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Physical Activity and Attitudes Toward Exercise in People With Axial and Peripheral Spondyloarthritis

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ABSTRACT. ***Objective.*** To evaluate physical activity and attitudes toward exercise among people with axial (ax-) and peripheral (p-) spondyloarthritis (SpA).

Methods. Using baseline information from an ongoing, longitudinal, prospective SpA cohort study (n = 264), self-reported attitudes and beliefs toward exercise were assessed using questionnaires. Total metabolic equivalent (MET) hours of self-reported physical activity per week, time spent in activities, and activity levels were calculated from the Nurses' Health Study Physical Activity Questionnaire II (NHSPAQ II). Adjusted multivariable linear models estimated the relationship between physical activity and disease status (axial vs peripheral).

Results. Regardless of predominant anatomic distribution of disease, most participants were well-educated, non-Hispanic White men. Approximately 40% met the US Department of Health and Human Services physical activity recommendations. Positive attitudes, beliefs, and perceived benefits toward exercise were similar by anatomic distribution of disease. Despite similar MET h/week, participants with axial disease had greater concerns regarding discomfort and joint injuries than those with peripheral disease. Compared to those with pSpA (n = 201), participants with axSpA (n = 63) spent less time engaging in light and moderate activities (adjusted β in light activity: −1.94 min/week, 95% CI −2.96 to −0.93; adjusted β in moderate activity: −1.05 min/week, 95% CI −2.12 to 0.02).

Conclusion. Participants with axSpA had greater concerns regarding discomfort and injuries from exercise than those with pSpA. Although no differences in time spent in vigorous activities were observed, participants with axSpA spent less time than those with pSpA in light to moderate activities.

Key Indexing Terms: ankylosing spondylitis, cohort studies, exercise, spondyloarthropathy

Spondyloarthritis (SpA) is one of the most prevalent forms of inflammatory arthritis among adults, occurring in 0.5% to 1% of the population[1,2]. In the United States, ~2.7 million people are affected with various forms of SpA[2]. SpA can be characterized as axial or peripheral disease based on the clinical manifestations[1,3]. Features of axial SpA (axSpA) include low back pain due to sacroiliitis, and neck and back stiffness with limited spinal motion[1,4,5]. Peripheral SpA (pSpA) is characterized by enthesitis, dactylitis, and arthritis affecting predominantly large joints[6]. Both axSpA and pSpA may be associated with extraarticular manifestations, such as uveitis, psoriasis, and inflammatory bowel disease[4,6].

Despite the health-related benefits of regular physical activity[7,8], patients with inflammatory arthritis, including those with SpA, are generally less active than individuals without disease[9,10]. Factors that may account for this difference include the paucity of recommendations for exercise in this population, failure of healthcare providers to regularly engage these patients in exercise, and disease-specific limitations related to SpA[11]. However, information on self-reported physical activity and attitudes toward exercise have not been well-characterized among patients with SpA in the United States.

The distribution of disease and resultant physical limitations differ between axSpA and pSpA. Therefore, physical activity

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interventions should be tailored according to these differences. Functional limitations among people with SpA are more strongly associated with peripheral joint involvement than with axial manifestations[12]. However, the extent to which these differences in functional limitations translate into differences in attitudes toward exercise and/or physical activity or in the types, modes, or intensity of physical activity remains unknown. The present study sought to evaluate the extent to which self-reported physical activity and attitudes toward exercise differ between people with axSpA and those with pSpA, using a US-based cohort. We hypothesized that people with predominantly axial disease might be more positively inclined toward exercise and be more physically active than those with predominantly peripheral joint involvement. Information regarding potentially different attitudes toward exercise, physical activity behavior, and how they vary relative to predominant anatomic distribution of disease could inform the development of more effective interventions to promote physical activity for people with SpA.

MATERIALS AND METHODS

The University of Massachusetts Medical School Institutional Review Board approved this study (ID: H00005916; H00006291). Participants have provided written informed consent to participate in the research. As part of the informed consent process, subjects were informed that their identity would remain confidential in any study results made public and therefore patient's written informed consent to publish the material was waived. The study was conducted using aggregated data for the analysis and no identifiable information was contained in the study. The reporting guidelines following the STROBE (STrengthening the Reporting of OBservational studies in Epidemiology) statement have been used for the present study.

