Rheumatology International (2019) 39:105–110
https://doi.org/10.1007/s00296-018-4217-8

Rheumatology
INTERNATIONAL

VALIDATION STUDIES

Validity and reliability of the ten-item Connor–Davidson Resilience Scale (CD-RISC10) instrument in patients with axial spondyloarthritis (axSpA) in Singapore

Yu Heng Kwan[1] · Amanda Ng[2] · Ka Keat Lim[1] · Warren Fong[3,4,5] · Jie Kie Phang[3] · Eng Hui Chew[2] · Nai Lee Lui[3] · Chuen Seng Tan[6] · Julian Thumboo[1,3,5] · Truls Østbye[1] · Ying Ying Leung[3,4,5]

Received: 12 October 2018 / Accepted: 30 November 2018 / Published online: 6 December 2018

Abstract

We aimed to assess the validity and reliability of the ten-item Connor–Davidson Resilience Scale (CD-RISC10) in patients with axial spondyloarthritis (axSpA) in Singapore. We used cross-sectional data from 108 patients with axSpA recruited from a dedicated axSpA clinic in a Singapore tertiary referral hospital from 2017 to 2018. Analyses were guided by the COnsensus-based Standards for the selection of health Measurement INstruments (COSMIN) framework. Face validity was assessed through cognitive debriefing interviews (CDIs). Internal consistency was assessed through Cronbach's alpha. Test–retest reliability was assessed through intraclass correlation (ICC). Measurement error was assessed through smallest detectable change (SDC). Construct validity was assessed through six a priori hypotheses through correlation of the CD-RISC10 score with other patient-reported outcome measures. Structural validity was assessed using confirmatory factor analysis (CFA). Fit indices evaluated were root-mean-square error of approximation (RMSEA), comparative fit index (CFI), Tucker–Lewis index (TFI), and standardized root-mean-squared residual (SRMR). Ten patients completed the CDIs and face validity was supported. Among 108 patients (median age: 37(21–77), 81.5% males, 93.5% Chinese), the CD-RISC10 demonstrated good internal consistency (Cronbach's alpha = 0.94), and excellent test–retest reliability [ICC = 0.964 (95% CI 0.937–0.980)]. SDC was calculated as 1.88. Construct validity was established by meeting five out of the six a priori hypotheses. Structural validity was supported as CFA confirmed a one-factor model, with adequate fit statistics after adding three covariances (RMSEA = 0.077; CFI = 0.975; TLI = 0.964; SRMR = 0.036). This study supports the CD-RISC10 as a valid and reliable measure of resilience for use in patients with axSpA.

Keywords Axial spondyloarthritis · Resilience · CD-RISC · Validation · Singapore

Introduction

Axial spondyloarthritis (axSpA) is a multifaceted rheumatologic disorder that affects the spine, joints, and entheses [1]. Patients experience fatigue, loss of mobility, and pain, which often leads to loss of function and quality of life [2]. Coping with symptoms and improving quality of life are important for disease management [3].

Resilience is the capability to maintain stable levels of functioning when exposed to an unsettling incident [4]. Earlier studies suggest that resilience has an important protective role in patients with chronic arthritis. Additionally, pain and quality of life can improve with increased resilience [4]. A validated resilience instrument can enable clinicians to justify initiation of resilience-improving therapies, such as cognitive behavioural therapy or mindfulness therapy in axSpA patients. As axSpA affects mainly young adults (onset age 20–30 years) [5], potential therapies targeting improvement in resilience may have long-term benefits towards improving quality of life and functioning.

The Connor–Davidson Resilience Scale (CD-RISC) is an instrument developed for measuring resilience [6, 7]. A shorter version, the ten-item CD-RISC (CD-RISC10) used in this study, has demonstrated adequate validity and reliability in other disease populations, such as patients with fibromyalgia [8]. Unlike the CD-RISC with an unstable

Yu Heng Kwan, Amanda Ng and Ka Keat Lim are co-first authors.

✉ Yu Heng Kwan
yuheng@u.duke.nus.edu

Extended author information available on the last page of the article

factor structure [9], CD-RISC10 has a more stable one-factor structure after deletion of items that were inconsistent or poorly defined [6]. Additionally, being shorter than CD-RISC, CD-RISC10 is more feasible for use in clinical practice. Few validation studies have been done for CD-RISC10 in Southeast Asia [9, 10], and none have been conducted among patients with rheumatological conditions. Validating the CD-RISC10 in axSpA populations may be valuable to the health of patients as it can enable piloting of resilience-improving interventions in axSpA patients.

