

# Effect of Psoriatic Arthritis According to the Affected Categories of the International Classification of Functioning, Disability and Health

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**ABSTRACT.** *Objective.* To determine the categories of the International Classification of Functioning, Disability and Health (ICF) checklist and core sets of rheumatoid arthritis and ankylosing spondylitis frequently occurring in people with psoriatic arthritis (PsA) and to compare the number of such categories with scores on self-report measures of participation restrictions and activity limitations.

*Methods.* Data were collected from 94 patients with PsA attending rheumatology clinics in 6 centers. For each ICF category affected by PsA in at least 30% of patients, the percentage of such patients was determined for Body Structures, Body Functions, Activities and Participation, and Environmental Factors. A count of all affected categories by ICF chapter was compared to patient self-report scores on a number of functional and health status instruments using Spearman's correlation.

*Results.* There were 25 categories in the Body Functions section, 6 categories in the Body Structures section, and 51 categories in the Activities and Participation section that were relevant in at least 30% of participants. Thirteen Environmental Factors were facilitating and 1 Environmental Factor (climate) was a barrier in at least 30% of participants. The number of involved Activities and Participation categories by chapter did not correlate in predictable ways with self-report measures of participation restrictions and activity limitations.

*Conclusion.* PsA is associated with a wide range of impairments, limitations, and restrictions across the ICF categories. People with PsA find environmental factors to be helpful more often than to be barriers. The unexpected pattern of correlation between ICF chapters and self-report measures suggests the need for a better way of quantitatively representing the ICF concepts. (J Rheumatol First Release July 1 2010; doi:10.3899/jrheum.091315)

## Key Indexing Terms:

PSORIATIC ARTHRITIS

DISABILITY

INTERNATIONAL CLASSIFICATION OF FUNCTIONING, DISABILITY AND HEALTH

Psoriasis (Ps) is a chronic inflammatory skin condition characterized by red, scaly plaques over extensor surfaces and elsewhere, with an unpredictable relapsing and remitting course. It is associated with significant physical and social problems<sup>1</sup>. Psoriatic arthritis (PsA) is an inflammatory

arthritis associated with psoriasis and characterized by painful swollen joints, spinal involvement, enthesitis, and dactylitis. It occurs in around 20% of people with Ps and has significant functional and quality of life (QOL) consequences<sup>2</sup>.

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Two important areas of assessment were highlighted at the 2006 OMERACT (Outcome Measures in Rheumatology Clinical Trials) conference, where consensus concerning outcome domains and measures in PsA was formulated<sup>3</sup>. First, "function" was seen as a vital area, but no condition-specific assessment tools had been developed for use in PsA. Second, the International Classification of Functioning, Disability and Health (ICF) concept of "participation" was promoted, but no satisfactory method of measuring this concept had been established. These 2 areas were seen as important items for the research agenda.

It would also be valuable for teaching, clinical practice, and research to define what should be measured to represent comprehensively the experience of patients with PsA or Ps.

To achieve that goal, a comprehensive framework and classification is needed, which can serve as a universal language understood by health professionals, researchers, policy makers, patients, and patient organizations.

With the approval of the new ICF (formerly International Classification of Functioning and Disability; [www.who.int/classification/icf](http://www.who.int/classification/icf))<sup>4</sup>, we can now rely on a globally agreed-upon framework and classification that could define the typical spectrum of problems in functioning of patients with Ps and PsA. For practical purposes and to set condition-specific health status measures, it would help to link specific conditions or diseases to salient ICF categories of functioning<sup>5</sup>. Such a generally agreed-upon list of ICF categories can serve as an ICF core set to be rated in all patients included in clinical studies and to guide multidisciplinary assessments in patients with PsA or Ps. ICF core sets have now been identified for 12 common health conditions using the prescribed methodology, and multicenter validation (Phase 3) is currently under way<sup>6</sup>.

