

# Responsiveness of the EuroQoL 5-Dimension (EQ-5D) questionnaire in patients with spondyloarthritis

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## Research article

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## Abstract

Background Spondyloarthritis (SpA) has a significant impact on patients' quality of life due to functional impairments. Generic health instruments like the EuroQoL 5-dimension (EQ-5D) is important for cost-utility analysis of health care interventions and calculation of quality-adjusted life-years. It has been validated in patients with SpA. However, its responsiveness property has yet to be determined. Hence, the aim of study is to test the responsiveness properties of the EQ-5D health measure for Chinese patients with SpA.

Methods Prospective and consecutive recruitment of 220 Chinese patients with SpA was conducted with follow-up assessments 6 months later. Demographic data including smoking and drinking habits, education level, income and occupation was collected. Disease-associated data including disease duration, presence of back pain, peripheral arthritis, dactylitis, enthesitis, uveitis, psoriasis, and inflammatory bowel disease was also recorded. Questionnaires regarding disease activity and functional disability (BASDAI, BASFI, BASGI, BASMI, ASDAS, ODI), mental health (HADS depression and anxiety) and the EQ-5D scores were recorded. Responsiveness was tested against the global rating of change scale (GRC) and changes in disease activity using BASDAI and ASDAS.

Results A total of 112 (50.9%) patients completed the follow-up assessments. Most patients (63.4%) had low disease activity level with BASDAI <4 and 50.9% of patients had inactive disease by ASDAS-CRP. EQ-5D scores was well discriminated between improved and worsened BASDAI scores. The GRC was not able to discriminate adequately. No significant ceiling or floor effect was observed.

Conclusions The EQ-5D demonstrates satisfactory responsiveness property for assessment of changes in disease activity in patients with SpA.

## Background

Assessing changes in clinical status for patients with chronic illness is important. This provides clinicians and caretakers a method to gauge treatment response and deterioration in condition. The patients' health status may not always be apparent to clinicians. Self-reported health-related quality of life (HRQoL) scores provide an objective assessment of patient health. One chronic illness that is particularly relevant is spondyloarthritis (SpA). SpA encompasses a group of interrelated rheumatic conditions including ankylosing spondylitis (AS), psoriatic arthritis (PsA), spondyloarthritis associated with inflammatory bowel disease (IBD) and reactive arthritis(1). AS, regarded as the prototype of SpA, has been shown to be associated with greater work disability (WD) compared to the general population, with WD rates varying from 3–50% in western countries(2–4). Patients with AS are 3.1 times more likely to have withdrawal from work than expected in the general population and they are also more likely to experience a lower quality of life (QoL)(5, 6). This in turn will result in loss of work productivity and increased socioeconomic burden(2, 3). Studies have also shown that patients with axial SpA report a lower HRQoL than do healthy controls and this reduction in HRQoL is associated with fatigue, pain, increased disease activity, and decreased daily activity and exercise(7–9). In addition, a lower HRQoL in SpA patients is associated with adverse psychological outcomes and a higher prevalence of anxiety and depression(10, 11).

There are mainly two different types of HRQoL instruments, namely disease-specific and generic, to assess patients of chronic diseases. For axial SpA, disease-specific tools for assessing functional disability include Bath Ankylosing Spondylitis Functional Index (BASFI)(12), the Leeds Disability Questionnaire (LDQ)(13) and the Dougados Functional Index (DFI)(14). Generic instruments are more useful for assessments of the disease impact by allowing comparisons between different disease populations.

The EuroQoL 5-dimension (EQ-5D) is a generic health measure instrument developed by the EuroQoL group, which allows a quantitative expression of the individual's perception of their overall health status(15). It serves as an important utility measure for clinical and economic appraisal, particularly in the cost-utility analysis of various health care interventions, and the calculation of quality-adjusted life-years (QALYs). It has been applied to the Chinese population previously(16) and has been shown to be useful in assessing QoL in patients with SpA(17). Responsiveness refers to the ability of a score to capture underlying changes in

a patients' health status over time. The responsiveness property of EQ-5D for assessment of changes in the health status of patients with SpA is currently unknown. Hence, the aim of this study is to test the responsiveness of the EQ-5D in patients with SpA.