Hence, the objective of this study is to assess the validity and reliability of CD-RISC10 among patients with axSpA in Singapore.

Methods

Study design and data collection

We conducted a cross-sectional study using the English version of CD-RISC10 instrument administered in paper and pencil format to all consenting English-literate patients treated at a dedicated axSpA clinic in a tertiary referral hospital in Singapore from 2017 to 2018. All patients fulfilled the Assessment of Spondyloarthritis International Society Classification 2009 for axSpA [11]. We excluded patients from statistical analyses if they had missing data.

We conducted three studies for face validity, reliability, and validity. The same patients were used for the latter two studies. For test–retest reliability, we collected CD-RISC10 data at baseline and after 2 weeks in patients with stable disease activity. Patients were considered stable if no therapeutic change had started. The 2-week time interval was chosen to be sufficiently long to minimize recall bias, while still short enough to fulfil the assumption of no significant change in disease activity.

We collected sociodemographic information, clinical information, and patient-reported outcome measures (PROMs) through self-administered instruments. Sociodemographic characteristics included age, gender, ethnic group, marital status, highest education level, and occupational status. Clinical information included date of diagnosis and axSpA features.

Face validity of CD-RISC10

We conducted cognitive debriefing interviews (CDIs) with ten consenting English-literate patients with axSpA to evaluate relevance, acceptability, and scope of instrument items. These patients were chosen to represent a range of genders, ages, and disease durations. Time taken to complete CD-RISC10 was noted. A trained observer was present to note any difficulties the patients faced in answering the items. The patients were also asked whether all items in CD-RISC10 were relevant in evaluating their resilience and whether any items were inappropriate or ambiguous. The study protocol was read and approved by the SingHealth Centralized Institutional Review Board (CIRB ref: 2017/2626).

CD-RISC10 instrument

CD-RISC10 (ranging from 0 to 40) is a self-administered instrument with ten items. It measures resilience and includes items regarding adaptability and stress-management abilities. It has a 5-point Likert-type additive scale with five responses ranging from 0 (not true at all) to 4 (true nearly all the time). Higher scores reflect higher resilience [6].

Comparison instruments

All PROMs were self-administered. ASAS HI (ranging from 0 to 17) measures health status, with higher scores indicating worse health status [12]. BASG (ranging from 0 to 100) and PGA (ranging from 0 to 10) measure functioning and disease activity, respectively, with higher scores reflecting poorer functioning and disease activity [13]. SF-36 measures quality of life in eight domains of perceived health, which make-up the physical component summary (PCS) and the mental component summary (MCS), with higher scores reflecting better quality of life [14]. EQ-5D-5L Health Questionnaire (ranging from − 0.5 to 1.0) is a generic health index measuring quality of life, with higher scores reflecting better quality of life [15].

Statistical analysis

We followed the Consensus-based Standards for the selection of health Measurement INstruments (COSMIN) framework. We investigated normality of the distribution of continuous variables using Shapiro–Wilk Tests. Due to the non-normal nature of the distribution of the variables, we tabulated median and range. We described categorical variables as *n* (%).

Interpretability of CD-RISC10 is summarized as information about the distribution of CD-RISC10 scores, including floor and ceiling effects. Floor is defined as the percentage of patients who scored the lowest score and ceiling is defined as percentage of patients who scored the highest score. Floor and ceiling effects were considered significant if they exceeded 15% [16].

Reliability is defined as the consistency of the instrument where observed measurements are within the acceptable limits of error of the true measurement. Internal consistency, the overall consistency of CD-RISC10, was supported if Cronbach's alpha > 0.70 [16]. We assessed measurement error by analysing the smallest detectable change (SDC)

based on the 95% limits of agreement using the formula: SDC = 1.96 × Standard Error of Measurement in mean difference in CD-RISC10 of the two assessments in the test–retest reliability sample $x\sqrt{2}$ [17]. We analysed test–retest reliability using intraclass correlation coefficient (ICC) (two-way mixed effects model, single measure) with a 95% CI. We considered test–retest reliability as excellent if ICC ≥ 0.75 [16].