Data source. We used data from an ongoing, longitudinal, prospective registry at a single site (the Rheumatology Center at UMass Memorial Medical Center). The cohort, which was created to address clinical and translational research questions, consists of people with SpA, including those with psoriasis and other comorbid diseases. Participants met the Assessment of SpondyloArthritis international Society (ASAS) classification criteria for either axSpA or pSpA[1,6]. Exclusion criteria were participants aged < 18 years, prisoners, pregnant women, non-English speakers, and/or people unable to complete the questionnaires. In addition to enrollment visits, participants were contacted by research staff to schedule 2 additional follow-up visits at approximately 12-month intervals from their baseline visit. Biological specimens and information regarding disease activity, function, and physical activity were collected at each study visit.

Study sample. We used cross-sectional data from the baseline visits of 264 people with SpA who had been enrolled prospectively into the registry between November 2014 to May 2019. For the current analysis, participants were classified as having predominantly axSpA or pSpA using the ASAS classification criteria[1,6].

Attitudes and beliefs toward exercise. Five domains of attitudes and beliefs regarding exercise were assessed using self-reported questionnaires[13] including: (1) general attitude toward exercise (e.g., regular exercise, type of exercise); (2) support from other people in the regular performance of exercise; (3) benefits of exercise/physical activity (e.g., "helping disease", pain relief, and improving strength and function); (4) complications of and/or concerns regarding physical activity (e.g., time, discomfort, joint injuries); and (5) exercise/physical activity behavior. A continuous scale (range 0–100) was used to evaluate attitudes and beliefs regarding exercise. High scores indicate a favorable attitude toward, approval of, or agreement with the benefits of exercise and/or that the individual is strongly or extremely likely to engage in exercise/physical activity.

Measurement of physical activity. Physical activity was measured using the validated Nurses' Health Study Physical Activity Questionnaire II (NHSPAQ II)[14]. The NHSPAQ II is a simple, short, self-report scale that evaluates types (e.g., swimming, walking, running) and determinants (i.e., frequency, intensity, and duration) of physical activity participation over the previous week[15]. We assessed physical activity in 2 ways. First, to calculate the overall energy expenditure engaging in physical activity, we used the total metabolic equivalent (MET) hours of physical activity per week (MET h/week) to incorporate the frequency, duration, and intensity by different type of activities[16,17]. Since each activity is assigned a MET score, which is a measure of energy expenditure, we calculated the total MET h/week[16]. We then multiplied the amount of time spent on each activity by its typical energy expenditure requirement in MET to calculate overall MET h/week for that activity. For example, if a participant engaged in aerobic exercise (MET 6.0) for 30 minutes during the previous week, the total MET h/week = 6 × 0.5 h = 3.0 MET h/week. We then summed the contribution of each activity for each activity engaged in over that week. Second, activity intensities were further classified as light (1.1–2.9 MET), moderate (3.0–5.9 MET), and vigorous (≥ 6.0 MET) to characterize the total time spent engaged in these different levels of recreational activities[18]. We then summed the total number of minutes that participants engaged in each level of activity. Participants were classified as either meeting or not meeting the following 2008 US Department of Health and Human Services (DHHS) physical activity recommendations: (1) ≥ 75 minutes per week for vigorous activities; (2) ≥ 150 minutes per week for moderate activities; or (3) a combination of moderate and vigorous activities that yielded an equivalent total weekly energy expenditure in MET to either (1) or (2)[18].