Note that these ICF core sets are quite different from core sets of domains of measurement developed through the Outcome Measures in Rheumatoid Arthritis Clinical Trial (OMERACT). OMERACT core sets refer to broad areas (e.g., inflammation, joint damage, physical functioning) that should be measured in all clinical studies of the specific rheumatic disease; while ICF core sets refer to the minimum set of ICF categories that concern aspects of functioning relevant to the specific disease. There are now some useful links between OMERACT and the ICF core set projects, particularly in relation to the use of the ICF as a framework for considering domains of outcome measurement and for ICF core sets to inform aspects of content validity for measurement instruments used in clinical research<sup>7,8</sup>.

It is necessary to justify the parallel development of core sets for both Ps and PsA, rather than just combining core sets from Ps with core sets from other inflammatory arthritic conditions [such as rheumatoid arthritis (RA) and ankylosing spondylitis (AS)]. First, PsA is a different condition from RA or AS. Although sharing features of each disorder, there are significant differences in the musculoskeletal pathology and disease expression. For example, fewer peripheral joints are involved in PsA compared to RA, involved joints are less tender in PsA compared to RA<sup>9</sup>, health-related QOL (HRQOL) has been shown to be worse in PsA compared to matched RA controls<sup>10</sup>, and both osteolysis and new bone formation may occur in PsA, leading to gross joint destruction (arthritis mutilans) as well as joint ankylosis, which is less common in RA<sup>11</sup>. Axial involvement is common in PsA but often not clinically symptomatic, in contrast to AS<sup>12</sup>. Further, the axial involvement is often more patchy, involving the cervical spine more frequently in isolation from sacroiliac or lumbar disease, which is not common in AS, and the radiographic changes are different in PsA spondylitis, with larger, more curvilinear non-

marginal syndesmophyte formation than is seen in AS<sup>11</sup>. Exactly how these differences in pathology and clinical expression will translate into functional consequences is not clear and cannot be simply assumed.

Second, it is unclear how the combination of skin disease with arthritis will affect functional status when considered in isolation. It cannot be assumed that these aspects will operate independently, and simply adding together the functional consequences of each health condition to arrive at an overall assessment may be misleading. It is possible that other interactions will occur; for example, synergistic effects may conceivably lead to more disability than anticipated (a multiplicative rather than additive model) or the severity of 1 aspect of the disease may “swamp” the other aspect of the disease and lead to no disability expressed from the minor component of the condition. Quite how the combination of 2 different expressions of the same pathological disorder will translate into the functional consequences of each clinical expression cannot be assumed.

In fact, the condition of PsA gives us an opportunity to better understand how combinations of completely different organ system dysfunction lead to broader expressions of function as defined by the ICF. By studying both conditions in parallel it will be possible to test hypotheses relating to how ICF core sets for complex disorders could be combined from existing core sets from related conditions.

In order to develop an ICF core set for PsA, a series of studies that identifies ICF categories relevant to PsA is necessary. The design for these studies was developed by the ICF Research Branch, Ludwig-Maximilians-University, for 12 other specific diseases<sup>13</sup> and culminated in a consensus conference that examined data gathered from these studies in order to recommend a core set of categories.

However, our report presents only 1 component of that work — a description of which ICF categories are affected in PsA, obtained by direct application of ICF categories to people with PsA, and how the number of affected ICF categories relates to self-reported measures of functioning and QOL. Other studies that are part of the overall ICF Core Set project are reported separately and include qualitative research with patients with PsA<sup>14</sup> and Ps (manuscript in preparation), direct application of the ICF to people with Ps (data collection in progress), Delphi studies of important aspects of functioning in people with PsA and Ps from the perspective of health professionals (manuscripts in preparation), and studies that map standard self-report questionnaires of functioning onto ICF categories in these diseases (manuscript in preparation).