Validity is defined as the extent an instrument measures what it intends to measure. We tested construct validity of the CD-RISC10 using six a priori hypotheses based on a literature search of papers that assessed validity in CD-RISC. We hypothesized the following: (1) CD-RISC10 had moderate negative correlation with ASAS HI [18] and BASG [18], and low negative correlation with PGA [18], (2) CD-RISC10 had moderate positive correlation with SF-36 MCS [18, 19] and EQ-5D-5L [19], and low positive correlation with SF-36 PCS [18, 19]. We used Spearman's rank correlation to assess the associations. High ($r \geq 0.70$) and moderate correlations ($r = 0.3$–0.7) suggest that two PROMs are related [16, 20]. Low correlation ($r < 0.30$) suggests that two PROMs are unrelated [16]. To reduce the likelihood of Type 1 errors, we adjusted the p values using Bonferroni's correction and p values < 0.0083 were considered significant. We considered CD-RISC10 to have good construct validity if 75% of the hypotheses were met [16].

We examined structural validity using confirmatory factor analysis (CFA). Model fit was evaluated using root-mean-square error of approximation (RMSEA), comparative fit index (CFI), Tucker–Lewis index (TFI), and standardized root-mean-squared residual (SRMR). A model had an adequate fit if (1) the RMSEA < 0.08, (2) CFI > 0.95, (3) TLI > 0.95, and (4) SRMR < 0.08 [21].

We performed all analyses using STATA SE 14.0 (StataCorp, College Station, TX, USA).

Results

Face validity of CD RISC10

We conducted CDIs with ten English-literate (age range 28–71 years, 70% males, disease duration range 1–16 years) patients with axSpA. Overall, patients took a mean of 1.2 min to complete CD-RISC10 and found CD-RISC10 easy to comprehend, complete and relevant in evaluating resilience. No changes to the CD-RISC10 were deemed necessary after CDIs.

Sociodemographic characteristics

Out of the 120 patients recruited, we excluded 12 patients from analyses, comprising 9 (7.5%) patients with missing CD-RISC10 data and 3 (2.5%) patients with missing data from other PROMs. We retained 108 patients for analysis, comprising 88 (81.5%) males and 94 (87.0%) with ≥ 10 years of education (Table 1).

Interpretability of CD-RISC10

A median CD-RISC10 score of 29 with a range of 10–40 was obtained (Fig. 1). 9.3% of patients had the maximum score and 0.9% of patients had the minimum score, indicating acceptable ceiling and floor effects.

Reliability

The Cronbach's alpha of CD-RISC10 in this cohort was 0.94, demonstrating good internal consistency. 37 patients were assessed for test–retest reliability. Test–retest reliability was excellent with an ICC of 0.964 (95% CI 0.937–0.980). The SDC was calculated as 1.88.

Construct validity

Five out of six hypotheses between CD-RISC10 and ASAS HI, BASG, PGA, SF-36 MCS, and EQ-5D-5L were met (Table 2). Overall, stronger correlations were observed with PROMs with psychological dimensions, namely BASG, ASAS HI, SF-36 MCS, and EQ-5D-5L. Hypotheses about the magnitude and direction of correlation were met in 83.3% of the results, supporting construct validity.

Structural validity

The one-factor model proposed for the CFA of the CD-RISC10 displayed the following fit indices [RMSEA = 0.110 (90% CI 0.078–0.142); CFI = 0.943; TLI = 0.927; SRMR = 0.043]. The SRMR was indicative of adequate fit, whereas RMSEA, CFI, and TLI were outside the cut-offs for adequate fit.

Modification indices (MIs) suggested that correlating the residuals of items 7 (focused under pressure) and 8 (not discouraged by failure) (MI = 8.754), the residuals of items 1 (adaptability to change) and 9 (belief in self as strong) (MI = 7.186), and items 1 and 4 (stress can strengthen) (MI = 6.650) could improve model fit. We correlated these items as studies suggest that not being easily discouraged by failure can be a behaviour of individuals with high self-esteem and positive affect [22], which may then be related to an individual's belief in themselves, positive attitude towards adversity, and ability to work under pressure [22]. The re-specified model showed acceptable fit statistics; RMSEA, CFI, TLI, and SRMR were within the cut-off values [RMSEA = 0.077 (90% CI 0.036–0.113); CFI = 0.975; TLI = 0.964; SRMR = 0.036], supporting structural validity.