## Methods

A total of 220 consecutive patients of Chinese ethnicity were prospectively recruited from 2 rheumatology specialist clinics between May to December 2017 and subsequently reassessed at a follow-up of 6 months later (November 2017 to June 2018). All recruited patients fulfilled either the ASAS axial SpA criteria(18, 19) or peripheral SpA criteria(20) for diagnosis. All recruited patients were 18 years old or above. Patients who did not give consent for participation, non-Chinese, illiterate and unable to comprehend the instruments were excluded. Subjects who consented were interviewed for a panel of sociodemographic and disease-associated parameters, disease activity and severity factors, and HRQoL scores that highlight the functional and mental health status. Both baseline and follow-up interviews were conducted in person at the consultation clinic. At the follow-up interview, subjects were assessed by the same research personnel for a reassessment of the same study questionnaires as well as the global rating of change scale.

## Sociodemographic and disease-associated data

Patients' smoking and drinking habits, education level, income and occupation was recorded. Disease-associated data including disease duration, presence of back pain and/or peripheral arthritis, dactylitis, enthesitis, and extra-articular manifestations such as uveitis, psoriasis, IBD and history of sexually-transmitted disease or dysentery was collected. Physical examination was performed to determine the number of tender joint count and swollen joint count, the dactylitis and enthesitis scores. Antero-posterior radiograph of the lumbosacral spine was utilized for grading of sacroiliitis according to the modified New York criteria(21) by a rheumatologist (HYC) who was blinded to the clinical data. Radiological sacroiliitis was graded as: 0, normal; 1, suspicious; 2, minimal sclerosis with some erosions; 3, erosion with widening of joint space and possible partial ankyloses; 4, complete ankyloses. Bilateral sacroiliitis of grade 2 or above, or unilateral sacroiliitis of grade 3 or above was defined as AS.

## Disease activity and severity scores

All recruited patients filled in the Bath Ankylosing Spondylitis Disease Activity Index (BASDAI)(22) and BASFI(12) to determine the disease activity and functional disability respectively. Spinal mobility was assessed clinically to determine the BASMI(23) score. The Bath Ankylosing Spondylitis Global Index (BASGI)(24) and CRP was measured for calculation of ASDAS-CRP(25), which is a composite disease activity measure of SpA. Human leucocyte antigen (HLA) B27 status was also checked as a poor prognostic marker.

## Functional and mental health status

The SF-36(26–28) was used for assessment of mental and physical health and as a comparable generic questionnaire marker of EQ-5D changes. Hospital Anxiety and Depression Scale (HADS)(29, 30) was utilized to assess the mental health status.

The main study parameter was the EQ-5D which is a standardized measure of health status developed by the EuroQoL group that allows a generic assessment of health status for clinical and economic appraisal(15). It consists of a 2-pages questionnaire, the EQ-5D descriptive system and the EQ visual analogue scale (EQ VAS). The descriptive system is comprised of 5 domains, including mobility, self-care, usual activities, pain/discomfort and anxiety/depression. There are 2 versions of EQ-5D, namely the EQ-5D-3 level (EQ-5D-3L) and the EQ-5D-5 level (EQ-5D-5L) versions. For the EQ-5D-3L, each domain will be scored by 3 levels (no problem, some problem and extreme problem). We utilized the EQ-5D-5L version for this study and each domain of this parameter was scored by 5 levels with 1 representing no problem and 5 representing extreme problem. Previous studies published by EuroQoL group have shown that the 5 level version could significantly increase reliability and sensitivity while maintaining the feasibility of the test and it could potentially reduce ceiling effects(15). The scores of the 5 domains are combined into a 5-digit number which is converted into a single index value. The EQ VAS allows patients to self-report their own perceived quality of life from a scale of 0 (worst) to 100 (best). Currently, no Chinese-specific EQ-5D-5L value set is available and hence, we have adopted an indirect two-step approach to obtain the index value. We do so by first converting the EQ-5D-5L into the EQ-5D-3L health status

via a transition probability matrix(31), and subsequently, the EQ-5D-3L health status is scored according to a Chinese-specific EQ-5D-3L value set ranging from -0.149 for the worst health status ('33333') to 1 for the best health status ('11111').

## Global rating of change scale

It was necessary to include an external anchor to act as a reference for indicating patient improvement or deterioration(32). To test the responsiveness of EQ-5D, this anchor represented the patient-reported assessment of health change over time and thus indicate whom change in health occurred(33). The global rating of change (GRC) scale is a single-item outcome measure for independent scoring of self-perceived improvement in a patient retrospectively and has been used in musculoskeletal research(34). All subjects answered the question asking "Compared to the previous visit, how would you rate your overall health now?".(34) The response scale was a seven-point Likert scale ranging from -3 to 3 corresponding to the 'much worse' to the 'much better' options with 0 for 'no change'. Three groups were defined using this scale: 'worse' (-3 to -1), 'unchanged' (0) and 'improved' (1 to 3).

