9 (W) 39.1 (MR)	27.5	55.1	21.7	11.6	0	4.3	29.4	11.5[a]
Multinational	García-Kutzbach et al., 2011 [44]	233	46	47.5*	n/r	n/r	10	9	33	47.2	0.8	n/r	n/r
	Benegas et al., 2012 [45]	1083	75	43	n/r	n/r	100	0	0	0	0	28	n/r
	Bautista-Molano et al., 2018 [46]	390	64	45	n/r	n/r	n/r	n/r	n/r	n/r	n/r	n/r	7.0

Continuous values are mean unless indicated (*) as median
References are articles unless indicated as conference abstracts (CA)
[a]Information not available in original RESPONDIA publication; data taken from Gallinaro et al., 2010 [5].
[b]Data for the 2 regional populations (Autonomous City of Buenos Aires, membership of the Hospital Italiano Medical Care Program) were presented separately.
[c]Patients were described as having axial spondyloarthritis.
[d]Patients were classified as having either axial SpA which was predominantly AS, or peripheral SpA which was predominantly PsA.
AB African-Brazilian (could include MR), *AS* ankylosing spondylitis, *CA* conference abstract, *I* Indigenous, *n* number of patients with specified condition, *MR* mixed race (white-black), *n/r* not reported, *NW* non-white, *O* Other; *PsA* psoriatic arthritis, *ReA* reactive arthritis, *SpA* spondyloarthritis, *T* total population, *uSpA* undifferentiated spondyloarthritis, *W* White, *WI* White-Indigenous, *y* years

($P < 0.05$) in patients with ≥3 comorbidities compared with patients who reported no comorbidities, as were mean BASDAI and BASFI scores (5.8 and 5.2 [≥3 comorbidities] vs. 3.3 and 3.2 [no comorbidities], respectively, $P < 0.05$) [22]. The most common comorbidities in patients with PsA from 2 hospitals in Southern Brazil were metabolic syndrome (54%), arterial hypertension (52%), and diabetes (20%); no comparisons were made with the general population [33].

Quality of life (QoL)

ASQoL or ASAS scores were presented in 9 single-country studies (Table 3). The highest mean/median ASQoL or ASAS score was 11.2 [23] and the lowest was 5 [17, 18]. The relationship between SpA status and QoL may have been impacted by factors such as employment status [17], ethnicity [27, 31], and treatment status [35], but their reporting was sporadic and interpreting the potential relationship is beyond the scope of this review.

Treatments

Data relating to SpA treatment were available from 14 studies [5, 18, 26, 27, 31, 32, 34, 39, 40, 42–46]. Non-steroidal anti-inflammatory drugs (NSAIDs) were the most commonly used class of medication, with most studies reporting use in 68–98% of patients. However, the most recent study from Brazil reported a use rate of 32% [32]. Conventional synthetic disease-modifying anti-rheumatic drugs (csDMARDs) were the second-most commonly prescribed class of treatment (Fig. 2). Methotrexate (MTX) and sulfasalazine (SSZ) were more frequently used than leflunomide (LEF), although there was a wider range of prescription rates for MTX (19–67% [Brazil]) and SSZ (9% in Argentina to 87% in Mexico) than for LEF (4% in Chile to 29% Mexico). Corticosteroid (CS) use ranged from 5 to 50% of patients (both Brazil). Tumor necrosis factor inhibitor (TNFi) use ranged from 5 to 45% of the populations in which they were reported (Fig. 2 and Supplementary Table 3), with etanercept (ETN) being the most commonly prescribed agent (35% of patients in 1 Brazilian study).

Discussion

This manuscript represents a comprehensive overview of the prevalence and burden of SpA in Latin America. A 2014 systematic review of global AS prevalence found the rate in Latin America to be 10.2 per 10,000 [47]. This calculation was based on 4 studies included here [8–11]. The additional studies included in our review are generally consistent with that prevalence rate. However, the majority (60%) of the epidemiology studies included in this narrative review were from Mexico, with prevalence data largely unavailable for the majority of

