ORIGINAL ARTICLE

Adaptation and validation of the Ankylosing Spondylitis Work Instability Scale (AS-WIS) for use in Turkey

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Abstract The Ankylosing Spondylitis Work Instability Scale (AS-WIS) is a recently developed 20-item measure to assess work instability in AS. This study aimed to adapt the AS-WIS to Turkish and to test its reliability and validity. After the translation process, 132 AS patients were assessed by the AS-WIS, Bath AS Disease Activity Index, Bath AS Functional Index and the AS Quality of Life Questionnaire. Reliability was tested by internal consistency, person separation index (PSI) and intra-class correlation coefficient (ICC); internal construct validity by Rasch analysis; external construct validity by associations with comparator scales and cross-cultural validity by comparison with the original UK data. Reliability of the Turkish AS-WIS was good with Cronbach's α and PSI of 0.88 and test–retest ICC of 0.91. Data showed good fit to Rasch model [mean item fit: −0.477 (SD 1.047), Chi-square interaction: 60.9 ($df = 40$, $p = 0.018$)]. There was no differential item functioning by age, gender, disease duration or work type. The scale was strictly unidimensional. 51 % of the patients were at moderate risk, and 9 % were at high risk of having to give up their work. External construct validity was confirmed by expected correlations with comparator scales, and a clear gradient of disease activity and functional status across increasing levels of risk. Cross-cultural validity showed some differences in item locations, but this cancelled out at the test level. Turkish version of the AS-WIS is reliable, valid and available for use in routine clinical setting to identify patients who are at risk of having to give up their current job.

Keywords Ankylosing spondylitis · Work · Validity · Cross-cultural · Reliability · Adaptation

Introduction

Ankylosing spondylitis (AS) is a chronic, progressive, inflammatory disease that may cause significant restrictions in

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activities and participation and limit work ability resulting in a substantial economic burden on patients and the healthcare system [1, 2]. Work disability is usually defined as the inability to work due to a health condition [3]. In patients with AS, this has been reported across various studies to range from 3 to 50 % [2]. However, the definition of work disability only includes those who have had to give up work due to their condition. It fails to recognise the limitations or difficulties in the workplace experienced by the individual with AS that may well affect their productivity and eventually lead to having to give up work. This period prior to the work disability is one that has been defined as a period of work instability (WI), reflecting the consequences of a mismatch between a person's functional (and cognitive) ability and the demands of their job, so potentially threatening continuing employment if not addressed [4, 5]. Thus, the understanding of WI from the patients' perspective might be an important factor in the management of individuals with AS during their working years. Furthermore, if WI is recognised early, it may be possible to reduce or eliminate the risk of work disability by appropriate clinical or work place intervention.

Recognising the potential importance of WI in AS, a work instability scale (AS-WIS) has recently been developed and validated [6]. The AS-WIS is a disease-specific 20-item questionnaire to assess work instability on patient self-perceived impact of disease on work. It is scored between 0 and 20 (0 = no, 20 = maximum risk of work instability). Cut points have been established to identify those with medium or high risk [6].

Despite its recent development, the scale has already been adapted into various languages and has been used in at least one clinical trial [7].

However, it has not yet been adapted into Turkish and there is no other instrument available to assess AS-related work instability in the Turkish population. Given an estimated 83 million worldwide people speak Turkish, a Turkish validation of the scale, including evidence of cross-cultural validity, is important both for the Turkish setting, and elsewhere. Consequently, this study was planned with the aim of adapting the AS-WIS to Turkish and testing its reliability and internal and external construct validity, together with the cross-cultural validity using the original UK data.

Patients and methods

Adaptation procedure

For the adaptation into the Turkish language, internationally accepted guidelines for the process of cross-cultural adaptation were utilised [8]. In this process, stage I involved three bilingual professionals translating the original version. One health professional had clinical background and was thus "informed" translator. The other two translators were an English teacher at the university and an engineer educated in the USA and therefore they were "uninformed" translators. At stage II, inconsistencies in the translations were resolved by discussions among the translators. In order to produce meaningful and easily understandable Turkish expressions, it was necessary to change some sentence structures in the English items. For example, items "I get on with the work but afterwards I have a lot of pain", "I'm finding my job is about all I can manage", "I am very worried about my ability to keep working" were translated as "I can do my work but afterwards I have a lot of pain", "I think about all I can manage is only my work" and "I am very worried that I will be able to keep working", respectively. At this stage, the accepted version of the instrument was back-translated (stage III) by a native English bilingual translator who was blind to the original version. Then, all the translators involved in the adaptation process reviewed and discussed the translations and the pre-final version before field testing was considered (stage IV). At this stage, item 8 "When I'm feeling tired all the time works a grind" gave rise to much discussion among the translators and finally all translators agreed upon the Turkish version to be "When I'm tired, everything at work seems very tedious". Field testing for face validity (stage V) was done in a group of 15 AS patients with variable age and educational levels. At this stage, a few items necessitated some modifications to make them more easily understandable in a Turkish setting, for example the terms "my condition" in items 5 and 18 were changed into "my disease". The final version was then ready for further testing with respect to validity and reliability.