## Statistical analysis

Overall descriptive characteristics were reported with mean ± standard deviation (SD). Any differences between baseline and follow-up were compared using independent t-test and Chi-squared test where appropriate. In addition to the GRC scale, assessment of differences was performed with disease activity scores of BASDAI and ASDAS-CRP.

The responsiveness of the EQ-5D was assessed using the effect size statistics. Differences between baseline and follow-up of the utility score was evaluated by standardized effect size (SES) and standardized response mean (SRM) separately for GRC, BASDAI and ASDAS-CRP. BASDAI of < 4 is considered low disease activity and a BASDAI ≥ 4 represents high disease activity. Change in disease activity either to the low disease activity group (improved) or high disease activity group (worsened) was studied. Those that stayed within their baseline groups at follow-up was considered "unchanged". ASDAS-CRP is categorized as inactive disease (< 1.3), moderate disease activity (1.3<2.1), high disease activity (2.1<3.5), and very high disease activity (> 3.5). A change of 1.1 is considered as clinically significant change.(35) The SES and SRM results were interpreted as trivial for values < 0.2, small for values ≥ 0.2 to < 0.5, moderate for values ≥ 0.5 to < 0.8, and large for values ≥ 0.8(36).

Spearman's correlation was performed to assess the relationship between changes in EQ-5D scores with erythrocyte sedimentation rate (ESR), C-reactive protein (CRP), ASDAS-CRP, ASDAS-ESR, BASDAI, BASFI, SF-36, and HADS. All statistical analyses were conducted using STATA version 13.0. A p-value of < 0.05 was considered as statistically significant and 95% confidence intervals (CIs) were listed as appropriate.

## Results

From a total of 220 Chinese patients with SpA recruited consecutively at baseline, 112 (50.9%) completed the follow-up assessments. The baseline demographics are listed in table 1. The mean age of subjects who completed all assessments was 44.7±13.0 years, and 75% of them were male patients. Most patients (63.4%) had low disease activity with BASDAI of <4 and 50.9% of patients had inactive disease by ASDAS-CRP.

The mean change of EQ-5D and EQ-VAS scores by disease activity and GRC is shown in tables 2 and 3. Improved and worsened EQ-5D scores discriminated well with change in disease activity level measured by BASDAI. Up to 98 patients did not have a change in disease activity level. There were no patients listed as clinically improved with the ASDAS-CRP. No significant findings were observed for the GRC. When comparing the EQ-5D scores at baseline and follow-up, no significant ceiling or floor effects were observed (table 4). Comparing the differences in EQ-5D-5L scores from baseline to follow-up (Figure 1), there was overall improvement (table 5) in various domains: mobility (30.8% with one level reduction), usual activities (23.1% with one level reduction), pain/discomfort (20.5% with one level reduction), depression/anxiety (18.0% with one level reduction) and self-care (18.0% with one level reduction). Overall correlations (table 6) between change in EQ-5D and change in other study parameters were not as useful as categorizing disease activity groups. Change in EQ-5D scores were significantly correlated with HADS while EQ-VAS was correlated with BP and emotion domains of the SF-36.

## Discussion

SpA is a chronic debilitating disease that significantly reduces a patient's QoL. The disease cannot be eradicated and thus patients require prolonged treatment to control the disease process and reduce symptomatology. Constant monitoring is necessary as symptoms and disease activity may fluctuate and warrant prompt adjustment of medications. This carries a heavy toll on patients' physical and mental wellness as they are faced with changing treatment outcomes, for better or worse, and facing new concerns and complications. With the high cost for various disease-modifying drugs, it is important for the patients and medical practitioners to design the most cost-effective strategies. Determining QALYs aid in this understanding of disease burden on the healthcare system, which will in turn drive various institutional policies based on cost-utility analyses. The EQ-5D has been shown to be an effective utility score for SpA. This is the first study to study the responsiveness of EQ-5D in patients with SpA. We have found it to discriminate improved and worsened disease activity levels well.