Table 3 Clinical characteristics of patients with SpA across Latin America

Country	Study	# Patients	HLA-B27 positive (%)	CRP, mg/dL	BASDAI	BASFI	ASQoL
Argentina	Marengo et al., 2008 [17]	61	n/r	n/r	27.2* (Em) 57.7* (Un)	40.3* (Em) 53.1* (Un)	5* (Em) 8* (Un)
	Bellomio et al., 2008 [18]	405	46	1.9*[b]	4.0	3.3	5
	Buschiazzo et al., 2011 [19]	402	45.3	n/r	3.8*	2.6*	n/r
	Schneeberger et al., 2015 [21]	73	5	n/r	n/r	n/r	n/r
	Sommerfleck et al., 2018 [22]	86	n/r	n/r	3.3 (0 c-m) 4.3 (1–2 c-m) 5.8 (≥3 c-m)	3.2 (0 c-m) 4.5 (1–2 c-m) 5.2 (≥3 c-m)	n/r
	Sommerfleck et al., 2018 [23]	50	n/r	n/r	4.1*	4.2*	11.2* (PsAQoL)
	Scarafia et al., 2016 (CA) [24]	92	5.6	n/r	n/r	n/r	n/r
Brazil	Sampaio-Barros et al., 2008 [26]	1036	69.5	n/r	4.1	4.5	n/r
	Skare et al., 2012 [27]	1318	72.8 (W) 62.4 (AB) 35 (O)	9.3 (W)[b] 9.3 (AB)[b] 11.2 (O)[b]	4.0 (W) 4.3 (AB) 4.4 (O)	4.4 (W) 4.8 (AB) 4.7 (O)	7.1 (W) 8.6 (AB) 8.7 (O)
	Skare et al., 2012 [28]	1424	72.8 (< 40 y) 49.5 (≥40 y)	10.3 (< 40 y) 8.02 (≥40 y)	4.15 (< 40 y) 4.47 (≥40 y)	4.6 (< 40 y) 4.7 (≥40 y)	7.8 (< 40 y) 7.8 (≥40 y)
	Duarte et al., 2014 [30]	1189	67.9	n/r	4.3	4.7	7.9
	Ribeiro et al., 2018 [31]	202	64.2	3.6 (W)[b] 3.7 (NW)[b]	3.6 (W) 3.7 (NW)	4.5 (W) 4.1 (NW)	7.9 (W) 6.5 (NW)
	Simioni et al., 2019 [32]	85	69.2	8*	2.4*	5.1*	9.2*
Chile	Gutiérrez et al., 2008 [34]	109	66.4	16.2[b]	4.9	4.5	n/r
	Ibáñez et al., 2019 (CA) [35]	472	n/r	n/r	6.1	5	10[a]
Colombia	Bautista-Molano et al., 2016 [37]	581	43.9	11.7	5.4 (Ax) 5.3 (Pr)	n/r	n/r
	Santos et al., 2017 [38]	189	40.7	n/r	n/r	n/r	n/r
Costa Rica	Sáenz Castro et al., 2008 [39]	33	57.1	0.6	4.6	3.9	n/r
Mexico	Casasola-Vargas et al., 2008 [40]	172	n/r	12[b]	4.5	4.0	n/r
	Peláez-Ballestas et al., 2013 [12]	28	14.3	n/r	n/r	n/r	n/r
Peru	Chávez-Corrales et al., 2008 [41]	60	31	n/r	n/r	n/r	n/r
Uruguay	Palleiro and Spangenberg, 2008 [42]	53	approx. 50 (AS, uSpA) 14 (PsA)	6.2 mg/L	5.3	4.3	n/r
Venezuela	Chacón et al., 2008 [43]	69	n/r	8.4[b]	4.4	3.6	n/r
Multinational	García-Kutzbach et al., 2011 [44]	233	57.1 (Costa Rica) 29 (El Salvador) 4 (Guatemala)[c]	n/r	n/r	n/r	n/r
	Benegas et al., 2012 [45]	1083	71	10[b]	4.3	4.8	7
	Bautista-Molano et al., 2018 [46]	390	n/r	n/r	n/r	3.4	n/r

Continuous values are mean unless indicated (*) as median
References are articles unless indicated as conference abstracts (CA)
[a]ASAS Health Index.
[b]Units (mg/dL or mg/L) not given in publication.
[c]HLA-B27 test not routinely performed.
AB African-Brazilian, *AS* ankylosing spondylitis, *ASQoL* Ankylosing Spondylitis Quality of Life, *Ax* patients with axial SpA, *BASDAI* Bath Ankylosing Spondylitis Disease Activity Index, *BASFI* Bath Ankylosing Spondylitis Functional Index, *CA* conference abstract, *c-m* comorbidities, *Em* employed, *HLA* human leukocyte antigen, *I* indigenous, *n/r* not reported, *NW* non-white, *MR* mixed race (white-black), *Pr* patients with peripheral SpA, *PsA* psoriatic arthritis, *Un* unemployed, *uSpA* undifferentiated spondyloarthritis, *W* white, *y* years

countries. Therefore, these data may not be representative of Latin America as a whole.