Table 1 Sociodemographic and clinical characteristics of patients with axSpA

Characteristics	Median (range), *n* (%) (*N* = 108)
Age	37 (21–77)
Gender	
Male	88 (81.5%)
Female	20 (19.3%)
Race	
Chinese	101 (93.5%)
Others	7 (6.5%)
Highest education level	
Primary (≤ 6 years of education)	7 (6.5%)
Secondary (> 6 and ≤ 10 years of education)	12 (11.1%)
Pre-university (> 10 and ≤ 12 years of education)	8 (7.4%)
Diploma (≥ 13 and ≤ 15 years of education)	28 (25.9%)
Degree and above (> 15 or more years of education)	53 (49.1%)
Marital status	
Single	51 (47.2%)
Married	53 (49.1%)
Divorced	4 (3.7%)
Widowed	0 (0.0%)
Occupational status	
Employer, self-employed or employee	83 (76.9%)
Unemployed and job seeking	6 (5.5%)
Unemployed and not job seeking (includes students, homemakers, or retirees)	19 (17.6%)
Disease duration (years)	7 (0–48)
Type of axSpA	
Ankylosing spondylitis	84 (77.8%)
Non-radiographic axSpA	24 (22.2%)
Extra-spinal manifestations	
Arthritis	46 (44.2%)
Dactylitis	2 (1.9%)
Heel enthesitis	26 (25.0%)
Extra-articular manifestations	
Uveitis	32 (30.5%)
Psoriasis	3 (2.9%)
Crohn's or ulcerative colitis	3 (2.9%)
Category of PROMs	
ASAS HI (ranging from 0 to 17)	3.2 (0–15)
BASG (ranging from 0 to 100)	29.3 (0–80.3)
PGA (ranging from 0 to 10)	3.0 (0–9.0)
SF-36 PCS (ranging from 0 to 100)	45.8 (7.6–60.4)
SF-36 MCS (ranging from 0 to 100)	47.7 (12.2–74.3)
EQ-5D-5L (ranging from − 0.5 to 1.0)	0.8 (− 0.3 to 1.0)

ax*SpA* Axial spondyloarthritis, *PROMs* patient-reported outcome measures, *ASAS HI* Assessment of Spondyloarthritis International Society Health Index, *BASG* Bath Ankylosing Spondylitis Global Score, *PGA* Patient Global Assessment, *SF-36 PCS* Short-Form Survey Instrument 36-item Physical Component Score, *SF-36 MCS* Short-Form Survey Instrument 36-item Mental Component Score, *EQ-5D-5L* EuroQol Five-Dimensional Questionnaire

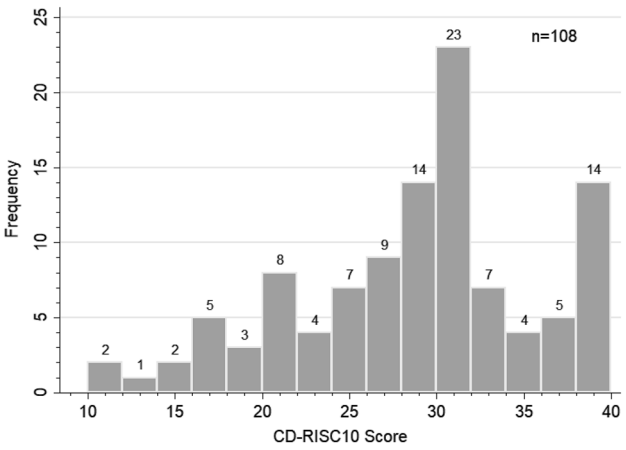

Fig. 1 Histogram illustrating the distribution of ten-item Connor–Davidson Resilience Scale (CD-RISC10) scores at baseline. The horizontal axis shows the total scores (range 0–40), with higher scores indicating higher resilience

Table 2 Construct validities of CD-RISC10: Spearman's rank correlation when compared with other patient-reported outcome measures