## MATERIALS AND METHODS

Broadly, we took the approach promoted by the ICF core sets project<sup>13</sup>. A convenience sample of patients with PsA attending clinics in New Zealand, Australia, Canada, the United States, and the UK were assessed by a health-care professional using the extended ICF Checklist<sup>15</sup>, an abbreviated version of the entire ICF developed by the World Health Organization (WHO)

and supplemented by categories identified as important for people with arthritis from the RA<sup>16</sup> and AS ICF core sets<sup>17</sup>. The RA and AS ICF core sets were developed according to the methodology specified by the ICF Research Branch. In total, this modified checklist of ICF categories contained 46 categories from the Body Functions section, 19 from the Body Structures section, 97 from the Activities and Participation section, and 37 from the Environmental section. Categories from the Body Functions, Body Structures, and Activities and Participation sections were assessed as being impaired or not on a 5-level qualifier (no problem, mild problem, moderate problem, severe problem, complete problem). Responses of “due to comorbidity,” “not specified,” or “not applicable” were treated as missing.

Patients were recruited from general rheumatology clinics. All patients had been diagnosed with PsA by experienced rheumatologists and all fulfilled the Classification of Psoriatic Arthritis study group criteria for PsA<sup>18</sup>. The number of participants (n = 94) was based upon the design of similar studies by the ICF Research Branch in which the numbers of participants ranged from 32 to 163<sup>19</sup>.

Trained health professionals (generally nurses) rated the level of impairment/restriction in each ICF category by interview with the patient, review of medical records, and consultation with the patient’s rheumatologist. The ICF is not designed to be a self-report questionnaire. Training materials for assessors were prepared using materials from the ICF Research Centre. Assessors underwent self-directed training within each center and did not meet together during the study. No problems with the assessment process were reported. In addition, patients completed the following self-report questionnaires: WHO Disability Assessment Schedule II (WHODAS II), PAR-PRO, the Medical Outcomes Study Short-Form 36 (SF-36), the PsA-specific QOL instrument PsAQOL, and the Health Assessment Questionnaire-Damage Index (HAQ-DI).

The WHODAS II is based explicitly upon the International Classification of Impairment, Disability and Handicap (ICIDH-2), the immediate precursor to the ICF<sup>20,21,22</sup>. It is a 36-item questionnaire that measures functioning and disability in 6 domains: understanding and communication, getting around, self-care, getting along with others, life activities, and participation in society. We were more interested in comparing ICF categories with the appropriate WHODAS II domain, so only 2 domain scores are reported (life activities and participation). The scoring algorithm developed by the WHO and obtained from the ICF Research Centre (Cieza A, personal communication) was used to calculate the domain scores.

The PAR-PRO is a new generic self-report instrument based explicitly upon the ICF concept of participation<sup>23</sup>. It contains 20 items reflecting social activities that are rated in terms of frequency of occurrence (not at all, at least once a month but less than once a week, and at least weekly). The score ranges from 0 (severe participation restriction) to 40 (no participation restriction).

The SF-36 is a 36-item instrument that scores as 8 subscores: physical functioning, role limitations (physical), role limitations (emotional), social, mental health, pain, vitality, and general perception of health, and 2 aggregated summary scores: physical health and mental health<sup>24</sup>.

Condition-specific health-related QOL was assessed using the PsAQOL instrument<sup>25</sup>. This 20-item measure was developed using a “needs-based” model of QOL using an item pool derived from qualitative interviews of people with PsA and then constructed to fit the Rasch model of unidimensional measurement.

Approval was granted by the appropriate Ethics Committee or Institutional Review Board at each site.

*Analysis.* ICF categories that were affected in at least 30% of the sample are tabulated to give a sense of the most important life areas affected by this disease, recognizing that individual patients may be affected in idiosyncratic ways. A 30% threshold was chosen since this was the approach taken by the ICF Research Centre in development of other ICF core sets<sup>19</sup>. The 5-level qualifiers for each ICF category were identified as being affected or not affected, because previous work has suggested that the reliability of assigning qualifiers is inadequate<sup>26</sup> and shows evidence of disordered

thresholds<sup>27</sup>, even by trained assessors, and because a reduced number of qualifiers is more robust.