The EQ-5D instrument is a good measure of disease activity change as shown by its strong association with changes in BASDAI scores shown by the SES and SRM. The SES was near 0 in the unchanged group which verifies its accuracy in detecting change. The SES of EQ-5D for the improved group was 0.67 and for the worsened group was -0.77. These results were similar to that of other chronic musculoskeletal disorders like scoliosis deformities(37). The higher disease activities supported by increased BASDAI score was identified by a reduction in EQ-5D. Similarly, reduced disease activity shown by reduced BASDAI score is matched by an increased EQ-5D score. No change in disease activity was also supported by no change in EQ-5D scores. The results

Due to the lack of clinically improved patients by ASDAS-CRP, we were unable to formulate any useful conclusions. This may be the limitation of its score to detect patient perceived QoL. Although we followed the clearly established cut-off value of ASDAS to determine improvement or worsened scores(35), we were unable to identify any individuals with improved ASDAS despite improved patients categorized by BASDAI. Despite ASDAS-CRP being a more objective assessment of SpA disease activity, it may not reflect the patient's perceived health as well. The components of BASDAI describes more subjective self-perceived components of pain, discomfort, and other disease manifestations. Hence, it is expected for BASDAI and EQ-5D to match better since they are both patient perceived HRQoL scores. It is also interesting to see the GRC scale as an unsatisfactory anchor for EQ-5D changes. This is not an unusual finding. Some HRQoL measures may be more responsive to a clinical anchor rather than GRC(38). Moreover, the GRC may be affected by many other factors whereas BASDAI is more targeted to the various facets of the disease. Various external factors such as the rapport with the doctor and mental status of the patient may influence the reporting of GRC. Comparatively, BASDAI is more appropriate for the disease status and it appears that the EQ-5D is able to capture changes in disease status as well.

The main limitation of this study is relatively low follow-up rate. Nevertheless, we did have a reasonable effect size generated from the EQ-5D results. In addition, the use of an indirect two-step approach to determine EQ-5D-5L may produce measurement errors in the score but due to the lack of a cultural-specific value set, this is still the best approach to generate the 5L scores.

## Conclusions

The EQ-5D-5L demonstrates satisfactory responsiveness properties for assessment of changes in health status in patients with SpA. It appears to represent the patient reported HRQoL better than more objective assessments. Future study should assess the versatility of the utility score to compare different treatment regimens and its cost-utility with other chronic diseases.

## Declarations

*Ethics approval and consent to participate:* Ethics was approved by the Institutional Review Board of the University of Hong Kong/Hospital Authority Hong Kong West Cluster (HKU/HA HKW IRB) Reference #: UW 17-201. All subjects consented to participate in the study.

*Consent for publication:* Not applicable

*Availability of data and materials:* The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

*Competing interests:* The authors declare that they have no competing interests.

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*Authors' contributions:* HHLT was involved in study design, data collection, analysis, interpretation of data and writing of manuscript. CKHW was involved in data analysis and interpretation of data. PWHC was involved in data analysis and interpretation of data. CSL was involved in data collection. HYC was involved in data collection. JPYC was involved in study design, data collection, analysis, interpretation of data, writing of manuscript, and final decision of submission.

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## **Tables**

Table 1. Demographic and clinical characteristics of patients

	Baseline (N=220)	Follow-up Completion (N=112)	Follow-up Incompletion (N=108)
<b>Demographic, % (n)</b>			
Age, mean ± SD	47.2±14.1	44.7±13.0	49.7±14.8
Gender			
Female	32.7 % (72)	33.0 % (37)	32.4 % (35)
Male	67.3 % (148)	67.0 % (75)	67.6 % (73)
Education level			
Nil	0.5 % (1)	0.0 % (0)	0.9 % (1)
Primary	10.5 % (23)	7.2 % (8)	13.9 % (15)
Secondary	47.5 % (104)	44.1 % (49)	50.9 % (55)
Tertiary or above	41.6 % (91)	48.7 % (54)	34.3 % (37)
Family income level			
<HK\$10000	18.9 % (41)	15.3 % (17)	22.6 % (24)
HK\$10000-30000	42.9 % (93)	41.4 % (46)	44.3 % (47)
HK\$30000-60000	20.7 % (45)	20.7 % (23)	20.8 % (22)
>HK\$60000	17.5 % (38)	22.5 % (25)	12.3 % (13)
Occupation			
Student	5.5 % (12)	6.3 % (7)	4.6 % (5)
Housewife	7.3 % (16)	4.5 % (5)	10.2 % (11)
Work	70.0 % (154)	75.0 % (84)	64.8 % (70)
Unemployed	4.1 % (9)	3.6 % (4)	4.6 % (5)
Retired	13.2 % (29)	10.7 % (12)	15.7 % (17)
<b>Clinical, % (n)</b>			
Positive HLA-B27			
No	21.5 % (42)	20.6 % (21)	22.6 % (21)
Yes	78.5 % (153)	79.4 % (81)	77.4 % (72)
BASDAI			
Low disease activity (<4)	61.4 % (135)	63.4 % (71)	59.3 % (64)
High disease activity (≥4)	38.6 % (85)	36.6 % (41)	40.7 % (44)
ASDAS-CRP			
Inactive disease (<1.3)	40.6 % (89)	50.9 % (57)	29.9 % (32)
Moderate disease activity (1.3-2.1)	29.2 % (64)	27.7 % (31)	30.8 % (33)
High disease activity (2.1-3.5)	26.0 % (57)	20.5 % (23)	31.8 % (34)