Sociodemographic and clinical characteristics. Sociodemographic characteristics included age (in years), sex (male/female), race/ethnicity, education, marital status, and employment and insurance status. Race/ethnicity was based on self-report (non-Hispanic White, non-Hispanic Black, Hispanic, and other). Educational levels were collapsed into high school or less, at least some college, and graduate school. Marital status was categorized using a binary variable (yes: married; no: other). Employment status was collapsed into paid employment, disabled, unemployed, retired, homemaker, and other. Insurance status was self-reported and categorized into private, Medicaid, Medicare, and uninsured. BMI was calculated from measured weight and height (kg/m^2) and was classified[19] as < 18.5 kg/m^2, 18.5–24.9 kg/m^2, 25.0–29.9 kg/m^2, or ≥ 30 kg/m^2.

Clinical characteristics included measures for years since diagnosis, disease severity, disease activity, and current treatments. The time since diagnosis was calculated as the number of years between the enrollment date and the date when the participant was diagnosed with axSpA or pSpA. Disease severity was evaluated using the patient global assessment on a 100-point visual analog scale (VAS; higher score indicating more severe symptoms)[20]. Pain over the past week was also evaluated using a 100-point VAS (higher score indicating more severe symptoms). Disease activity was measured using the Bath Ankylosing Spondylitis Disease Activity Index[21] and Bath Ankylosing Spondylitis Functional Index[22]. Both scales range from 0 to 10, and higher scores indicate higher disease activity. Current medication use, including conventional synthetic disease-modifying antirheumatic drugs (csDMARD), corticosteroids, biological medications, nonsteroidal antiinflammatory drugs (NSAID), and opioids, was self-reported and coded as a series of binary variables (yes/no). Participants were asked whether they had undergone physical therapy for their disease within the previous 6 months; their responses were categorized as yes, no, and unknown.

Statistical analyses. We first described sociodemographic and clinical characteristics separately for participants with pSpA and axSpA. The data were summarized using descriptive statistics, such as the means for each continuous variable and the percentages for each categorical variable. For the continuous variables of interest, the distributions were visually inspected to evaluate departures from normality. Given the skewed distributions, the medians, 25th, and 75th percentiles were computed to describe the

attitudes and beliefs toward exercise in participants with SpA classified by predominant anatomic distribution. To evaluate the association between predominant anatomic distribution and attitudes and beliefs toward exercise, 2 sample *t*-tests (if normally distributed) or Mann-Whitney *U* tests (if skewed) were conducted for continuous variables. The relative proportions of each activity type in which participants engaged over the past week were calculated separately for those with pSpA and those with axSpA. The medians, 25th, and 75th percentiles were used to summarize the skewed MET h/week and the time spent (minutes) in each activity level (i.e., light, moderate, vigorous).

For overall time of MET h/week and time spent in each physical activity level (i.e., light, moderate, vigorous), we developed 4 models to examine the relationship between physical activity and predominant anatomic distribution of SpA (axial vs peripheral). Due to the skewed nature of the data, we fitted generalized linear models using maximum likelihood methods with the underlying assumptions that the distributions were other than normal[23,24]. Multivariable models were used to estimate crude and adjusted β coefficients and 95% CI. To develop the final model, we used an iterative approach that considered sociodemographic and clinical characteristics during the model building process for each outcome. Positive β coefficients corresponded to the higher MET h/week or more time spent engaging in each physical activity level. The proportion of participants who met the physical activity guideline was calculated for both axSpA and pSpA. Logistic models estimated adjusted OR and 95% CI to examine the association between meeting the 2008 DHHS physical activity recommendations and predominant anatomic distribution of SpA.

RESULTS

In the present study, 201 people with pSpA and 63 people with axSpA were included. Overall, 23.9% of participants had axSpA (Table 1). Participants with axSpA were younger and had a shorter average duration of disease since diagnosis than those with pSpA. Irrespective of predominant anatomic distribution (axial vs peripheral), most were non-Hispanic White men, married, had attended at least some college, and had a BMI ≥ 25.0 kg/m^2. The distribution of disease activity measures was similar in both groups. While csDMARD were used by participants with predominantly peripheral disease (34.3%), only 1.6% of participants with axSpA were treated with csDMARD. Over half of participants with axSpA had received physical therapy, whereas only 1 in 5 participants with pSpA had received physical therapy during the previous 6 months.