To compensate for the likelihood of individual variation that would be lost by recognizing only categories affected in at least 30% of the sample, for the Activities and Participation and Environmental factors (barriers and facilitators separately), the number of all affected categories was found by adding up ICF chapters. Chapter-level classification is 9 classes for Activities and Participation that consisted of “learning and applying knowledge,” “general tasks and demands,” “communication,” “mobility,” “self-care,” “domestic life,” “interpersonal interactions and relationships,” “major life areas,” and “community, social and civic life.” Environmental factors were totaled over all 5 chapters together. These category scores were compared to scores obtained from the patient-reported measures to further assess the construct validity of these measures in PsA, using Spearman’s correlation. In an effort to see whether separation of Activity categories from Participation categories made sense, we added up affected categories from each chapter separately. The possibility of using ICF category scores, albeit after transformation to a Rasch model, has been explored in patients with AS<sup>27</sup> and osteoarthritis<sup>28</sup>, but direct comparison of such scores with other patient-reported measures has not been published. In RA, the change in ICF category qualifiers following treatment has been reported<sup>29</sup>.

Finally, the determinants of QOL (as measured by the PsAQOL) in terms of ICF categories were assessed by multiple regression of PsAQOL scores as the dependent variable and the number of affected categories grouped by level 1 classes (chapters) of Activities and Participation (9 chapters) and Environmental factors (barriers separately from facilitators: EB score and EF score) as the dependent variables. The interest in modeling QOL was to test the notion that impairments/restrictions in ICF components are indeed important to individuals with PsA. QOL is a distinct concept from functioning (which is the focus of the ICF), in that it represents patients’ own perception of their satisfaction with life, irrespective of their actual level of impairment or disability. Given this distinction, assessment of the relationship between ICF components and QOL provides an opportunity to determine the relevance of the ICF to patients’ perception of their well-being. PsAQOL was used to measure QOL since it is the only condition-specific measure yet developed.

## RESULTS

Ninety-four patients agreed to take part in the study (Australia 24, Canada 21, UK 6, New Zealand 25, USA 18). The mean age was 51.3 (SD 11.4) years, there were 40.4% men, and the mean disease duration was 9.8 (SD 8.4) years. Respondents were generally well educated [mean number of years of education 14.5 (SD 3.6)] and 25.5% were receiving a disability pension (Table 1).

Tables 2 to 4 show the frequency of affected categories for at least 30% of respondents. Only 1 Environmental factor was a barrier for at least 30% of people (e225 Climate). Several Environmental factors were viewed as being facilitators by at least 30% of respondents (Table 4).

The correlation between the number of affected categories and patient self-report measures was generally high (Table 5). It is difficult to discern any particular difference between self-report instruments purporting to measure “participation restriction” compared to “activity limitation,” in terms of their association with particular ICF chapters. For example, the ICF chapter of “Community, social and civic life” might be expected to primarily represent the “participation” concept, yet there was no significant correlation

Table 1. Demographic and disease characteristics of the sample.

Characteristics	Valid N	Mean (SD)	N
Age, yrs	94	51.33 (11.41)	
Sex			
Male			38
Female			56
Years of formal education	94	14.50 (3.61)	
Disability pension (Yes/No)			
Yes			24
No			70
Duration of disease, yrs	93	9.79 (8.43)	
Health professional's rating of overall health (0 to 10)	92	4.49 (2.09)	
Health professional's rating of overall functioning (0 to 10)	92	4.67 (2.31)	

Table 2. Body structures and Function categories of the ICF that were rated as problems by a health professional for at least 30% of participants.