Patient demographics were widely available. Sex and mean age of patients with SpA were consistently reported, whereas race, ethnicity, family history of SpA, age at disease onset, and disease duration were not. Most patients were male and, where reported, typically had disease onset before the age of 40. These values are consistent with previously reported global estimates [4]. The proportions of patients with AS and PsA varied between countries. Patients included in studies conducted in Argentina were more likely to have PsA than AS,

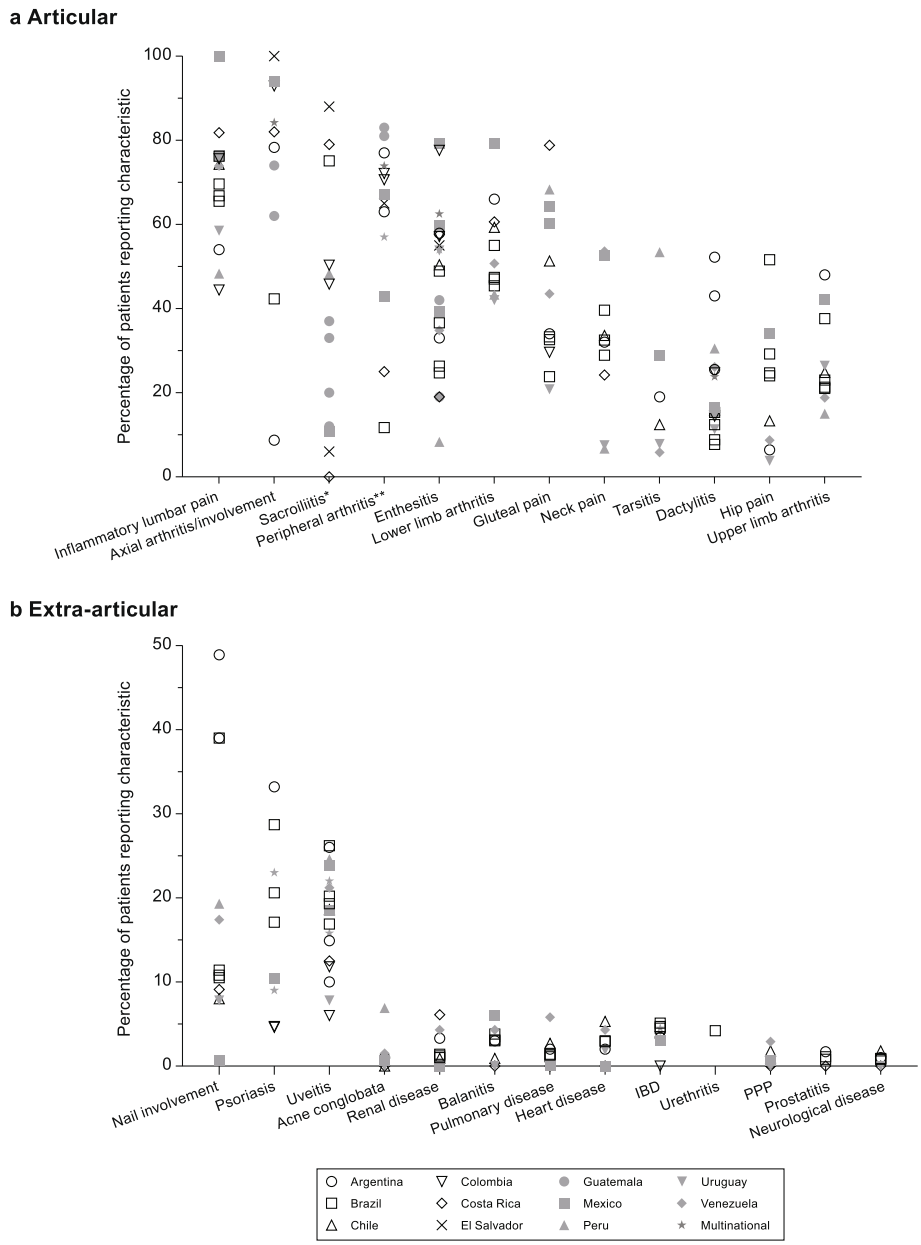

Fig. 1 Disease manifestations in Latin American patients with SpA: **a** articular; **b** extra-articular. * Sacroiliitis includes bilateral sacroiliitis, unilateral sacroiliitis, radiographic sacroiliitis, sacroiliitis assessed by MRI, and sacroiliac syndrome. ** Peripheral arthritis includes peripheral arthritis, oligoarthritis, asymmetrical oligoarthritis, and arthritis that is unspecified by the publication. Source data for this figure can be found in Supplementary Tables 1 and 2. IBD, inflammatory bowel disease; MRI, magnetic resonance imaging

while the opposite was the case in studies from Brazil. There were fewer patients with PsA than other SpA subtypes in studies from Colombia (4 studies), Costa Rica, Mexico, Peru, Uruguay, and Venezuela (1–3 studies each). However, the majority of studies in these countries were small (< 100 patients) and differences in the proportion of SpA subtypes may be due to potential differences in patient selection and the diagnostic criteria used, rather than representative of prevalence as a whole.