CD-RISC10			
Hypotheses	Spearman's correlation coefficient	*p* value	Met hypothesis
ASAS HI			
Moderate (−)	− 0.319*	0.0008	Yes
BASG			
Moderate (−)	− 0.516*	< 0.0001	Yes
PGA			
Low (−)	− 0.266*	0.0054	Yes
SF-36			
PCS			
Low (+)	0.253	0.0116	No
MCS			
Moderate (+)	0.459*	< 0.0001	Yes
EQ-5D-5L			
Moderate (+)	0.338*	0.0018	Yes

CD-RISC10 Ten-item Connor–Davidson Resilience Scale, *ASAS HI* Assessment of Spondyloarthritis International Society Health Index, *BASG* Bath Ankylosing Spondylitis Global Score, *PGA* Patient Global Assessment, *SF-36 PCS* Short-Form Survey Instrument 36-item Physical Component Score, *SF-36 MCS* Short-Form Survey Instrument 36-item Mental Component Score, *EQ-5D-5L* EuroQol Five-Dimensional Questionnaire

*As *p* value < 0.0083, we considered the hypothesis to be statistically significant. Corrected using Bonferroni's correction as six a priori hypotheses were tested; (+) and (−) indicate direction of correlations

Discussion

Our findings provide support for adequate face validity, internal consistency, test–retest reliability, construct validity, and structural validity of the CD-RISC10 in patients with axSpA in Singapore. Following the COSMIN guidelines and formulating hypotheses a priori in context of construct validity are key strengths of the study.

The internal consistency and test–retest reliability of CD-RISC10 in our sample are like those previously reported [6, 8]. Consistent with previous studies, CFA confirmed that CD-RISC10 has a one-factor structure in patients with axSpA [6]. We also found significant positive associations between resilience and quality of life, health status, and functioning, which are consistent with other studies [6, 8, 19]. This corroborates the protective role of resilience in patients with axSpA.

Our study has only validated the English version of CD-RISC10. However, Singapore has a high English literacy rate of 78.6% [23], and the English-illiterate are typically the older adults. Hence, this is less relevant for axSpA, which affects younger adults who are largely English-literate.

Our study has several implications for research and clinical practice. To our knowledge, this is the first validation study of CD-RISC10 in patients with a rheumatological condition, in our case axSpA. Our findings suggest that the CD-RISC10 may be a useful clinical tool for psychological assessment of patients with axSpA. Future interventions can be developed to prevent mental health problems and preserve good quality of life, and effectiveness of these interventions can be measured with CD-RISC10. Furthermore, the psychological screening of patients with other rheumatic diseases may also be undertaken with CD-RISC10.

Our study has some limitations. First, there may be limited generalizability of the findings to non-Chinese populations due to the few Malay and Indian patients. However, findings of studies of patients with axSpA in Singapore reflected similar proportions (Chinese/non-Chinese ratio is 4.3:1), consistent with clinical practice [24]. Second, we were unable to estimate minimal important change (MIC), the minimum change in resilience score that is important to patients [16], due to limited numbers of patients who had therapy initiated. Consequently, we only reported SDC, in line with recommendations from the COSMIN guidelines [16].

In conclusion, our findings on face validity, internal consistency, test–retest reliability, construct validity, and structural validity support the use of CD-RISC10 to assess resilience in patients with axSpA in Singapore. The findings give confidence for researchers and clinicians to use CD-RISC10 and enable them to evaluate resilience-improving interventions.

Authors' contributions YHK, TO, WF, and JT conceived and designed this study. JKP, AN, WF, NLL and YYL acquired the data for this study. AN, KKL and YHK performed the analyses and prepared the first draft of the manuscript. CST advised the statistical analyses. KKL, CST, EHC, and NLL interpreted the results. All authors read, revised critically, and approved the final manuscript.

Funding/support This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Compliance with ethical standards

Conflict of interest The authors declare that there is no other conflict of interest to disclose.

Ethical approval The SingHealth Centralised Institutional Review Board approved this research. All patients provided written informed consent to participate in this research.