Table 2 shows the attitudes and beliefs of participants toward exercise. In general, the attitudes and beliefs toward exercise and its perceived benefits were similar, regardless of whether a participant had predominantly axial or peripheral disease—the median score for general attitude toward regular exercise was 81.0 for participants with axSpA and 88.0 for participants with pSpA. However, the median scores for pain relief were 67.0 for participants with axSpA and 70.0 for participants with pSpA. The median proportions of participants who were concerned about discomfort and joint injuries resulting from exercise or other physical activity were 61.0% and 34.5%, respectively, for those with axSpA, and 50.0% and 20.0%, respectively, for those with pSpA. When asked to recall regular exercise before age 30 years, 57.9% of those with axSpA and 80.0% of those with pSpA reported having exercised regularly at least once per week.

Table 3 displays the types of activities in which participants usually engaged. Overall, these were similar, irrespective of predominant anatomic distribution. Among participants with axSpA, walking was the most common type of physical activity (83.6%), followed by back stretching or strengthening exercises (62.3%), brisk walking (44.3%), and bicycling (30.0%). Among those with pSpA, walking was the most common type of physical

Table 1. Characteristics of participants with SpA by predominant anatomic distribution (peripheral or axial; N = 264).

Characteristics	Peripheral SpA, n = 201	Axial SpA, n = 63
Sociodemographics		
Age, yrs, mean (SD)	53.7 (12.1)	44.4 (12.8)
Women	46.9	43.1
Race/ethnicity		
Non-Hispanic White	92.3	86.2
Non-Hispanic Black	0.5	1.7
Hispanic	3.6	6.9
Other	3.6	5.2
Education level		
≤ High school	14.5	20.4
Some college	54.9	46.3
Graduate school	30.6	33.3
Married	73.1	69.6
Work status		
Paid employment	63.8	67.2
Disabled	9.6	13.8
Unemployed	0.5	1.7
Retired	18.1	3.5
Homemaker	4.3	3.5
Other	3.7	10.3
Insurance status		
Private	83.2	84.2
Medicaid	3.8	3.5
Medicare	11.4	12.3
Uninsured	1.6	0.0
BMI, kg/m^2		
< 18.5	0.0	3.3
18.5–24.9	15.0	16.7
25.0–29.9	34.7	36.7
≥ 30	50.3	43.3
Disease severity/activity, mean (SD)		
Patient global assessment	68.6 (24.6)	63.5 (24.1)
Pain in the past week	35.7 (31.1)	40.5 (30.6)
BASDAI*	3.7 (2.5)	3.9 (2.5)
BASFI*	2.4 (2.4)	2.9 (2.5)
Yrs since diagnosis	19.1 (14.4)	12.0 (12.7)
Current treatment, %		
csDMARD alone	34.3	1.6
Corticosteroids alone	6.5	3.2
csDMARD + corticosteroids	38.8	4.8
Biologics	42.3	39.7
NSAID	58.7	58.7
Opioids	8.5	11.1
Physical therapy in the past 6 months	20.7	52.0

Data are expressed in percent unless otherwise indicated. BASDAI: Bath Ankylosing Spondylitis Disease Activity Index; BASFI: Bath Ankylosing Spondylitis Functional Index; csDMARD: conventional synthetic disease-modifying antirheumatic drug; NSAID: nonsteroidal antiinflammatory drug; SpA: spondyloarthritis.

Table 2. Attitudes and beliefs[a] towards exercise in people with axial and peripheral SpA (N = 264).