Very high disease activity (>3.5)	4.1 % (9)	0.9 % (1)	7.5 % (8)
<b>Peripheral arthritis</b>			
No	60.5 % (133)	57.1 % (64)	63.9 % (69)
Yes	39.6 % (87)	42.9 % (48)	36.1 % (39)
<b>Dactylitis</b>			
No	96.4 % (211)	96.4 % (108)	96.3 % (103)
Yes	3.7 % (8)	3.6 % (4)	3.7 % (4)
<b>Uveitis</b>			
No	63.9 % (140)	64.0 % (71)	63.9 % (69)
Yes	36.1 % (79)	36.0 % (40)	36.1 % (39)
<b>Psoriasis</b>			
No	85.0 % (187)	82.1 % (92)	88.0 % (95)
Yes	15.0 % (33)	17.9 % (20)	12.0 % (13)
<b>ODI</b>			
Minimal disability (0-20)	63.6 % (140)	64.3 % (72)	63.0 % (68)
Moderate disability (21-40)	24.6 % (54)	24.1 % (27)	25.0 % (27)
Severe disability (41-60)	10.0 % (22)	9.8 % (11)	10.2 % (11)
Crippled (61-80)	1.8 % (4)	1.8 % (2)	1.9 % (2)
<b>HADS</b>			
Depression			
Normal (0-7)	77.8 % (161)	76.2 % (80)	79.4 % (81)
Borderline (8-10)	15.5 % (32)	16.2 % (17)	14.7 % (15)
Abnormal (11-21)	6.8 % (14)	7.6 % (8)	5.9 % (6)
Anxiety			
Normal (0-7)	66.7 % (138)	70.5 % (74)	62.8 % (64)
Borderline (8-10)	21.7 % (45)	20.0 % (21)	23.5 % (24)
Abnormal (11-21)	11.6 % (24)	9.5 % (10)	13.7 % (14)
Backpain duration	16.6±12.1	15.9±11.5	17.4±12.7
Psoriasis duration	16.1±11.9	16.4±10.9	15.6±13.8
Any back pain			
No	9.2 % (20)	8.2 % (9)	10.3 % (11)
Yes	90.8 % (197)	91.8 % (101)	89.7 % (96)
Current back pain			
No	23.5 % (51)	23.6 % (26)	23.4 % (25)

Yes	76.5 % (166)	76.4 % (84)	76.6 % (82)
Tender joints	0.32±1.07	0.43±1.38	0.21±0.56
Swollen joints	0.16±0.94	0.25±1.28	0.07±0.28
Dactylitis score	0.01±0.10	0.01±0.09	0.01±0.10
Enthesitis score	0.20±0.69	0.23±0.82	0.17±0.52
CRP	0.73±1.45	0.73±1.59	0.73±1.30
ESR	24.25±19.22	22.73±19.20	25.81±19.20

Table 2. Mean Change, Standardized Effect Size, Standardized Response Mean and Responsiveness Statistic of EQ-5D Score and EQ-VAS by Disease Activity and GRS