References

1. Zeidler H, Amor B (2011) The Assessment in Spondyloarthritis International Society (ASAS) classification criteria for peripheral spondyloarthritis and for spondyloarthritis in general: the spondyloarthritis concept in progress. Ann Rheumatic Dis 70(1):1–3. https://doi.org/10.1136/ard.2010.135889
2. Ward MM (1999) Health-related quality of life in ankylosing spondylitis: a survey of 175 patients. Arthritis Care Res 12(4):247–255
3. Perrotta FM, De Socio A, Scriffignano S, Lubrano E (2018) From clinical remission to residual disease activity in spondyloarthritis and its potential treatment implications. Expert Rev Clin Immunol 14(3):207–213. https://doi.org/10.1080/1744666x.2018.1429918
4. Strand EB, Zautra AJ, Thoresen M, Odegard S, Uhlig T, Finset A (2006) Positive affect as a factor of resilience in the pain-negative affect relationship in patients with rheumatoid arthritis. J Psychosom Res 60(5):477–484. https://doi.org/10.1016/j.jpsychores.2005.08.010
5. Sykes MP, Doll H, Sengupta R, Gaffney K (2015) Delay to diagnosis in axial spondyloarthritis: are we improving in the UK? Rheumatology 54(12):2283–2284. https://doi.org/10.1093/rheumatology/kev288
6. Campbell-Sills L, Stein MB (2007) Psychometric analysis and refinement of the Connor–Davidson Resilience Scale (CD-RISC): validation of a 10-item measure of resilience. J Trauma Stress 20(6):1019–1028. https://doi.org/10.1002/jts.20271
7. Connor KM, Davidson JR (2003) Development of a new resilience scale: the Connor–Davidson Resilience Scale (CD-RISC). Depression Anxiety 18(2):76–82. https://doi.org/10.1002/da.10113
8. Notario-Pacheco B, Martínez-Vizcaíno V, Trillo-Calvo E, Pérez-Yus MC, Serrano-Parra D, García-Campayo J (2014) Validity and reliability of the Spanish version of the 10-item CD-RISC in patients with fibromyalgia. Health Qual Life Outcomes 12:14. https://doi.org/10.1186/1477-7525-12-14
9. Cosco TD, Kaushal A, Richards M, Kuh D, Stafford M (2016) Resilience measurement in later life: a systematic review and psychometric analysis. Health Qual Life Outcomes. https://doi.org/10.1186/s12955-016-0418-6
10. Windle G, Bennett KM, Noyes J (2011) A methodological review of resilience measurement scales. Health and Quality of Life Outcomes 9(1):8. https://doi.org/10.1186/1477-7525-9-8