Categories	N (%)
s7701 Joints	90 (95.7)
s810 Skin	71 (76.3)
s770 Additional MSK structures	51 (56)
s750 Lower extremity	51 (55.4)
s730 Upper extremity	39 (41.9)
s7600 Vertebral column	36 (41.9)
b28016 Pain in joints	85 (91.4)
b710 Mobility of joint functions	80 (86.0)
b7800 Sensation of muscle stiffness	73 (77.7)
b28013 Pain in back	64 (73.6)
b1300 Energy level	57 (61.3)
b28010 Pain in the head and neck	56 (60.7)
b1343 Quality of sleep	54 (58.7)
b130 Energy and drive functions	55 (58.5)
b730 Muscle power functions	54 (58.1)
b280 Sensation of pain	50 (54.3)
b640 Sexual functions	36 (50)
b134 Sleep functions	46 (50)
b1301 Motivation	43 (45.7)
b840 Sensation related to the skin	39 (42.4)
b152 Emotional functions	39 (42.4)
b6700 Discomfort associated with sexual intercourse	28 (40.6)
b735 Muscle tone functions	36 (38.7)
b530 Weight maintenance functions	30 (31.9)
b144 Memory functions	28 (30.1)

ICF: International Classification of Functioning, Disability and Health; MSK: musculoskeletal.

between this chapter and PAR-PRO (designed to be a measure of participation restrictions) and a similar level of correlation was observed with HAQ-DI (a measure of activity limitations) and WHODAS II participation (a measure of participation restrictions).

There was a significant relationship between the number of affected categories in the “mobility” and “general tasks and demands” chapters with QOL as measured by PsAQOL, but no independent association between QOL and the num-

Table 3. Activity and Participation categories of the ICF that were rated as problems by a health professional for at least 30% of participants.

Categories	N (%)
d4551 Climbing	68 (78.2)
d4102 Kneeling	68 (74.7)
d9201 Sports	56 (73.7)
d4101 Squatting	66 (73.3)
d4154 Maintaining a standing position	52 (66.7)
d4502 Walking on different surfaces	59 (63.4)
d4502 Putting on footwear	58 (63)
d4501 Walking long distances	57 (62.6)
d430 Lifting and carrying objects	55 (60.4)
d640 Doing housework	55 (59.8)
d440 Fine hand use	55 (58.5)
d415 Maintaining a body position	54 (57.4)
d4301 Carrying in the hands	53 (57)
d850 Remunerative employment	42 (56.8)
d4105 Bending	53 (56.4)
d6402 Cleaning living area	50 (54.9)
d4402 Manipulating	51 (54.8)
d920 Recreation and leisure	49 (54.4)
d4153 Maintaining a sitting position	50 (53.2)
d420 Transferring oneself	47 (52.2)
d4300 Lifting	47 (51.1)
d450 Walking	47 (50.5)
d4100 Lying down	47 (50)
d5400 Putting on clothes	46 (49.5)
d6403 Using household appliances	46 (49.5)
d530 Toileting	46 (48.9)
d230 Carrying out daily routine	45 (48.4)
d4201 Transferring oneself while lying	44 (48.4)
d4150 Maintaining a lying position	44 (47.3)
d435 Moving objects with lower extremities	43 (46.7)
d4453 Turning or twisting the hands or arms	43 (46.2)
d4103 Sitting	43 (45.7)
d540 Dressing	43 (45.7)
d240 Handling stress and other demands	41 (45.1)
d4600 Moving about within the home	42 (44.7)
d2401 Handling stress	40 (44)
d4400 Picking up	41 (43.6)
d630 Preparing meals	37 (39.8)
d4500 Walking short distances	36 (38.3)
d4702 Using public transport	32 (37.6)
d6505 Taking care of plants	28 (36.4)
d770 Intimate relationships	29 (35.8)
d5102 Drying oneself	32 (34)
d465 Moving around using equipment	30 (33.7)
d4554 Swimming	31 (33.3)
d6200 Shopping	31 (33)
d470 Using transportation	27 (32.9)
d170 Writing	29 (30.9)
d5101 Washing whole body	29 (30.9)
d220 Undertaking multiple tasks	28 (30.1)
d4452 Reaching	28 (30.1)

ICF: International Classification of Functioning, Disability and Health.

ber of environmental facilitators or barriers or other elements of Activities and Participation (Table 6).