Measure/subscale	Baseline (Mean±SD)	At follow-up (Mean±SD)	Paired difference (Mean±SD)	P- value	SES (95% CI)	SRM (95% CI)	RS (95% CI)
<b>Disease activity measured by BASDAI</b>							
Worsened group (N=14)							
EQ-5D score	0.80±0.12	0.72±0.14	-0.09±0.09	0.002*	-0.77 (-1.16,-0.40)	-1.04 (-1.56,-0.54)	-0.77 (-1.16,-0.40)
EQ-VAS	58.57±17.48	54.14±13.08	-4.43±16.57	0.336	-0.25 (-0.79,0.18)	-0.27 (-0.84,0.19)	-0.20 (-0.63,0.14)
Unchanged group (N=98)							
EQ-5D score	0.80±0.19	0.80±0.19	0.00±0.12	0.880	-0.01 (-0.13,0.12)	-0.02 (-0.21,0.19)	-0.02 (-0.21,0.19)
EQ-VAS	66.77±17.02	64.66±19.92	-2.10±21.95	0.346	-0.12 (-0.40,0.12)	-0.10 (-0.31,0.10)	-0.10 (-0.31,0.10)
Improved group (N=13)							
EQ-5D score	0.73±0.14	0.83±0.10	0.10±0.14	0.027*	0.67 (0.26,1.24)	0.70 (0.27,1.29)	0.83 (0.32,1.53)
EQ-VAS	59.46±13.20	67.77±11.32	8.31±13.96	0.053	0.63 (0.06,1.15)	0.60 (0.06,1.09)	0.38 (0.04,0.69)
<b>Global rating of change</b>							
Worsened group (N=44)							
EQ-5D score	0.76±0.18	0.77±0.14	0.00±0.12	0.940	0.01 (-0.16,0.25)	0.01 (-0.24,0.36)	0.01 (-0.25,0.38)
EQ-VAS	62.00±15.35	57.18±15.12	-4.82±20.51	0.127	-0.31 (-0.74,0.07)	-0.23 (-0.55,0.05)	-0.23 (-0.55,0.05)
Unchanged group (N=39)							
EQ-5D score	0.81±0.18	0.80±0.18	-0.01±0.11	0.685	-0.04 (-0.26,0.15)	-0.07 (-0.40,0.23)	-0.07 (-0.40,0.23)
EQ-VAS	67.15±17.78	61.03±19.47	-6.13±20.70	0.072	-0.34 (-0.70,0.02)	-0.30 (-0.60,0.01)	-0.30 (-0.60,0.01)
Improved group (N=29)							
EQ-5D score	0.84±0.16	0.86±0.12	0.02±0.12	0.317	0.15	0.19	0.20

					(-0.09,0.47)	(-0.11,0.59)	(-0.12,0.64)
EQ-VAS	69.28±15.01	74.86±18.33	5.59±20.34	0.150	0.37 (-0.24,0.79)	0.27 (-0.18,0.58)	0.27 (-0.18,0.57)

\* denotes statistical significance

Table 3. Difference in Mean Change at follow-up by Disease activity and Global Rating of Change Scale

Disease activity	Change in EQ-5D score			Change in EQ-VAS		
	Mean Difference (95% CI)	Effect size	AUC (95% CI)	Mean Difference (95% CI)	Effect size	AUC (95% CI)
Unchanged Vs Worsened	0.08 (0.02,0.14)	0.73	0.75 (0.62,0.88)	2.56 (-7.90,13.03)	0.12	0.54 (0.41,0.67)
Improved Vs Unchanged	0.09 (0.03,0.16)	0.78	0.73 (0.57,0.90)	9.09 (-1.20,19.37)	0.42	0.66 (0.54,0.77)
Improved Vs Worsened	0.18 (0.09,0.27)	1.25	0.90 (0.77,1.00)	11.65 (2.60,20.70)	0.77	0.72 (0.57,0.88)
Improved/unchanged Vs worsened	0.09 (0.03,0.16)	0.78	0.76 (0.64,0.89)	3.81 (-6.17,13.79)	0.18	0.57 (0.44,0.69)
Improved Vs worsen/unchanged	0.11 (0.04,0.17)	0.87	0.75 (0.60,0.91)	9.44 (-0.46,19.33)	0.45	0.67 (0.55,0.78)

Global Rating of Change Scale	Change in EQ-5D score			Change in EQ-VAS		
	Mean Difference (95% CI)	Effect size	AUC (95% CI)	Mean Difference (95% CI)	Effect size	AUC (95% CI)
Unchanged Vs Worsened	-0.01 (-0.06,0.04)	0.08	0.52 (0.40,0.65)	-1.31 (-10.32,7.70)	0.06	0.48 (0.35,0.60)
Improved Vs Unchanged	0.03 (-0.03,0.09)	0.26	0.52 (0.38,0.66)	11.71 (1.66,21.77)	0.55	0.69 (0.56,0.82)
Improved Vs Worsened	0.02 (-0.04,0.08)	0.18	0.55 (0.42,0.69)	10.40 (0.65,20.15)	0.50	0.66 (0.53,0.78)
Improved/unchanged Vs worsened	0.00 (-0.04,0.05)	0.04	0.53 (0.42,0.65)	3.69 (-4.34,11.71)	0.18	0.55 (0.44,0.67)
Improved Vs worsen/unchanged	0.03 (-0.02,0.08)	0.22	0.54 (0.42,0.66)	11.02 (2.28,19.76)	0.53	0.67 (0.56,0.78)