Patients

Actively working patients with AS who fulfilled the modified New York Criteria were consecutively recruited and assessed at the rheumatology outpatient clinic of the Department of Physical Medicine and Rehabilitation at the Medical Faculty of Ankara University between January and December 2009. The total number of AS patients seen at the rheumatology outpatient clinic during this period was 181, 137 of these were actively working. Subsequently, 5 patients with concomitant disease or disorder that might affect their work status were excluded. Therefore, 132 patients were included in the study. All patients gave informed consent to take part in the study. The study was carried out in compliance with Helsinki Declaration and was approved by the Ethical Committee of Medical Faculty of Ankara University.

Outcome measures

The patients were assessed with the adapted version of the AS-WIS; the Bath AS Disease Activity Index (BASDAI);

the Bath AS Functional Index (BASFI) and the AS Quality of Life Questionnaire (ASQoL). Data about the disease duration, work duration, work type, medication used and CRP levels of patients were also recorded.

Disease activity was assessed using the Turkish version of BASDAI [9]. The BASDAI is a composite index of six items scored on 10-cm visual analogue scales pertaining to the five major symptoms of AS: fatigue, spinal pain, joint pain and swelling, areas of local tenderness, and morning stiffness [10]. The mean of the two scores relating to morning stiffness is taken. The resulting 0–50 score is divided by five to give a final 0–10 BASDAI score (0 = no; 10 = maximum disease activity).

The functional status of the patients was assessed using the Turkish version of the BASFI [11]. The BASFI consists of ten questions relating to a range of daily activities relevant to AS [12]. Each question is answered on a 10-cm horizontal visual analogue scale (VAS). The mean of the 10 scales gives the total BASFI score between 0 and 10 (0 = normal function, 10 = worst possible function).

The quality of life of the patients was assessed using the Turkish version of the ASQoL [13]. The ASQoL is a disease-specific quality of life measure which comprises 18 items, each with a dichotomous "yes/no" response format, scored as "1" or "0", respectively. A score of "1" indicates poor QoL. Total scores range from 0 to 18, with a higher score indicating poor quality of life [14].

Statistical analysis

Internal construct validity

Internal construct validity was determined by fit of the data to the Rasch measurement model [15]. The process of Rasch analysis is described in detail elsewhere [16, 17]. Briefly, the process involves testing a number of assumptions of the model and these tests are summarised by a series of fit statistics (Chi-square fit statistics are required to be non-significant Bonferroni-adjusted; residual fit statistics are expected to be within a given range, ±2.5 for individual items; summary mean fit residual values should be close to 0.0 with a standard deviation approaching 1.0 (usually <1.4) for summary statistics.

Local independence assumes that a response to an item is independent of responses to other items, after controlling for the latent trait. Breaches of this assumption can arise because of two causes; response dependency is where the answer to one item would determine the answer to another, for example, if you can walk a kilometre, you must be able to walk all lesser distances, and thus such items relating to lesser distances would be linked to the item with the longest distance; trait dependency, is multidimensionality [18, 19].

Another key attribute which is tested with the process is differential item functioning (DIF). DIF is a form of bias in which one subgroup (e.g. younger people) with given levels of latent trait responds differently to an item compared to another subgroup (e.g. older people) with similar levels of latent trait. DIF is detected by conducting an analysis of variance for each item, comparing across levels of subject characteristics and levels of latent trait (that is their level of Work Instability in this case). In the current study, DIF was tested for age, gender, disease duration and work type.

A Person Separation Reliability Index (PSI) is also calculated which is an estimate of a scale's internal consistency and, given a normal distribution of patients, can be considered equivalent to Cronbach's alpha [20].

Reliability

Reliability of the Turkish AS-WIS was initially tested by internal consistency which is an estimate of the degree to which its constituent items are interrelated and is assessed by Cronbach's alpha coefficient [20]. Usually a reliability of 0.70 is required for analysis at the group level, and values of 0.85 and higher for individual use [21]. Finally, test–retest reliability was assessed by intra-class correlation coefficient [ICC (1,1)] [22]. For test–retest reliability assessment, 39 patients were assessed twice with a 2-weeks interval.