11. Rudwaleit M, Landewe R, van der Heijde D, Listing J, Brandt J, Braun J, Burgos-Vargas R, Collantes-Estevez E, Davis J, Dijkmans B, Dougados M, Emery P, van der Horst-Bruinsma IE, Inman R, Khan MA, Leirisalo-Repo M, van der Linden S, Maksymowych WP, Mielants H, Olivieri I, Sturrock R, de Vlam K, Sieper J (2009) The development of Assessment of SpondyloArthritis international Society classification criteria for axial spondyloarthritis (part I): classification of paper patients by expert opinion including uncertainty appraisal. Ann Rheumatic Dis 68(6):770–776. https://doi.org/10.1136/ard.2009.108217
12. Kiltz U, van der Heijde D, Boonen A, Cieza A, Stucki G, Khan MA, Maksymowych WP, Marzo-Ortega H, Reveille J, Stebbings S, Bostan C, Braun J (2015) Development of a health index in patients with ankylosing spondylitis (ASAS HI): final result of a global initiative based on the ICF guided by ASAS. Ann Rheumatic Dis 74(5):830–835. https://doi.org/10.1136/annrheumdis-2013-203967
13. Thong ISK, Jensen MP, Miro J, Tan G (2018) The validity of pain intensity measures: what do the NRS, VAS, VRS, and FPS-R measure? Scand J Pain 18(1):99–107. https://doi.org/10.1515/sjpain-2018-0012
14. Kwan YH, Fong WW, Lui NL, Yong ST, Cheung YB, Malhotra R, Ostbye T, Thumboo J (2016) Validity and reliability of the Short Form 36 Health Surveys (SF-36) among patients with spondyloarthritis in Singapore. Rheumatol Int 36(12):1759–1765. https://doi.org/10.1007/s00296-016-3567-3
15. Leung YY, Png ME, Wee HL, Thumboo J (2013) Comparison of EuroQol-5D and short form-6D utility scores in multiethnic Asian patients with psoriatic arthritis: a cross-sectional study. J Rheumatol 40(6):859–865. https://doi.org/10.3899/jrheum.120782
16. Mokkink LB, Terwee CB, Patrick DL, Alonso J, Stratford PW, Knol DL, Bouter LM, de Vet HC (2010) The COSMIN checklist for assessing the methodological quality of studies on measurement properties of health status measurement instruments: an international Delphi study. Qual Life Res 19(4):539–549. https://doi.org/10.1007/s11136-010-9606-8
17. Bruynesteyn K, Boers M, Kostense P, van der Linden S, van der Heijde D (2005) Deciding on progression of joint damage in paired films of individual patients: smallest detectable difference or change. Ann Rheumatic Dis 64(2):179–182. https://doi.org/10.1136/ard.2003.018457
18. Jeong HS, Kang I, Namgung E, Im JJ, Jeon Y, Son J, Yu S, Kim S, Yoon S, Lyoo IK, Chung YA, Lim JH, Kim JE (2015) Validation of the Korean version of the Connor–Davidson Resilience Scale-2 in firefighters and rescue workers. Compr Psychiatry 59:123–128. https://doi.org/10.1016/j.comppsych.2015.01.006
19. Fernandez AC, Fehon DC, Treloar H, Ng R, Sledge WH (2015) Resilience in organ transplantation: an application of the Connor–Davidson Resilience Scale (CD-RISC) with liver transplant candidates. J Pers Assess 97(5):487–493. https://doi.org/10.1080/00223891.2015.1029620
20. Mukaka MM (2012) A guide to appropriate use of correlation coefficient in medical research. Malawi Med J 24(3):69–71
21. Hu LT, Bentler PM (1999) Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives. Struct Equ Model 6(1):1–55. https://doi.org/10.1080/10705519909540118
22. Fredrickson BL, Branigan C (2005) Positive emotions broaden the scope of attention and thought-action repertoires. Cognition Emot 19:313–332. https://doi.org/10.1080/02699930441000238
23. Singapore Department of Statistics (2016) General Household Survey 2015. Department of Statistics, Ministry of Trade & Industry, Republic of Singapore, Singapore
24. Ng X, Low AH, Chew LC, Chong YY, Fong KY, Lui NL, Sim E, Tan YK, Yoong J, Thumboo J (2013) Disease patterns of rheumatology outpatients seen in a tertiary hospital serving a multiethnic, urban Asian population in Singapore. Int J Rheumatic Dis 16(3):273–278. https://doi.org/10.1111/1756-185x.12016

Affiliations

Yu Heng Kwan[1] · Amanda Ng[2] · Ka Keat Lim[1] · Warren Fong[3,4,5] · Jie Kie Phang[3] · Eng Hui Chew[2] · Nai Lee Lui[3] · Chuen Seng Tan[6] · Julian Thumboo[1,3,5] · Truls Østbye[1] · Ying Ying Leung[3,4,5]

Amanda Ng
amandanyl96@gmail.com; e0008921@u.nus.edu

Ka Keat Lim
limkk@u.duke.nus.edu; lkkeat@gmail.com

Warren Fong
warren.fong.w.s@singhealth.com.sg

Jie Kie Phang
phang.jie.kie@sgh.com.sg

Eng Hui Chew
phaceh@nus.edu.sg

Nai Lee Lui
lui.nai.lee@singhealth.com.sg

Chuen Seng Tan
ephtcs@nus.edu.sg

Julian Thumboo
julian.thumboo@singhealth.com.sg

Truls Østbye
truls.ostbye@duke.edu

Ying Ying Leung
katy.leung.y.y@singhealth.com.sg

[1] Program in Health Services and Systems Research, Duke-NUS Medical School, 8 College Road, Singapore 169857, Singapore

[2] Department of Pharmacy, Faculty of Science, National University of Singapore, Singapore, Singapore

[3] Department of Rheumatology and Immunology, Singapore General Hospital, Singapore, Singapore

[4] Duke-NUS Medical School, 8 College Road, Singapore 169857, Singapore

[5] Department of Medicine, Yong Loo Lin School of Medicine, National University of Singapore, Singapore, Singapore

[6] Saw Swee Hock School of Public Health, National University of Singapore and National University Health System, Singapore, Singapore