CI = confidence interval; AUC = area under the curve

	Mean	Standard deviation	Observed range	Theoretical range	Floor (%)	Ceiling (%)
<b>EQ-5D-5L</b>						
Baseline	0.789	0.191	-0.04 to 1.000	- 0.391 to 1.000	0.0	3.2
Baseline <sup>^</sup>	0.796	0.179	-0.04 to 1.000	- 0.391 to 1.000	0.0	5.5
Follow-up	0.794	0.18	-0.11 to 1.000	- 0.391 to 1.000	0.0	12.5
Mean change	0.001	0.12	-0.02 to 0.02			
<b>EQ-VAS</b>						
Baseline	62.85	18.89	10 to 97	0 to 100	0.0	0.0
Baseline <sup>^</sup>	64.93	16.83	15 to 97	0 to 100	0.0	0.0
Follow-up	63.68	18.66	5 to 95	0 to 100	0.0	0.0
Mean change	1.22	20.84	-2.44 to 4.88			

Table 4. Descriptive statistics of EQ-5D-5L utility score and EQ-VAS at baseline and follow-up

<sup>^</sup>Baseline descriptive statistics of respondents who have completed both baseline and follow-up

Table 5. Redistribution EQ-5D-5L response levels from baseline to follow-up by dimension among unchanged health condition over time

Baseline		Follow-Up		Consistent pairs		
level	% (n)	level	% (n)	same level, % (n)	<-1 level, % (n)	>+1 level, % (n)
Mobility			53.85% (21)			30.77% (12) 15.38% (6)
1	66.67% (26)	1	66.67% (26)			
2	15.38% (6)	2	25.64% (10)			
3	15.38% (6)	3	7.69% (3)			
4	2.56% (1)	4	0.00% (0)			
5	0.00% (0)	5	0.00% (0)			
Self-care			74.36% (29)			17.95% (7) 7.69% (3)
1	71.79% (28)	1	79.49% (31)			
2	23.08% (9)	2	17.95% (7)			
3	5.13% (2)	3	2.56% (1)			
4	0.00% (0)	4	0.00% (0)			
5	0.00% (0)	5	0.00% (0)			
Usual activities			71.79% (28)			23.08% (9) 5.13% (2)
1	58.97% (23)	1	69.23% (27)			
2	30.77% (12)	2	25.64% (10)			
3	7.69% (3)	3	2.56% (1)			
4	0.00% (0)	4	2.56% (1)			
5	2.56% (1)	5	0.00% (0)			
Pain / discomfort			69.23% (27)			20.51% (8) 10.26% (4)
1	12.82% (5)	1	15.38% (6)			
2	61.54% (24)	2	66.67% (26)			
3	23.08% (9)	3	15.38% (6)			
4	2.56% (1)	4	2.56% (1)			
5	0.00% (0)	5	0.00% (0)			
Depression / anxiety			71.79% (28)			17.95% (7) 10.26% (4)
1	51.28% (20)	1	53.85% (21)			
2	35.90% (14)	2	38.46% (15)			