External construct validity

External construct validity was determined by testing for expected associations of AS-WIS with BASDAI, BASFI and ASQoL through the process of convergent construct validity [23]. In this study, the degree of associations was analysed by Spearman's correlation coefficient.

Cross-cultural Validity

Finally, to examine the cross-cultural validity of the scale, data were pooled with the original UK development data to test for item invariance across culture by DIF analysis [24].

Sample size and statistical software

For the Rasch analysis, a sample size of 132 patients will estimate item difficulty, with α of 0.05, to within ±0.34 logits [25]. This sample size is also sufficient to test for DIF where, at α of 0.05 a difference of 0.25 within the residuals can be detected for any two groups with β of 0.20. Bonferroni correction was applied to both fit and DIF statistics due to the multiple testing [26]. Statistical analysis was undertaken with SPSS 11.5, Rasch analysis with RUMM2020 package [27].

Table 1 Demographic and clinical characteristics of patients ($n = 132$)

Age	37.8 ± 10.7 (median 37, range 19–71)
Gender	77 % male
Education	20.5 % primary
	48.5 % middle
	31.1 % high
Disease duration (months)	96.0 ± 99.6 (median 60, range 3–468)
Work duration (years)	13.0 ± 10.2 (median 10.5, range 0.5–60)
Work type	20 % cognitive; 39 % physical; 41 % cognitive and physical
Medication use	55 % Sulphasalazine and/or NSAID;
	45 % TNF-alpha blockers
CRP (mg/L)	10.8 ± 16.5 (median 5.3)
BASDAI score (0–10)	2.8 ± 2.0 (median 2.4)
BASFI score (0–10)	4.8 ± 11.3 (median 1.1)
ASQoL score (0–18)	7.4 ± 4.4 (median 7.0)
AS-WIS score (0–20)	11.2 ± 5.1 (median 12)
Work instability risk according to AS-WIS score (0–10 no risk, 11–17 moderate risk, 18–20 high risk)	40 % no risk, 51 % moderate risk, 9 % high risk

Results

Patients' characteristics

One hundred and thirty-two patients were recruited with a mean age of 37.8 years (SD 10.7), and mean disease duration of 96.0 months (SD 99.6), and of whom 77.3 % were male. One-fifth (20.5 %) had only completed primary (5 years) education, while almost one-third (31.1 %) had completed university education. Almost four-out-of-five (80 %) had some physical component in their work. There was no difference in age, disease duration and type of work by gender ($p > 0.05$). Males had a significantly longer work duration than females ($p = 0.024$). The patients' characteristics are shown in Table 1.

Internal construct validity

Data from the 20 items of the AS-WIS were fitted to the Rasch measurement model. Fit was found to be good with item fit residual of −0.477 (SD 1.047); person fit residual −0.284 (SD 0.894); Chi-square interaction 60.9 ($df = 40$, $p = 0.018$) and PSI reliability of 0.88. There was no evidence of DIF by age, gender, disease duration or work type. Likewise, there was no evidence of local response dependency (i.e. residual correlations above 0.3), and the scale was strictly unidimensional (t tests 3.80 %; CI 0.01–7.50 %). The median score on the AS-WIS was 12.0 (IQR 7–15). The scale was well targeted with the mean of the persons at 0.414 on the logit scale and few people outside of the operational range of the scale (Fig. 1). That is, the person distribution (top of graph) was well matched by the item distribution (bottom of graph). Using the established cut

points, one-fifth of patients (40.2 %) were at low risk; half (50.8 %) at medium risk and just under one-in-ten (9.1 %) were at high risk of having to give up their work. There was no significant difference in age or disease duration by risk level (ANOVA: $p > 0.05$).

Reliability

Internal consistency of the Turkish version of AS-WIS was high with Cronbach's alpha of 0.88. The test–retest ICC was 0.91. The demographic characteristics of the subgroup of patients used in test–retest reliability analysis were similar to the main group (mean age 38.0 ± 11.2, 79 % male). However, their disease duration was lower (median 36 months).

External construct validity

The Turkish AS-WIS showed moderate correlations with BASDAI and ASQoL (Spearman r 0.41 and 0.59, respectively) and low correlation with BASFI (Spearman r 0.32). All correlations were statistically significant. All comparator measures with the exception of CRP showed a significant gradient (worsening) in their scores across the levels of risk of work instability (Table 2).

