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A comparison of the Work and Social Adjustment Scale (WSAS) across different patient populations using Rasch analysis and exploratory factor analysis

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ABSTRACT

Introduction: The Work and Social Adjustment Scale (WSAS) is designed to measure patients' perceived functional impairment associated with a health problem. There is a paucity of studies that explore the stability of the item hierarchy in the WSAS across different disease populations. This study investigated the unidimensional structure of the WSAS across different disease populations.
Methods: Secondary data analysis was conducted on pooled patient data (HIV, breast cancer, and inflammatory conditions) to create a new dataset ($n = 554$). The data were analysed using Rasch analysis and exploratory factor analysis.
Results: Exploratory factor analysis and principle component analysis of the WSAS showed a good fit as a unidimensional scale, person and item separation indices were >2 suggesting that the WSAS is sensitive enough to distinguish between participants of varying levels of ability. Some differential item functioning was seen by diagnosis and by sex for items 1 and 5 of the WSAS.
Conclusions: Overall, a one dimensional structure was identified for the WSAS. However, a small number of differential item functioning (DIF) was identified, suggesting that scores from the WSAS cannot be compared across groups.

1. Introduction

The Work and Social Adjustment Scale (WSAS) is designed to measure patients' perceived functional impairment resulting from a health problem. The original measure was a four item scale, that covered the work, home, social, and private leisure domains, for rating disability in psychotherapy studies of phobias [1]. Marks et al. [2] adapted the measure by adding a fifth item concerning interpersonal relations. The five WSAS items determine the following impairment dimensions: (1) work; (2) home management; (3) social leisure activities; (4) private leisure activities; and (5) relationships with others. Scores range from 0 to 40 with lower scores indicating better adjustment. Scores above 20 suggest moderately severe psychopathology, scores between 10 and 20 are associated with significant functional impairment but less severe clinical symptomatology, and scores below 10 are associated with subclinical populations [3].

Whilst the WSAS has been used to measure impairment in various populations with results suggesting a one-factor solution [4–6], there is a paucity of studies that explore the stability of the item hierarchy in the WSAS across disease clinical populations. Should item hierarchies vary across groups, for example if some items are easier or more difficult to answer for one group compared to another group, the resulting scores cannot be generalised or compared.

This study aimed to examine the dimensionality and reliability of the WSAS in HIV, breast cancer, and inflammatory conditions in patient populations using Rasch analysis and exploratory factor analysis, to investigate if scores from the WSAS can be validly and reliably used across illness groups.

2. Method

Secondary data analysis was conducted on patient data pooled from a number of studies carried out at King's College London. The data have been combined from patients with HIV, breast cancer, and inflammatory conditions [7]. A total of 554 patients completed the WSAS. All patients provided demographic information, and information about their employment status. All studies from which these data have been drawn received ethical approval from the local research ethics committee (REC reference: 12/LO/1510; IRAS project ID: 83,947, breast cancer study that received approval from the ethics research and audit panel

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at King's College Hospital). Informed consent was obtained from all participants.

2.1. Analysis

In order to establish the dimensionality or factorial structure underpinning the WSAS, i.e. whether the scale is unidimensional, or if it can be better characterised by a number of underlying dimensions, a Rasch model was used to analyse the similarity of the WSAS item hierarchy across the three diagnostic groups [8].

Rasch analysis is also useful in examining differential item functioning (DIF). This is where the response to an item differs for people by diagnostic group. This is a useful comparison as it identifies whether the same item on a scale represents a different level of impairment by diagnostic group. Carrying out exploratory factor analysis in conjunction with Rasch analysis is a valuable technique which allows for the identification of any latent dimensions in the scale that can be further explored using Rasch analysis.

2.2. Step 1

To evaluate the dimensionality and reliability of the WSAS, exploratory factor analysis, and the Rasch measurement model were used. Unidimensionality was examined by conducting exploratory factor analysis and through carrying out a principal component analysis (PCA) of the standardized residuals to determine whether any sub-dimensions existed within the items of the WSAS. As there are no fixed rules for interpreting the results of principal component analysis of residuals, for this study unidimensionality was supported if the proportion of variance explained by the measures was >50% and the eigenvalue of unexplained variance explained by first contrast was smaller than 2 [8].

Test of fit to the Rasch model was evaluated with two indices, information-weighted fit statistic (INFIT) and the outlier-sensitive fit statistic (OUTFIT), were used to test the dimensionality of the WSAS. These statistics are the average weighted and un-weighted standardized residuals (residuals represented by the difference between actual responses and Rasch model expected responses). Items with INFIT or OUTFIT outside a reasonable range for rating scales of 0.6–1.4 are considered misfitting [9].