The majority of studies reporting clinical characteristics were conducted in Argentina and Brazil. One study reported HLA-B27 status by ethnicity [27] and 1 by age [28] (both Brazil). HLA-B27-positive status was more common in white than in black patients [28], and in older than younger patients [28], consistent with previously reported global estimates [4]. HLA-B27 is not common among indigenous communities in South America [48], but no studies

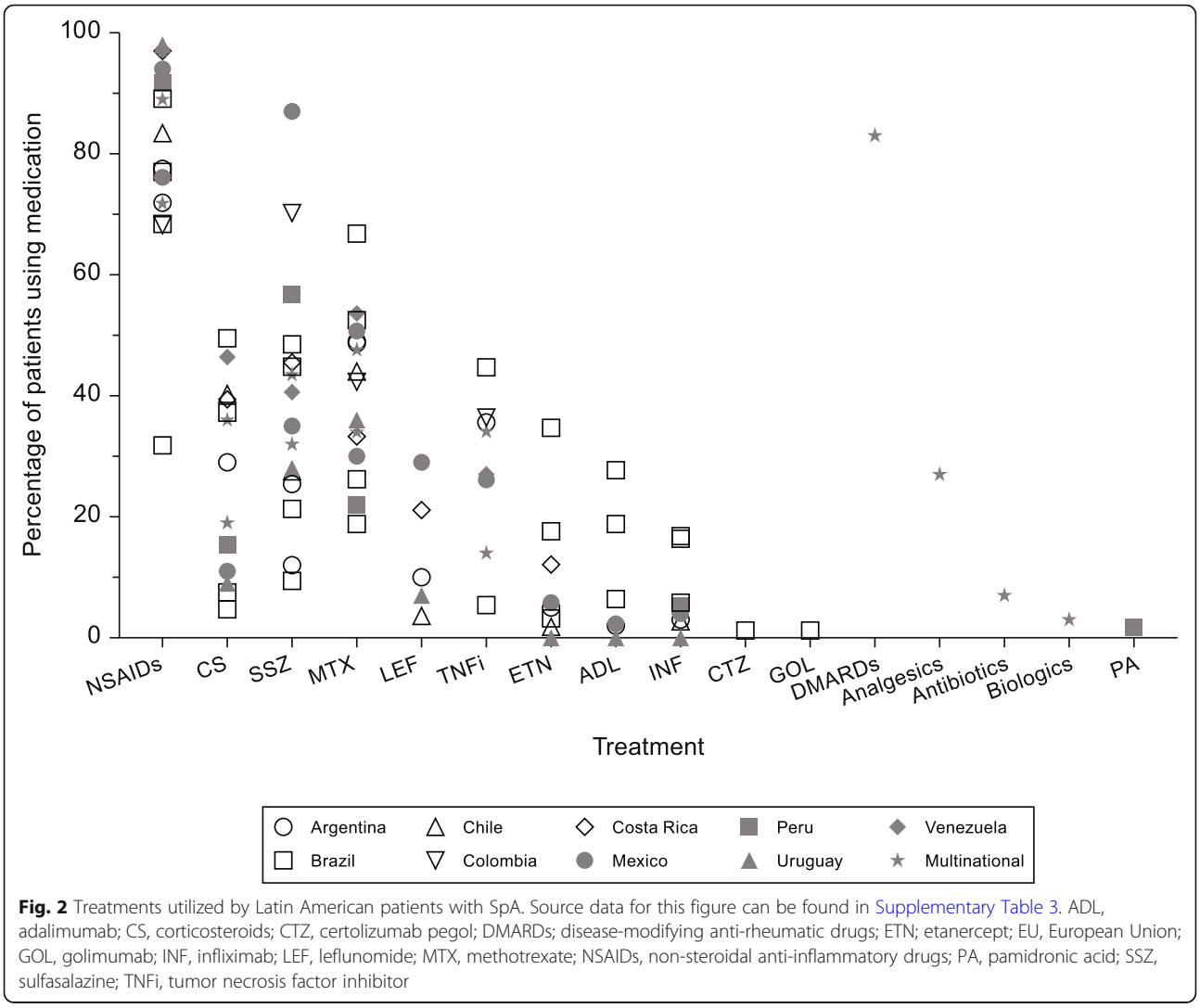

Fig. 2 Treatments utilized by Latin American patients with SpA. Source data for this figure can be found in Supplementary Table 3. ADL, adalimumab; CS, corticosteroids; CTZ, certolizumab pegol; DMARDs; disease-modifying anti-rheumatic drugs; ETN; etanercept; EU, European Union; GOL, golimumab; INF, infliximab; LEF, leflunomide; MTX, methotrexate; NSAIDs, non-steroidal anti-inflammatory drugs; PA, pamidronic acid; SSZ, sulfasalazine; TNFi, tumor necrosis factor inhibitor

collected for this review provided HLA-B27 data for these populations.

