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HEALTH SERVICES RESEARCH

The Fear Avoidance Beliefs Questionnaire (FABQ) Does it Really Measure Fear Beliefs?

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Study Design. A cohort study with 12 months of follow-up.
Objective. To assess (1) the unidimensionality of the Fear-Avoidance Beliefs Questionnaire (FABQ) and (2) whether single questions in the FABQ predict future sickness absence as well as the whole scale.
Summary of Background Data. The fear-avoidance model is a leading model in describing the link between musculoskeletal pain and chronic disability. However, reported measurement properties have been inconsistent regarding the FABQ.
Methods. Individuals (n = 722) sick listed due to musculoskeletal, unspecified or common mental health disorders undergoing rehabilitation was included. A Rasch analysis was applied to evaluate the measurement properties of FABQ and its two subscales (physical activity and work). Linear regression was used to assess how well single items predicted future sickness absence.
Results. The Rasch analysis did not support the FABQ or its two subscales representing a unidimensional construct. The 7-point scoring of the items was far too fine meshed and in the present population the data only supported a yes or no or a 3-point response option. The items were invariant to age, whereas two of the items revealed sex differences. The item "I do not think that I will be back to my normal work within 3 months" was the best predictor of future sickness absence. Adding the item "I should not do my regular work with my present pain" improved the prediction model slightly.
Conclusion. The FABQ is not a good measure of fear-avoidance beliefs about work or physical activity, and the predictive property of the FABQ questionnaire is most likely related to expectations rather than fear. Based on these results we do not recommend using the FABQ to measure fear-avoidance beliefs.
Key words: mental health, musculoskeletal diseases, Rasch analysis, return to work, sick leave.
Level of Evidence: 1
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The fear-avoidance model is a leading model in describing the link between musculoskeletal pain and chronic disability.[1,2] Central in this model is fear that activity will aggravate pain.[1] Based on experiences of how physical activity affects their pain, patients develop fear-beliefs about pain and its consequences, which may lead to avoidance of activities, inactivity, and reduced functioning.[2,3]

The Fear-Avoidance Beliefs Questionnaire (FABQ) aims not only to measure fear-avoidance beliefs, but also to identify patients who are at risk for long-term disability.[3] The FABQ, although originally developed for low back pain, has later been evaluated for other populations and is now widely used.[4–7] Several studies have showed that the FABQ, particularly the work-subscale, is a good predictor of future work outcomes,[8–11] and is thus much used in the clinic and in research.

However, measurements properties of the FABQ have been inconsistent.[12–16] Conventional factor analysis of the FABQ have supported a two-factor structure of physical activity and work.[3] In contrast a study by Meroni et al,[15] applying Rasch methodology, indicated that neither of the four items comprising the physical activity subscale nor the seven items comprising the work subscale of the FABQ,

supported a underlying unidimensional construct. Hence, the study did not support the questionnaire as a general measure of fear-avoidance beliefs.[15] Furthermore, their study indicated the 7-point Likert scaling of the items was far too fine-meshed. The advantage of the Rasch approach, compared with conventional factor analysis, is the lack of assumption of equal intervals of the scoring options and parametric based statistics. In addition, the Rasch approach allows for evaluation of patients and items on the same metrics, and items work in the same way when comparing different sample groups.[17,18]

One of the questions in the FABQ regards expectations about length of sick leave ("I do not think I will be back to my normal work within 3 months"). Expectations is one of the most consistent predictors of return to work (RTW).[19–22] If this question is the main predictor and the remaining 10 questions in FABQ do not contribute substantially, this may explain the low responsiveness of the questionnaire.[12,13] Hence, the aims of this study were to assess the unidimensionality of the FABQ using a Rasch analysis and to assess whether single questions in the FABQ predict RTW as well as the whole scale.

MATERIALS AND METHODS

Study Design

A cohort study with 12 months of follow-up. Participants were individuals participating in one of three randomized trials evaluating the effects of occupational rehabilitation programs on RTW. The ARIS project compared outpatient work-focused rehabilitation to multidisciplinary rehabilitation,[23] while the Hysnes project compared two different inpatient occupational rehabilitation programs with outpatient acceptance and commitment therapy (in two randomized trials).[24] The studies were approved by the Regional Committee for Medical and Health Research Ethics in Central Norway (No.: 2012/1241) and evaluated by South-East Norway (S09024b 2009/1000).

Participants

Sick listed workers aged 18 to 60 years were recruited in all trials. The ARIS project recruited patients referred for diagnostic assessment or multidisciplinary treatment for neck and/or back pain at St Olavs Hospital and Oslo University Hospital. Participants had to be employed or self-employed and sick listed from 1 to 12 months. In the Hysnes project, potential participants were identified through the Norwegian Labor and Welfare Service. Participants had to be sick listed from 2 to 12 months (at least 50% if graded sick leave) with a diagnosis within the musculoskeletal (L), psychological (P), or general and unspecified (A) chapters of ICPC-2 (International Classification of Primary Care, Second edition).

Common exclusion criteria for the two projects were serious somatic and psychological disorders, specific disorders requiring specialized treatment, pregnancy, and insufficient Norwegian language skills to participate in the programs. For the ARIS project, further exclusion criteria included legal labor dispute and Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-V) diagnosed mental disorders. In the Hysnes project, alcohol and drug abuse and scheduled surgery within the next 6 months were additional exclusion criteria.