2.3. Step 2

The reliability of the WSAS was examined using the person separation reliability statistic. The person separation index indicates how well the WSAS items separate the participants into statistically distinct levels of severity and the item separation index indicates how well the participants separate the items into different levels of difficulty. The separation index (SI) must exceed 2 to achieve the desired level of separation reliability (i.e., a value of 0.80) and exceed 3 to attain a value of 0.90 [10].

2.4. Step 3

The items on the WSAS were tested for any overall Differential item functioning (DIF) by sex, and across the three illness groups.

Exploratory factor analysis was conducted using Stata (version 11.2). The Rasch analysis was completed using Winsteps (version 3.91.2).

3. Results

402 females and 152 males were included in the combined dataset. The mean age of the participants was 48.3 years. 39.7% of female participants were employed compared to 34.8% of males. Full demographic information and the distribution of impairment severity as measured by the WSAS by illness, sex, age, and employment is presented in Table 1.

3.1. Dimensionality

The INFIT, OUTFIT statistics were; item 1 INFIT 1.36, OUTFIT 1.23, item 2 INFIT 0.74, OUTFIT 0.75, item 3 INFIT 0.52, OUTFIT 0.56, item 4 INFIT 0.83, OUTFIT 0.81, item 5 INFIT 1.74, OUTFIT 1.69. Items with INFIT or OUTFIT outside a reasonable range for rating scales of 0.6–1.4 are considered misfitting therefore, the results suggest that the items relating to social leisure activities (item 3), and close relationships (item 5) do not fit well with the expectations of the rating scale models.

In order to further examine the results from the fit statistics, a principal component analysis of residuals was carried out to check the dimensionality of the data. Table 3 shows that the percentage of variance explained by the measures (73.2%) is very close to the expected variance (73.4%). According to Rasch model simulations, it is unlikely that the 1st contrast in the unexplained variance will be >2.0(8). The unexplained variance explained by the first contrast here was 1.60 eigenvalue units (i.e., <2.0 eigenvalue units) indicating that the WSAS shows a good fit as a unidimensional scale (Table 2).

The data were further examined for unidimensionality using exploratory factor analysis. A one, two, three and four factor solution was calculated. All items loaded satisfactorily in the one factor solution (loadings > 0.7) but not for any other solutions (loadings < 0.7) [data not shown but available from authors]. The analysis was re-run by sex, and diagnostic group. The factor loadings for all items on the WSAS were satisfactory for patients from the three diagnostic groups, and by sex, confirming one dimension for the scale (Table 3).

3.2. Reliability

The reliability of the WSAS was tested by calculating the Cronbach's alpha coefficient, which for the 5-item WSAS scale was 0.93 suggesting that the items are closely related, and by obtaining person and item separation ratios and reliability estimates from WINSTEPS. The separation index must exceed 2 to achieve the desired level of separation reliability (i.e., a value of 0.80) and exceed 3 to attain a value of 0.90. The item measure reliability estimate was 0.98, and the separation index was 6.58. The person measure reliability estimate was 0.80, and the separation index was 2.01. Person and item reliability exceeded the criterion

Table 1
Levels of functional impairment as measured by the WSAS by illness, sex, age, and employment. n = number, % = column percentage.

Demographic variables	Mild functional impairment WSAS < 10 (& >0) n (%)	Moderately severe functional impairment WSAS 10–20 n (%)	Severe functional impairment WSAS > 20 n (%)
Illness			
Inflammatory conditions	73 (50.3)	52 (40.9)	65 (47.8)
Breast cancer	33 (22.8)	42 (33.1)	52 (38.2)
HIV	39 (26.9)	33 (26.0)	19 (14.0)
Sex			
Male	36 (24.8)	37 (29.4)	31 (23.1)
Female	109 (75.2)	89 (70.6)	103 (76.9)
Age group			
≤29 years	13 (9.0)	5 (3.9)	26 (6.4)
30–34	17 (11.7)	10 (7.9)	10 (7.4)
35–39	17 (11.7)	9 (7.1)	14 (10.3)
40–49	31 (21.4)	43 (33.9)	40 (29.4)
>50	67 (46.2)	60 (47.2)	64 (47.1)
Employment status			
Employed	15 (50.0)	9 (40.9)	5 (25.0)
Unemployed, looking for work	7 (23.3)	3 (13.6)	3 (15.0)
Student, not in paid work	0 (0.0)	1 (4.6)	1 (5.0)
Homemaker/not working	2 (6.7)	3 (13.6)	5 (25.0)
Retired	6 (20.0)	3 (13.6)	2 (10.0)
Disability/sick leave	0 (0.0)	3 (13.6)	4 (20.0)