Consistent with the findings of the ASAS-COMOSPA study of patients from 22 countries [49], the prevalence ranges of disease manifestations reported here showed considerable variability. Peripheral articular involvement and enthesitis were similar in range between ASAS-COMOSPA and our study (3–82% vs. 12–73%, and 6–72% vs. 8–79%, respectively), whereas the study conducted in Latin America and the European Union (EU) reported higher prevalence of peripheral arthritis and enthesitis in Latin American than in EU patients [45]. We found a wider range of reported joint involvement (9–100%) and dactylitis (8–52%) than ASAS-COMOSPA (52–100% and 0–35%, respectively), whereas the range of reported extra-articular manifestations was generally lower in our study than in the ASAS-COMOSPA study.

Overall, there was a lack of data on impact of disease variables and comorbidities in Latin American patients with SpA. One study investigated the impact of variables such as disease duration or activity on QoL [17]. Other studies explored the relationship between QoL and employment status, treatment status [17, 35], or patients' age or age at disease onset [28, 45], but there were too few to make any meaningful conclusions. Only 3 studies presented data on comorbidities. Conditions such as osteoporosis, cardiovascular disease, cancer, and infections are key comorbidities in patients with SpA [50], yet only 1 study presented frequencies of malignancies and infections (TB) [46].

Treatment data were available from almost half of the studies reviewed, but for most countries, information was available from a single study only. The range of NSAID use across studies was largely comparable with that previously reported in the ASAS-COMOSPA study (32–98% vs. 46–98%, respectively). MTX use was higher in our review (19–67% vs. 2–51%), but SSZ (9–87% vs. 0–90%) and TNFi (5–45% vs. 44%) use was typically

lower [49]. In the comparison study of Latin America and Europe, Latin American patients with AS had a significantly higher use of NSAIDs, CS, MTX, SSZ, and MTX-TNFi combination therapy than their EU counterparts ($P < 0.001$ for all comparisons); there was no significant difference in the use of TNFi monotherapy [45].

Although the literature surveyed was relatively recent (the past 10 years), most of the estimates of treatment data date back to the beginning of that period. Since then, most Latin American countries have adopted regulatory standards for biosimilars [51] and have allowed biosimilars into their markets, and new therapies are constantly being developed. Therefore, treatment options for patients with SpA in this region have changed and the estimates summarized here may not be representative of the current situation.

This review had some limitations. Overall, we found that, outside of the 8 RESPONDIA papers, study methodology and design varied widely, and the types of data collected (prevalence, disease manifestations, comorbidities, QoL, treatments) were not consistent between studies. Several areas covered had limited data. The possibility of assessing the true extent of disease manifestations was limited due to a lack of clarity regarding data collection. Fewer than one-quarter of studies listed disease manifestations that were reported by none of the enrolled patients [34, 37, 39, 40, 42, 44]. For other studies, it was not obvious if unreported disease manifestations were not found or if the data were not collected. Several treatment-related areas were not covered. For example, patient views on medication, including patient satisfaction with their treatment, were missing. Treatment adherence was not reported in any of the studies, even though poor adherence to treatments for inflammatory diseases is associated with poorer clinical outcomes [52]. Finally, study inclusion criteria for this review were specific to prevalence data or patient demographics. Consequently, studies with a sole focus on other aspects (e.g., disease manifestations) may not have been identified.

In summary, our review identified several gaps in the literature on SpA from Latin America. Prevalence studies outside Mexico are generally lacking. More than half the studies providing data on clinical characteristics came from Argentina and Brazil. There are insufficient data on comorbidities and QoL, particularly from countries other than Argentina and Brazil. Finally, data on treatment patterns are mostly out of date. Up-to-date reports on treatment adherence or patient views would add clarification to the literature. Future research efforts in this region should also focus on the need for standardized care, follow-up, and regular monitoring of disease, as well as characterizing the side effects of medications used for treatment.

Conclusions

A total of 41 publications relating to the prevalence and characteristics of SpA in Latin America were identified. Several gaps were evident in terms of the countries and data covered, particularly in terms of the treatment patterns and impact of SpA. More consistent methodologies between studies would help provide a more accurate picture of the disease burden in this region.

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s42358-020-00161-5.

Additional file 1.

Abbreviations

ADL: Adalimumab; AS: Ankylosing spondylitis; ASAS: Assessment in Spondyloarthritis International Society; ASQoL: Ankylosing Spondylitis Quality of Life; BASDAI: Bath Ankylosing Spondylitis Disease Activity Index; BASFI: Bath Ankylosing Spondylitis Functional Index; CS: Corticosteroids; csDMARDs: Conventional synthetic disease-modifying anti-rheumatic drugs; CTZ: Certolizumab pegol; ETN: Etanercept; EU: European Union; GOL: Golimumab; IBD: Inflammatory bowel disease; INF: Infliximab; JSpA: Juvenile-onset SpA; LEF: Leflunomide; MRI: Magnetic resonance imaging; MTX: Methotrexate; nr-axSpA: Non-radiographic axSpA; NSAID: Non-steroidal anti-inflammatory drugs; PsA: Psoriatic arthritis; QoL: Quality of life; ReA: Reactive arthritis; SpA: Spondyloarthritis; SSZ: Sulfasalazine; TB: Tuberculosis; TNFi: Tumor necrosis factor inhibitor; uSpA: Undifferentiated SpA

Acknowledgements

Medical writing support was provided by Lorna Forse, PhD, of Engage Scientific Solutions and was funded by Pfizer.