## DISCUSSION

Our study of clinic patients with PsA across 5 countries



Table 4. Environmental factors that were rated as facilitators by a health professional for at least 30% of participants.

Factors	N (%)
e1101 Drugs	65 (72.2)
e355 Health professionals	65 (69.9)
e310 Immediate family	54 (60)
e410 Family attitudes	49 (57)
e580 Health services	45 (51.7)
e450 Attitudes of health professionals	43 (49.4)
e320 Friends	42 (46.7)
e420 Attitudes of friends	38 (43.2)
e110 Products for personal consumption	34 (41)
e1151 Assistive products	25 (36.2)
e325 Acquaintances	29 (32.6)
e115 Products and technology for personal use in daily living	26 (31.7)
e455 Attitudes of health-related professionals	25 (30.5)

demonstrates the broad effect of the disease upon functioning as described by the ICF. The ICF provides an important framework to consider the range of ways that disease can affect individuals, and as a conceptual framework can greatly assist an approach to assessment in the clinic. The findings largely confirm the range of problems voiced by patients elicited from focus group research<sup>14</sup>. The large number of affected categories in the Activities and Participation domain (51 of 97 categories that were assessed, 53%) highlights the importance of this concept in PsA and compares with 16 of 48 (33%) categories listed as affected in a methodologically similar study of patients with RA<sup>19</sup> and 35 of 78 (45%) in AS<sup>17</sup>. This comparison raises

the possibility that patients with PsA are affected to a greater extent by their disease than is the case in RA or AS. This is plausible, given the additional burden of skin disease and the broad range of musculoskeletal manifestations in PsA, including the entheses and spine, in addition to peripheral joints.

Environmental factors were generally viewed as being facilitators (13 of 37 assessed categories) rather than barriers (1 of 37), which supports a clinical approach that builds upon existing support structures for patients. The extent of environmental influence reported by patients with PsA compares to 16 of 35 factors viewed as facilitators in AS and 3 factors seen as barriers (“climate” was cited frequently as a barrier — for example, wintry weather can exacerbate both skin and joint symptoms in PsA). In the RA study, 17 of 32 factors were viewed as facilitators and 2 factors as barriers. However, it is relevant to consider that ratings by health professionals of environmental factors are potentially problematic because patients can see the attitudes of health professionals themselves as either facilitators or barriers.

Patient self-report measures of functioning tended to broadly correlate with the number of affected categories in separate chapters of the Activities and Participation component. It was difficult to clearly distinguish a pattern of correlation between chapters that might be anticipated to more represent participation than activity, with self-report measures purported to measure 1 of these concepts specifically. For example, the chapter “Community, social and civic life” correlated with the HAQ-DI (supposedly a measure of activity limitations) as well as it did with WHODAS participation, and there was no significant correlation with PAR-PRO

Table 5. Correlation between total of numbers of affected ICF categories and scores on self-report questionnaires (Spearman’s rho,  $p < 0.05$ ).

	PAR-PRO	WHODAS- Participation Domain	WHODAS- Life Activities Domain	SF-36 Role Physical	SF-36 Role Emotional	SF-36 Physical Function	HAQ-DI
Activities and Participation							
Learning and applying knowledge	-0.22	NS	0.21	-0.33	NS	NS	0.24
General task and demands	-0.29	0.41	0.51	-0.53	-0.38	-0.47	0.45
Communication	NS	0.21	0.30	NS	NS	NS	0.24
Mobility	-0.48	0.60	0.64	-0.61	-0.36	-0.66	0.72
Self-care	-0.46	0.55	0.60	-0.50	-0.25	-0.57	0.66
Domestic life	-0.28	0.49	0.63	-0.52	-0.28	-0.54	0.64
Interpersonal interactions and relationships	-0.26	0.46	0.33	-0.36	-0.38	-0.30	0.35
Major life areas	NS	0.46	0.34	-0.31	-0.29	NS	0.21
Community, social, and civic life	NS	0.43	0.39	-0.37	-0.23	-0.34	0.41
Total number of affected categories	-0.45	0.62	0.64	-0.61	-0.38	-0.62	0.69
Environmental barriers	NS	NS	NS	-0.25	-0.25	NS	NS
Environmental facilitators	-0.29	0.51	0.34	-0.26	-0.25	-0.31	0.39

ICF: International Classification of Functioning, Disability and Health; WHODAS: World Health Organization Disability Assessment Schedule; SF-36: Medical Outcomes Study Short-Form-36; HAQ-DI: Health Assessment Questionnaire-Damage Index. NS: nonsignificant.