	Peripheral SpA, n = 201	Axial SpA, n = 63	95% CI
General attitude towards			
Regular exercise	88.0 (51.0–98.0)	81.0 (50.0–99.0)	−14.1 to 7.3
Swimming and aquatic exercise	82.0 (50.0–99.0)	86.5 (48.0–100)	−13.2 to 12.4
Moderate activity for reduced symptoms	76.0 (50.0–99.0)	72.5 (50.0–91.0)	−9.3 to 11.9
Moderate activity for arthritis	84.0 (59.5–99.5)	80.0 (64.0–97.0)	−7.9 to 11.6
Support from people for			
Regular exercise	97.0 (77.0–100)	98.0 (75.0–100)	−10.5 to 5.7
Swimming and aquatic exercise	93.0 (51.0–100)	94.0 (77.0–100)	−13.1 to 4.0
Benefits in exercise/physically active			
Help disease	96.5 (74.0–100)	89.0 (74.0–100)	−6.4 to 9.3
Improve abilities to do things	98.0 (80.0–100)	89.0 (70.0–100)	−0.7 to 15.4
Better for themselves	99.0 (85.0–100)	94.0 (75.0–100)	−2.6 to 8.9
Pain relief	70.0 (50.0–97.0)	67.0 (41.0–95.0)	−7.9 to 14.2
Improve muscle strength	99.0 (87.0–100)	91.0 (80.0–100)	−2.5 to 8.9
Take care of home and family	97.0 (76.0–100)	86.0 (69.0–100)	−3.2 to 12.0
Improve general function	97.0 (83.0–100)	92.0 (71.0–100)	−1.6 to 12.6
Complication and/or concerns			
Discomfort	50.0 (11.0–74.5)	61.0 (32.0–85.0)	−22.4 to 2.0
Joint injuries	20.0 (1.0–50.0)	34.5 (10.0–53.0)	18.6 to 3.0
Take time away from things	10.0 (0–32.5)	22.5 (4.0–42.0)	−17.2 to 2.8
Boring	22.0 (2.0–50.0)	35.5 (6.0–52.0)	−17.1 to 5.9
Behavior for exercise/physical activity			
Likely for at least 3 times/week for 10 min	99.0 (67.0–100)	98.0 (75.0–100)	−12.3 to 5.4
Regular exercise prior to age 30 yrs			
Sporadic	10.9	18.4	
≥ 1 time/month	6.4	13.2	
≥ 1 time/week	80.0	57.9	

Data are expressed as median (25th–75th percentiles) unless otherwise indicated. [a] Zero indicates unfavorable/disapprove/disagree strongly/extremely unlikely, and 100 indicates favorable/approve/agree strongly/extremely likely. SpA: spondyloarthritis.

Table 3. Type of activities that patients usually participate in by predominant anatomic distribution of disease (N = 264).

Activity	Peripheral SpA, n = 201	Axial SpA, n = 63
Jogging/running	10.1	14.8
Brisk walking	44.5	44.3
General walking	81.1	83.6
Swimming	15.8	25.0
Water exercising	5.1	6.7
Aerobic/calisthenics	14.7	18.0
Weightlifting	20.2	26.2
Bicycle/exercise bike	28.5	30.0
Team sports	8.7	6.7
Yoga/Pilates	8.7	15.0
Back stretching or strengthening exercises	45.3	62.3
Other	28.9	21.3

Data are expressed in percent. SpA: spondyloarthritis.

activity (81.1%), followed by back stretching or strengthening exercises (45.3%), brisk walking (44.5%), and other activities (28.9%).

The associations between predominant anatomic distribution and time spent in different levels of physical activity are shown in Table 4. Despite there having been no difference between the 2 groups in the average MET h/week (adjusted β 0.01, 95% CI −1.66 to 1.68) after adjusting for sociodemographic and clinical characteristics such as sex, marital status, NSAID use, and physical therapy within the past 6 months, participants with axSpA spent fewer minutes engaging in light and moderate activities (adjusted β in light activity: −1.94 min/week, 95% CI −2.96 to −0.93; adjusted β in moderate activity: −1.05 min/week, 95% CI −2.12 to 0.02). The proportion of participants that met the physical activity recommendations was 49.2% for those with axSpA and 41.3% for those with pSpA, but this did not differ between the 2 groups after adjusting for sociodemographic and clinical factors.

DISCUSSION

To our knowledge, this is the first study to describe and compare self-reported physical activity and attitudes toward exercise among people with SpA by predominant anatomic distribution of disease, using cross-sectional data from an ongoing, longitudinal, single-site, prospective, US-based cohort. In this cohort, approximately 1 in 4 participants had predominantly axial disease. The median level of physical activity measured by MET h/week in participants with SpA observed in our US-based

Table 4. Association between predominant anatomic distribution (peripheral or axial) and time spent in different levels of physical activity (N = 264).