Cross-cultural validity

When data were merged with the original UK development data, it was found that significant DIF was evident for half of the items. Fit of the merged data was adequate [with item fit residual of −0.360 (SD 1.233); person fit residual −0.197 (SD 0.827)]; Chi-square interaction 89.5
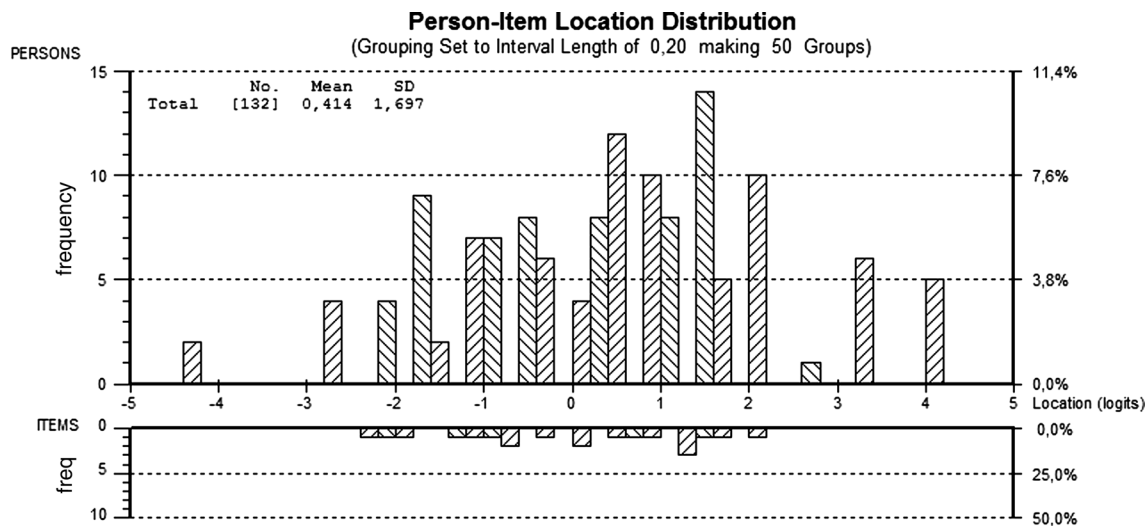
Fig. 1 Targeting of the Turkish version of the AS-WIS to the patients

Table 2 Association of outcome measures with work instability risk

	No risk (AS-WIS 0–10)	Moderate risk (AS-WIS 11–17)	High risk (AS-WIS18–20)	p^a
CRP (mg/L)	2.85 (0.18–47.60)	6.07 (0.05–108)	9.62 (0.05–42)	0.136
BASDAI	1.60 (0–7.50)*	2.94 (0.10–7.26)	3.53 (0–31.10)	<0.001
BASFI	0.40 (0–35)*	2.79 (0–82.40)	4.30 (0–31.10)	0.019
ASQoL	4 (0–11)*	9 (1–18)	14 (0–18)	<0.001
N	53	67	12	

* Significantly different from the others

[a] Kruskal-Wallis test

($df = 60$, $p = 0.008$) and PSI of 0.91. The combined data was strictly unidimensional (*t* tests 5.36; CI 2.7–8.0). Items displayed different response probabilities at a given level of work instability. For example "I push myself to go to work because I don't want to give into my condition" showed a significantly higher probability of affirmation in the UK (higher curve) than in Turkey (lower curve) (Fig. 2). In contrast, the item "Getting around at work is hard for me" showed a significantly higher probability of affirmation in Turkey than the UK. At the test level, these different biases cancelled out, that is when all items that displayed DIF were pooled into a "impure" set, and the remaining items into a "pure" set, no evidence of DIF remained. Fit of this model was good with item fit residual of 0.159 (SD 0.003); person fit residual of −0.586 (SD 1.009); Chi-square interaction 4.15 ($df = 6$, $p = 0.656$) and PSI of 0.92.

Discussion

This paper reports the adaptation and validation of the AS-WIS for use in Turkey. The adaptation of the scale to Turkish followed the international guidelines for cross-cultural adaptation procedure of self-report measures [8]. Face validity of the adapted version was confirmed at the field testing stage, which revealed that the new instrument was acceptable and relevant for Turkish AS patients.

The newly adapted version of the scale showed excellent reliability compatible with the original version [6]. Rasch analysis results revealed that Turkish AS-WIS satisfied model expectations, confirming the internal validity of the scale. The scale showed no DIF by age, gender, disease duration or work type and was strictly unidimensional. It is worth noting that the age and gender distribution were similar across both countries.