Table 6. Regression model of ICF categories added up by chapter predicting condition-specific health-related quality of life (PsAQOL scores).

Chapters	$\beta$	p
General tasks and demands	0.33	0.01
Communication	-0.18	0.12
Mobility	0.49	0.002
Self-care	0.14	0.28
Domestic life	-0.11	0.47
Interpersonal interactions and relationships	0.10	0.41
Major life areas	0.08	0.51
Community, social, and civic life	-1.36	0.18
Environmental facilitators	-0.09	0.31
Environmental barriers	0.13	0.19

Model-adjusted  $R^2 = 0.46$ ,  $p < 0.001$ . ICF: International Classification of Functioning, Disability and Health; PsAQOL: psoriatic arthritis quality of life.

(both supposedly measuring participation restrictions). Unexpected relationships such as these are difficult to interpret and imply a number of possibilities: the conceptual basis distinguishing participation from activities is flawed, the self-report measures are flawed, or the approach involving the total number of categories is flawed. It is especially relevant to note that the ICF categories were derived from assessment by a healthcare professional, so that low correlation with patient self-reported measures might be expected; however, the correlations were generally high, which would tend to mitigate such a possibility. It is more probable that the simple adding up of affected categories of ICF chapters is not psychometrically robust and that more development work, such as fitting these responses to a Rasch model, could lead to better numerical representation of the ICF.

It did appear that the PAR-PRO instrument behaved differently from the other instruments regarding their relationship with the number of affected ICF chapter categories. The correlation with each ICF chapter was numerically weaker or nonsignificant. This was surprising, given that this instrument was explicitly based upon the ICF. It was expected that this instrument might demonstrate the strongest relationship with the number of affected ICF categories. One possible reason for the difference is the different response framework. The PAR-PRO assesses actual performance (how many days did the respondent actually engage in an activity?), while all other instruments assess perception of difficulty with an activity. This framework is similar to the ICF assessment framework, in which the perceived difficulty (from a healthcare professional's perspective) with an activity is typically assessed rather than the actual frequency of activity performance.

The modeling of QOL using the number of affected ICF categories grouped by chapter was not especially illuminating. The model suggested that only Mobility and General Tasks and Demands, of all the Activity and Participation chapters, contributed to QOL, as measured by the PsAQOL. This seems implausible.

Taken together, these analyses using summation of affected ICF categories suggest that this particular approach may not produce valid scores that represent the concept within the chapter heading. Further work is necessary to clarify the best approach of numerically representing the extent of affected ICF categories. It should be noted that the intent of the ICF has never been to produce a numerical score, yet the validation of the ICF approach would be assisted if categories of affected life areas could be appropriately translated into some kind of quantitative format. This has recently been explored in more detail with patients who have osteoarthritis<sup>28</sup> and AS<sup>27</sup>, with promising results.

A potential limitation of our study is the number of centers involved in recruiting participants. The diverse environmental context of the different countries could have influenced the experience of participation restriction and environmental factors. The small number of participants precludes analysis at the site level, but this would be an interesting issue to investigate further with larger numbers of participants.

We have described the range of life areas affected by PsA in terms of the categories of the ICF model. People with PsA face a broad range of issues in the domain of Activities and Participation. The number of affected categories appears to be greater for people with PsA compared to those with RA or AS. The relationship between self-report measures of functioning or QOL and the number of affected ICF categories was not entirely as expected, and suggests the need for more to be done to develop a more robust quantitative representation of affected ICF categories.

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