Authors' contributions

All authors contributed to the design of the work, the analysis and interpretation of the data reviewed, revised each draft critically for important intellectual content, approved the final version to be published, and agreed to be accountable for all aspects of the work.

Funding

This review was sponsored by Pfizer.

Availability of data and materials

Not applicable.

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Competing interests

GC received speaker fees from AbbVie, Pfizer, BMS, Roche, Lilly, and Novartis; WBM received speaker fees from Novartis, Janssen, and Pfizer; VA received speaker fees from AbbVie, Pfizer, Janssen, Novartis, Sanofi, and Sandoz and received grants for clinical trials from GSK, Lilly, Pfizer, Genentech, Boehringher Ingelheim, and AbbVie. MC and CB are employees of Pfizer. RAP, IPB, and JAMR did not declare any conflicts of interest.

Author details

[1]Instituto de Rehabilitación Psicofísica, Echeverría 955, Buenos Aires, Argentina. [2]Universidad Militar Nueva Granada and University Hospital Fundación Santa Fe de Bogotá, Bogotá, Colombia. [3]Hospital General de México "Dr. Eduardo Liceaga", Mexico City, Mexico. [4]Universidade Federal do Paraná, Curitiba, Brazil. [5]Hospital Nacional Guillermo Almenara Irigoyen, Lima,

Peru. [6]Hospital La Católica, Guadalupe, San José, Costa Rica. [7]Pfizer, Buenos Aires, Argentina.

Received: 24 August 2020 Accepted: 30 December 2020
Published online: 08 January 2021