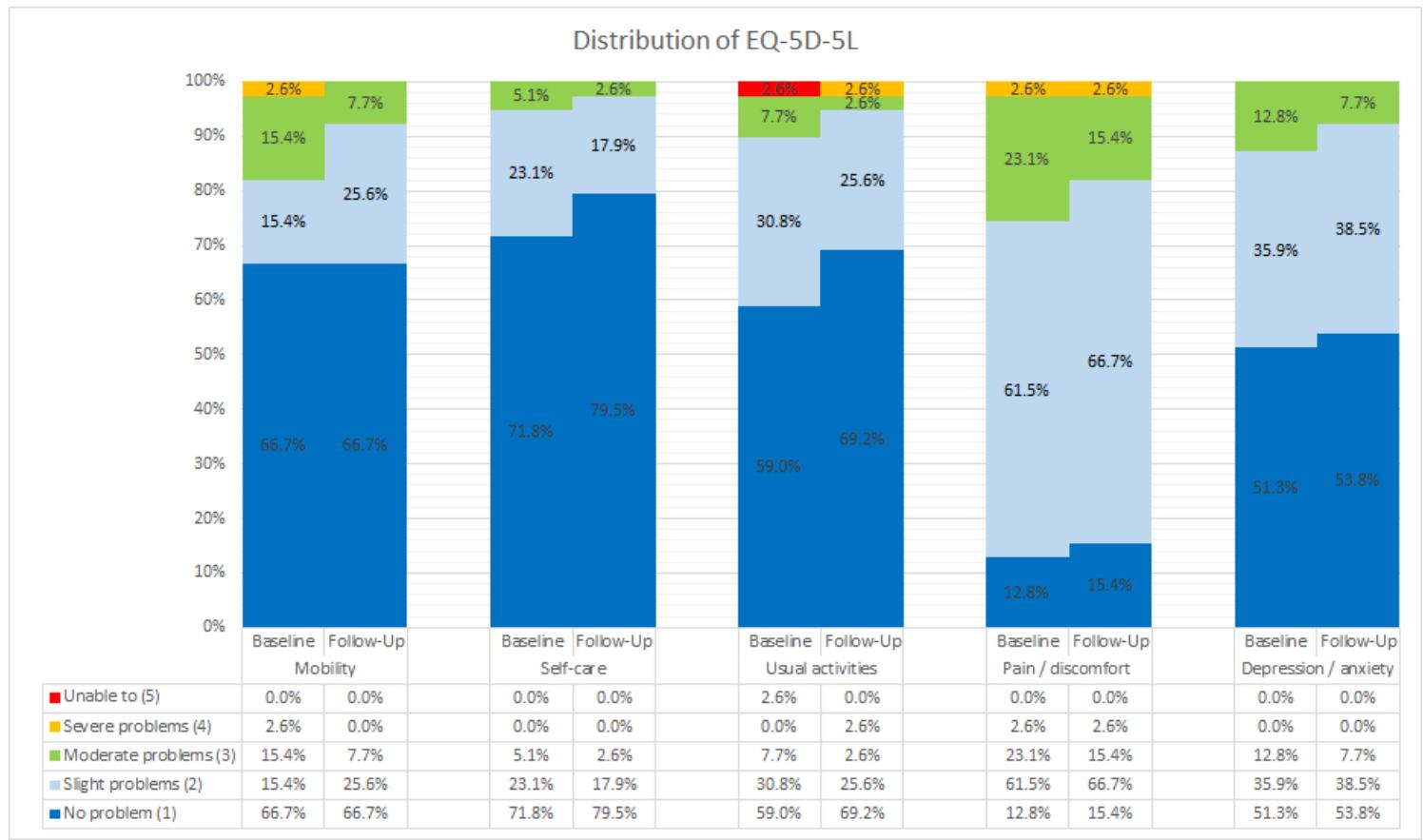
3	12.82% (5)	3	7.69% (3)
4	0.00% (0)	4	0.00% (0)
5	0.00% (0)	5	0.00% (0)

Table 6. Spearman correlation coefficients between the changes in EQ-5D scores and other scores

	Change in EQ-5D score		Change in EQ-VAS	
	r	P-value	r	P-value
ASDAS-CRP	0.081	0.300	0.080	0.301
ASDAS-ESR	0.091	0.244	0.106	0.172
ESR	0.044	0.567	0.078	0.312
CRP	-0.002	0.979	0.088	0.251
BASDAI	0.048	0.538	0.081	0.295
BASFI	0.058	0.453	0.043	0.576
SF-36				
Physical functioning	-0.082	0.285	-0.142	0.062
Role-physical	-0.057	0.462	-0.103	0.179
Bodily pain	0.106	0.173	0.221	0.004*
General health	0.093	0.226	0.022	0.770
Vitality	-0.006	0.943	-0.080	0.296
Emotion	-0.086	0.263	-0.168	0.028*
Social functioning	-0.138	0.073	-0.056	0.468
Mental health	-0.081	0.294	-0.105	0.174
Physical component score	-0.085	0.277	-0.042	0.593
Mental component score	0.048	0.540	0.020	0.803
HADS				
HADS-Anxiety	0.116	0.133	0.136	0.077
HADS-Depression	0.189	0.014*	0.076	0.328
HADS-total	0.162	0.035*	0.114	0.139

\* denotes statistical significance

## Figures



**Figure 1**

Distribution of EQ-5D-5L responses in the study cohort.