	Peripheral SpA, n = 201	Axial SpA, n = 63	Crude β Coefficients[a], 95% CI	Adjusted β Coefficients[a], 95% CI
	Median (25th–75th percentiles)			
Recreational activity in MET h/week	36.9 (14.0–96.2)	33.7 (16.0–175.1)	0.24 (–0.70 to 1.18)	0.01 (–1.66 to 1.68)
Time in levels of recreational activity, min/week				
Light activities, < 3.0 MET	210.0 (60.0–480.0)	210.0 (60.0–480.0)	0.35 (–1.66 to 2.35)	–1.94 (–2.96 to –0.93)
Moderate activities, 3.0–5.9 MET	210.0 (210.0–930.0)	480.0 (210.0–930.0)	0.05 (–0.78 to 0.88)	–1.05 (–2.12 to 0.02)
Vigorous activities, ≥ 6.0 MET	120.0 (0–405.0)	90.0 (0–690.0)	0.29 (–0.74 to 1.32)	0.0002 (–1.21 to 1.21)
	Proportion Meeting Guideline, %		Crude OR[a] (95% CI*)	Adjusted OR[a] (95% CI*)
Meeting physical activity guideline	41.3	49.2	0.73 (0.41–1.28)	0.70 (0.35–1.40)

[a] β coefficients and OR (95% CI) were estimated using participants with predominantly peripheral disease as the reference group. All models were adjusted for sex, marital status, NSAID use, and physical therapy in the past 6 months. MET: metabolic equivalent; NSAID: nonsteroidal antiinflammatory drug; SpA: spondyloarthritis.

study is consistent with that in studies using Scandinavian cohorts[25,26]. Participants with SpA, whether axial or peripheral, generally expressed similar attitudes and beliefs toward exercise and its perceived benefits, although participants with axSpA had slightly greater concerns about exercise/physical activity than those with pSpA. Walking was the type of physical activity reported most commonly by participants, regardless of their predominant anatomic distribution of disease.

As stated earlier, we had anticipated greater inclination toward exercise among participants with axSpA. However, our findings did not support this hypothesis. The axSpA and pSpA groups reported similar weekly energy expenditure and time spent participating in vigorous activities. Further, participants with axSpA appeared to spend less time engaging in light to moderate activities than did those with pSpA. This potentially reflects the greater concern about discomfort and joint injuries as well as less perceived benefits of physical activity expressed by people with axSpA, compared to that by those with pSpA; this might have influenced the type of exercise in which participants engaged. Also, since over half of the participants with axSpA in our study had received physical therapy during the previous 6 months, they might have been more limited physically than those who did not require physical therapy and thus may have been less active than we had anticipated[27]. Whereas the majority of participants in both groups reported participation in light to moderate physical activities, such as walking and back stretching or strengthening exercises, only 25% of participants with axSpA and 16% of participants with pSpA reported participation in swimming, which can be an activity of moderate to vigorous intensity. These exercise patterns of people with axSpA are consistent with findings of studies conducted in Norway and France; however, these European studies did not evaluate people with pSpA and thus did not make any comparison between axSpA and pSpA[7,26].

We observed that participants in our US-based cohort of SpA patients generally express positive attitudes toward exercise, particularly regarding the perceived benefits (e.g., improved "abilities to do things," muscle strength) of being physically active. This is consistent with the findings of European studies conducted in similar clinical settings, in which questionnaires were used to elicit self-reported attitudes/beliefs toward exercise[8,28,29,30]. Although most perceived the advantages of being physically active, only half of SpA patients in our cohort achieved the weekly amount of physical activity recommended by the US DHHS guideline[18]. Symptoms such as pain were frequently reported as being the barrier to exercise and physical activity[31]. We observed that, despite their beliefs in the benefits of exercise and being physically active, participants in our cohort rated the effect of physical activity on pain relief less favorably. Our observation that, in our US-based cohort, half of SpA patients did not meet this physical activity guideline is comparable to that reported among people with SpA in European cohorts[7,29,31]. Indeed, studies conducted in Ireland and Spain have also found that people with SpA often consider themselves to be "non-exercisers" and need more education about exercise[28,32]. To address this knowledge gap, studies are needed to evaluate the extent to which behavioral interventions that are tailored to patients' attitudes and beliefs toward regular exercise can increase and sustain levels of physical activity.