References

1. Rudwaleit M, van der Heijde D, Landewe R, et al. The Assessment of SpondyloArthritis International Society classification criteria for peripheral spondyloarthritis and for spondyloarthritis in general. Ann Rheum Dis. 2011; 70:25–31.
2. Stolwijk C, van Onna M, Boonen A, van Tubergen A. Global prevalence of spondyloarthritis: a systematic review and meta-regression analysis. Arthritis Care Res. 2016;68:1320–31.
3. Burgos-Vargas R, Peláez-Ballestas I, Gutiérrez-Suárez R. Challenges in juvenile-onset spondyloarthritis. Int J Clin Rheumatol. 2010;5:229–39.
4. Stolwijk C, Boonen A, van Tubergen A, Reveille JD. Epidemiology of spondyloarthritis. Rheum Dis Clin N Am. 2012;38:441–76.
5. Gallinaro AL, Ventura C, Sampaio Barros PD, Goncalves CR. Spondyloarthritis: analysis of a Brazilian series compared with a large Ibero-American registry (RESPONDIA group). Rev Bras Reumatol. 2010;50:581–9.
6. Londono J, Pelaez Ballestas I, Cuervo F, et al. Prevalence of rheumatic disease in Colombia acording to the Colombian Rheumatology Association (COPCORD) strategy. Prevalence study of rheumatic disease in Colombian population older than 18 years. Rev Colomb Reumatol. 2018;25:245–56.
7. Fernández-Ávila DG, Bernal-Macías S, Rincón-Riaño DN, Gutiérrez-Dávila JM, Rosselli-Cock D. Prevalence of rheumatic diseases in Colombia: an approach from the ministry of health and social protection data (SISPRO). J Clin Rheumatol. 2018;24:S172.
8. Reyes-Llerena GA, Guibert-Toledano M, Penedo-Coello A, et al. Community-based study to estimate prevalence and burden of illness of rheumatic diseases in Cuba: a COPCORD study. J Clin Rheumatol. 2009;15:51–5.
9. Peláez-Ballestas I, Sanin LH, Moreno-Montoya J, et al. Epidemiology of the rheumatic diseases in Mexico. A study of 5 regions based on the COPCORD methodology. J Rheumatol Suppl. 2011;86:3–8.
10. Rodriguez-Amado J, Pelaez-Ballestas I, Sanin LH, et al. Epidemiology of rheumatic diseases. A community-based study in urban and rural populations in the state of Nuevo Leon, Mexico. J Rheumatol Suppl. 2011; 86:9–14.
11. Alvarez-Nemegyei J, Pelaez-Ballestas I, Sanin LH, Cardiel MH, Ramirez-Angulo A, Goycochea-Robles MV. Prevalence of musculoskeletal pain and rheumatic diseases in the southeastern region of Mexico. A COPCORD-based community survey. J Rheumatol Suppl. 2011;86:21–5.
12. Peláez-Ballestas I, Navarro-Zarza JE, Julian B, et al. A community-based study on the prevalence of spondyloarthritis and inflammatory back pain in Mexicans. J Clin Rheumatol. 2013;19:57–61.
13. Del Rio ND, Santana N, Pelaez-Ballestas I, Gonzalez-Chavez SA, Quinonez-Flores CM, Pacheco-Tena C. Prevalence of rheumatic diseases in Raramuri people in Chihuahua, Mexico: a community-based study. Clin Rheumatol. 2016;35(Suppl 1):43–52.
14. Julian-Santiago F, Garcia-Garcia C, Garcia-Olivera I, Goycochea-Robles MV, Pelaez-Ballestas I. Epidemiology of rheumatic diseases in Mixtec and Chontal indigenous communities in Mexico: a cross-sectional community-based study. Clin Rheumatol. 2016;35(Suppl 1):35–42.
15. Peláez-Ballestas I, Navarro-Zarza E, Julian B, et al. The prevalence of inflammatory back pain, spondyloarthritis, and axial spondyloarthritis in the community. Arthritis Rheum. 2009;60:1652–3.
16. Granados Y, Rosillo C, Cedeno L, et al. Prevalence of musculoskeletal disorders and rheumatic disease in the Warao, Kari'na, and Chaima indigenous populations of Monagas State, Venezuela. Clin Rheumatol. 2016; 35(Suppl 1):53–61.
17. Marengo MF, Schneeberger EE, Citera G, Cocco JA. Work status among patients with ankylosing spondylitis in Argentina. J Clin Rheumatol. 2008;14: 273–7.
18. Bellomio V, Berman A, Sueldo RR, et al. Registro Iberoamericano de Espondiloartritis (RESPONDIA): Argentina. Reumatol Clin. 2008;4:S23–9.
19. Buschiazzo E, Maldonado-Cocco JA, Arturi P, et al. Epidemiology of spondyloarthritis in Argentina. Am J Med Sci. 2011;341:289–92.
20. Soriano ER, Rosa J, Velozo E, et al. Incidence and prevalence of psoriatic arthritis in Buenos Aires, Argentina: a 6-year health management organization-based study. Rheumatology (Oxford). 2011;50:729–34.
21. Schneeberger EE, Citera G, Rodriguez Gil G, et al. Clinical and immunogenetic characterization in psoriatic arthritis patients. Clin Rheumatol. 2015;34:1413–8.
22. Sommerfleck F, Schneeberger E, Citera G. Comorbidities in Argentine patients with axial spondyloarthritis: Is nephrolithiasis associated with this disease? Eur J Rheumatol. 2018;5:169–72.
23. Sommerfleck FA, Schneeberger EE, Orozco MC, Zamora N, Landi M, Citera G. Validation and cultural adaptation of the qualisex questionnaire in patients with axial spondyloarthritis in Argentina. Rheumatol Int. 2018;38:2103–9.
24. Scarafia S, Duarte V, Romanini FE, et al. Prevalence of overweight and obesity in early psoriatic arthritis clinic. J Clin Rheumatol. 2016;22:139.
25. Capelusnik D, Cavalieri M, Rolón Campuzano R, et al. Prevalence and characteristics of uveitis in a large cohort of patients with axial spondyloarthritis. J Clin Rheumatol. 2018;24:S103–4.
26. Sampaio-Barros PD, Gonçalves CR, Braga da Silva JA, et al. Registro Iberoamericano de Espondiloartritis (RESPONDIA): Brasil. Informe del Registro Brasileño de Espondiloartritis. Reumatol Clin. 2008;4:S30–5.
27. Skare TL, Bortoluzzo AB, Goncalves CR, et al. Ethnic influence in clinical and functional measures of Brazilian patients with spondyloarthritis. J Rheumatol. 2012;39:141–7.
28. Skare TL, Leite N, Bortoluzzo AB, et al. Effect of age at disease onset in the clinical profile of spondyloarthritis: a study of 1424 Brazilian patients. Clin Exp Rheumatol. 2012;30:351–7.
29. Rodrigues CE, Vieira WP, Bortoluzzo AB, et al. Low prevalence of renal, cardiac, pulmonary, and neurological extra-articular clinical manifestations in spondyloarthritis: analysis of the Brazilian Registry of Spondyloarthritis. Rev Bras Reumatol. 2012;52:375–83.
30. Duarte AP, Marques CD, Bortoluzzo AB, et al. Epidemiologic profile of juvenile-onset compared to adult-onset spondyloarthritis in a large Brazilian cohort. Rev Bras Reumatol. 2014;54:424–30.
31. Ribeiro SLE, de Campos APB, Palominos PE, et al. Different ethnic background is associated with distinct clinical profiles in the spondyloarthritides in the North and South of Brazil. Clin Rheumatol. 2018; 383:195–203.
32. Simioni J, Skare TL, Campos APB, et al. Fecal calprotectin, gut inflammation and spondyloarthritis. Arch Med Res. 2019;50:41–6.
33. Henrique L, Mello A, Kohem C, et al. Psoriatic arthritis patients followed in university hospitals in southern Brazil have a high prevalence of metabolic syndrome, overweight/obesity, diabetes and hypertension. J Clin Rheumatol. 2018;24:S106.
34. Gutiérrez MA, Pérez C, Saavedra J, et al. Registro Iberoamericano de Espondiloartritis (RESPONDIA): Chile. Reumatol Clin. 2008;4:S41–7.
35. Ibanez S, van Bentum R, Valenzuela O, van der Horst-Bruisnsma I. Chilean axial spondyloarthritis patients report high disease burden and impaired work activity - an internet survey in 472 patients. Ann Rheum Dis. 2019;78:A477.
36. Valle-Onate R, Candia L, Romero-Sanchez C, et al. Epidemiology of spondyloarthritis in Colombia. Am J Med Sci. 2011;341:293–4.
37. Bautista-Molano W, Landewe RB, Londono J, Romero-Sanchez C, Valle-Onate R, van der Heijde D. Analysis and performance of various classification criteria sets in a Colombian cohort of patients with spondyloarthritis. Clin Rheumatol. 2016;35:1759–67.
38. Santos AM, Pena P, Avila M, et al. Association of human leukocyte A, B, and DR antigens in Colombian patients with diagnosis of spondyloarthritis. Clin Rheumatol. 2017;36:953–8.
39. Sáenz CR. Registro Iberoamericano de Espondiloartritis (RESPONDIA): Costa Rica. Reumatol Clin. 2008;4:S36–40.
40. Casasola-Vargas JC, Flores-Alvarado DE, Huerta-Sil G, et al. Registro Iberoamericano de Espondiloartritis (RESPONDIA): México. Reumatol Clin. 2008;4:S56–62.
41. Chávez-Corrales JE, Montero Jáuregui M, Alva Linares M, et al. Registro Iberoamericano de Espondiloartritis (RESPONDIA): Perú. Reumatol Clin. 2008;4: S63–7.
42. Palleiro DR, Spangenberg E. Registro Iberoamericano de Espondiloartritis (RESPONDIA): Uruguay. Reumatol Clin. 2008;4:S73–8.
43. Chacón R, Granados Y, Esteva MH, et al. Registro Iberoamericano de Espondiloartritis (RESPONDIA): Venezuela. Reumatol Clin. 2008;4:S79–86.
44. García-Kutzbach A, Montenegro A, Iraheta I, Bara C, Saenz R. Epidemiology of spondyloarthropathies in Central America. Am J Med Sci. 2011;341:295–7.
45. Benegas M, Munoz-Gomariz E, Font P, et al. Comparison of the clinical expression of patients with ankylosing spondylitis from Europe and Latin America. J Rheumatol. 2012;39:2315–20.