External construct validity of the Turkish AS-WIS was investigated by its association with disease activity (BASDAI), functional status (BASFI) and quality of life (ASQoL). It should also be noted that the AS sample in this study has a considerably low disease activity with a median BASDAI score of 2.4, compared with a larger cohort from the Turkish population [28]. This is due to the fact that almost half of the patients (45 %) were on TNF-alpha blockers and had a good disease activity control. The associations of AS-WIS
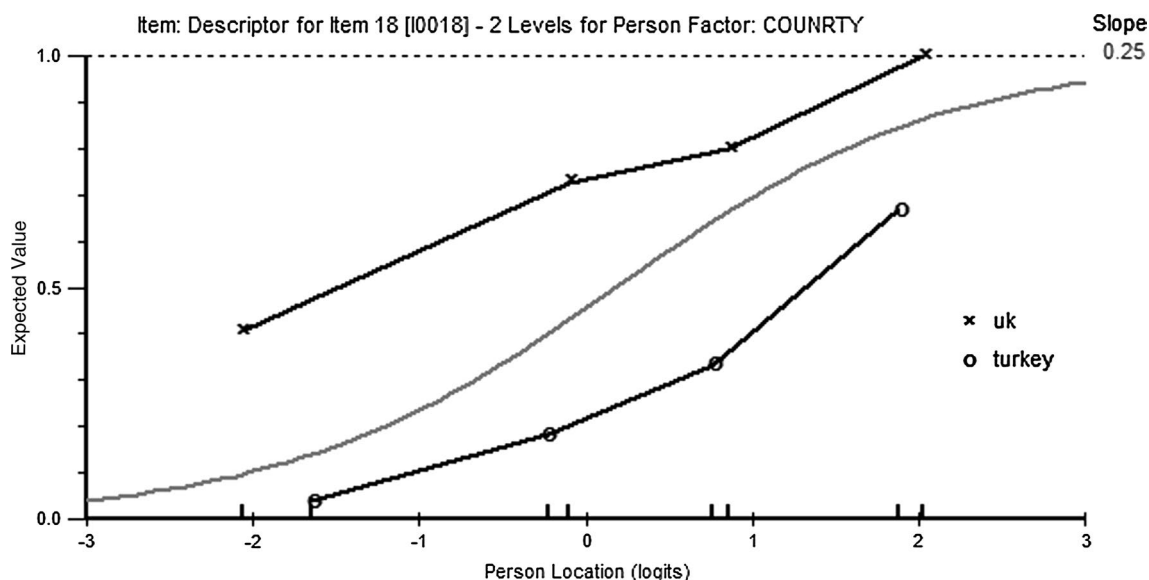
Fig. 2 Differential item functioning for the item "I push myself to go to work because I don't want to give into my condition" by country

scores with BASDAI, BASFI and ASQoL were as expected and in concordance with previous reports [29–32]. The highest correlation was found with the ASQoL which indicates the work impact upon quality of life [6].

Cross-cultural validity results revealed that half of the items of the AS-WIS presented DIF across the UK and Turkey. This finding shows that those items do not work in the same way in these populations. This might be due to the difference between the two countries with respect to the country-specific nuances of work stability [4]. The lack of invariance of the items across culture is no longer seen as a problem within the Rasch framework, as the differences can be adjusted when data need to be compared [33]. Given the scales work well within their own country, this adjustment just becomes a requirement when data are to be pooled. The fact that the DIF cancelled out at the test level suggests that the cut point scores derived in the UK study can be used in the Turkish population.

There are limitations to the study. The sample size was at the lower end of acceptability for the Rasch model, although the fact that the scale was well targeted in the study population would have increased the level of precision of the item difficulty estimates [25]. Nevertheless, replication in larger samples will support the robustness of the results. The clinical cut points are those derived from the UK population, representing the risk of job loss within the UK context. While the DIF between countries cancelled out at the test level, suggesting that the Turkish version can be compared directly to the UK version, it could be the case that there are nuances of the workplace in Turkey, and thus the interaction between the patient and their workplace, that are not reflected by the existing cut points.

Thus, as a consequence, its predictive validity in the Turkish population requires validation. Routine use of the scale in a clinical setting, and consequent risk estimation, may help to identify if such problems exist.

The response to different levels of risk itself may differ between countries, reflecting local resources and practice. However, those screened as high risk are at imminent risk of having to give up work, and this matter should always be discussed with the patient, and appropriate treatment and other interventions considered.

In conclusion, the Turkish adaptation of the AS-WIS satisfies both modern and classical psychometric standards and is available for use in routine clinical setting to identify those patients who are at risk of having to give up their current employment. While the scale items lacks invariance across cultures, data from the UK and Turkey can be pooled as the cross-cultural differences cancel out at the test level.

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