Given that people with SpA are at increased risk of developing cardiovascular (CV) disease[33,34,35], understanding how best to promote different types of physical activity in these patients may yield beneficial effects beyond those to the musculoskeletal system[33,34]. Since we assessed patients only at a single timepoint, we could not determine the extent to which dissimilarities in physical activity might be associated with differences in longitudinal disease outcomes. The relative benefits of different types or levels of activity to people with SpA has not been studied adequately, despite the demonstration that regular exercise (e.g., ≥ 150 min of moderate to vigorous activity per week) is generally associated with better long-term disease-specific function among people with axSpA[36]. An evidence base is needed to better inform specific recommendations for people with axSpA or pSpA regarding the type, mode, and intensity of physical activity. In addition, we observed that 80% of participants with

pSpA reported having performed regular exercise at least once per week before the age of 30. However, the extent to which an association between exercise behavior during younger years (or before diagnosis) and current activity level remains unclear.

By using an ongoing, longitudinal, single-site, prospective cohort, this study has several strengths. Our analytical sample consisted of ~250 participants with SpA, which was comparable to that of other studies that examined physical activity in people with SpA[7,25,29]. A large amount of information on sociodemographics, medical history regarding diagnosis and treatment, clinical examinations, and laboratory data were collected from the cohort participants. As such, we were able to compare and contrast many factors associated with physical activity by predominant anatomic distribution of disease. Additionally, the frequency and duration of each type of physical activity were also collected, allowing us to calculate total energy expenditure in MET h/week, a summary measure that has been used to quantify the longitudinal association of different types of physical activities and outcomes (e.g., CV risk, disease activity, and symptoms)[37,38].

Several limitations must be acknowledged. First, the sample size limits the statistical power to conduct additional stratified analyses. Second, NHSPAQ II, which was used to assess self-reported physical activity, is a summated construct based on the mode, frequency, intensity, and duration of the types of activity. Thus, activities of daily living and therapeutic exercises may not be evaluated distinguishably[14,15]. Differences of reporting between subgroups is also a possibility[39,40,41]. However, our observations are consistent with those of studies that used objective measures of physical activity[9,42]. In addition to using self-reported physical activity/exercise, physical function/performance testing might also be used to evaluate exercise capacity in this particular group[43]. Third, the characteristics of those who agreed to participate in the current cohort may differ from those who did not participate. Fourth, generalizability is a concern, since our study participants were recruited from a single site—a rheumatology clinical practice at an academic medical center. Indeed, we found that the majority of the participants were well-educated, which may have had an effect on how patients reported their physical activity levels[41,44]. Other than the distribution of sex/gender and BMI, the characteristics of our US-based study sample, such as age and disease duration, are comparable to those of participants in the European studies of physical activity in people with SpA[31]. A larger study using both self-reported and objective measures obtained from a sociodemographically more diverse group of people with axSpA and pSpA would complement data from the present study to further understand the relative amounts of time spent by each group engaged in different physical activities.

In summary, we found that although participants with SpA have generally positive attitudes toward exercise and physical activity, those with axial disease were slightly more concerned about discomfort and joint injuries than those with peripheral disease. Further, we observed similar levels of weekly energy expenditure and participation in vigorous physical activities among participants with axSpA and those with pSpA, but less time spent engaging in light to moderate activities among participants with axSpA. Given the potential health benefits to this patient population of engaging in regular physical activity, further research is needed to understand how best to improve patients' physical activity, taking into account their attitudes and beliefs. In addition, a prospective evaluation of the longitudinal relationship between physical activity and disease outcomes will be critical to understanding the long-term effects of exercise in this patient population.

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