46. Bautista-Molano W, Landewé R, Burgos-Vargas R, et al. Prevalence of comorbidities and risk factors for comorbidities in patients with spondyloarthritis in Latin America: a comparative study with the general population and data from the ASAS-COMOSPA study. J Rheumatol. 2018;45: 206–12.
47. Dean LE, Jones GT, MacDonald AG, Downham C, Sturrock RD, Macfarlane GJ. Global prevalence of ankylosing spondylitis. Rheumatology (Oxford). 2014;53:650–7.
48. Khan MA. HLA-B27 and its subtypes in world populations. Curr Opin Rheumatol. 1995;7:263–9.
49. Molto A, Etcheto A, van der Heijde D, et al. Prevalence of comorbidities and evaluation of their screening in spondyloarthritis: results of the international cross-sectional ASAS-COMOSPA study. Ann Rheum Dis. 2016;75:1016–23.
50. Molto A, Nikiphorou E. Comorbidities in spondyloarthritis. Front Med (Lausanne). 2018;5:62.
51. Azevedo VF, Babini A, Caballero-Uribe CV, Castaneda-Hernandez G, Borlenghi C, Jones HE. Practical guidance on biosimilars, with a focus on Latin America: what do rheumatologists need to know? J Clin Rheumatol. 2019;25:91–100.
52. Contreras-Yanez I, Ponce De Leon S, Cabiedes J, Rull-Gabayet M, Pascual-Ramos V. Inadequate therapy behavior is associated to disease flares in patients with rheumatoid arthritis who have achieved remission with disease-modifying antirheumatic drugs. Am J Med Sci. 2010;340:282–90.

Publisher's Note