The Rehabilitation Programs

The different programs have been described extensively.[23,24] Briefly, the work-focused program in the ARIS project consisted of a 5 to 6 days group-based multidisciplinary program with focus on the RTW process and on reducing fear-avoidance beliefs about work. The program included individual appointments with a caseworker and creating a RTW-plan. The comparative arm consisted of a comprehensive multidisciplinary program consisting of both cognitive behavioral therapy and exercise or a brief intervention focused on diagnostic clarification and encouraging physical activity.[23] In the Hysnes project, the inpatient, multimodal groups-based programs consisted of acceptance and commitment therapy, exercise, work-related problem solving, and creating a RTW-plan. One program lasted 3.5 weeks and the other 4 + 4 days (with 2 weeks at home in-between). The comparative arms in both these trials were outpatient acceptance and commitment therapy. The participants in this intervention were offered 2.5-hour-long group sessions once a week during 6 weeks; one group session with psychoeducation on physical activity, two individual sessions with a social worker; and a short individual closing session with the group therapist (a psychologist or a medical doctor).[24]

Questionnaires

Self-reported fear-avoidance beliefs were recorded using the FABQ[3] at inclusion in all trials. The FABQ consists of two subscales: (1) a 7-item work subscale (FABQ-W, range 0–42), and (2) a 4-item physical activity subscale (FABQ-P, range 0–24). Each item on the two subscales is scored on an ordinal 7-point Likert-type scale. In the Hysnes project the questionnaire was modified, to make the questionnaire usable for participants with other complaints than back pain: "complaints" replaced "pain" and "body" replaced "back."

Other variables registered by questionnaires at inclusion were anxiety and depression symptoms (measured using The Hospital Anxiety and Depression scale [HADS][25]), pain level and level of education.

Sick Leave Register Data

Sick leave was measured using data from the Norwegian Labor and Welfare Service, where all individuals receiving any form of sickness absence or disability benefits in Norway are registered. The data consisted of all registered medical benefits individually traceable for each participant by their social security number. Number of sickness absence days was measured as the number of days receiving medical benefits during 12-months of follow-up after inclusion (adjusted for graded sick leave).

Statistical Analysis

A Rasch analysis,[26] the partial credit model,[27] was applied to evaluate the measurement properties of FABQ and its two subscales FABQ-P and FABQ-W. All items originally scored on a 7-point scale were analyzed regarding the thresholds between the scoring points/levels. If the threshold were disordered, that is, the score levels did not separate the level of the underlying construct, the responses were rescored. Local dependency of the items was evaluated using a correlation analysis of the residuals of the items. A coefficient of 0.2 was chosen as the threshold value to indicate that the responses to two items were dependent on each other.[28]

Fit to the Rasch model was investigated for the items and individual participants and by a final summary fit for all 11 items in FABQ and for each of the two subscales. The fit of the items was statistically evaluated using standardized residuals and Chi-square statistics according to the weighted maximal likelihood method with residuals less than ±2.5 and a non-significant Chi-square probability accepted as fit to Rasch Model. The overall summary fit of FABQ and the subscales was evaluated using the Chi square item trait interaction statistics (χ^2). The probability level of 0.05 chosen with Bonferroni adjustment for four items in the FABQ-P and seven items in FABQ-W. A non-significant probability value indicates a fit to the Rasch model.[29]

Invariance across age (dichotomized into groups below and above the median age of 43 years), sex, and Hysnes/ARIS project was examined using a differential item functioning (DIF) analysis. A DIF is assessed by an analysis of variance for each item, comparing the scores across each level of sex and age.[30] The Rasch analysis were performed in RUMM 2030 (RUMM laboratory, Perth, Australia).

Linear regression and adjusted R^2 were used to compare how well single items predicted future sickness absence compared with the FABQ subscales. Only participants with no missing data on the FABQ were included in these analyses. The following models were compared: (1) including the two subscales, separately, (2) including the different FABQ single items separately, and (3) adding the single items one at the time, successively according to their explained variance (adjusted R^2). All the FABQ measures were included as continuous variables. The analyses were adjusted for age, sex, education, and project (i.e., ARIS and Hysnes). Age was included as a continuous variable. Education was dichotomized as high (college/university) or low. In a sensitivity analysis, the analyses were stratified by project (Hysnes and ARIS). The linear regression analyses were done using STATA 14 (StataCorp. 2015. Stata Statistical Software: Release 14. College Station, TX: StataCorp LP).

RESULTS

A total of 722 participants answered the FABQ (the ARIS project n = 398; the Hysnes project n = 324) and were included in the study (Table 1). The mean age was 43 years old (SD 10) and 61% were women. The mean FABQ-W score was 25.0 (standard deviation [SD] 11.1) and the mean FABQ-P 11.6 (SD 6.6). Median number of sickness absence days during 12 months of follow-up was 147 (interquartile range 66–269).

The Rasch Analysis

The Rasch analysis revealed disordered thresholds in all items (Table 2), and only one to two thresholds were detectable for each of the items. The revised scoring options with two to three points are given for all items (Table 2).

The 11 items of FABQ did not fit the Rasch model despite rescoring all the items with disordered thresholds ($\chi^2 = 274.46$, $P < 0.001$). The subscales of FABQ-P and FABQ-W were subsequently analyzed separately with none of them fitting the Rasch model. The FABQ-P ($\chi^2 = 141.10$, $P < 0.001$) revealed three out of four items not fitting the Rasch model whereas the FABQ-W subscale ($\chi^2 = 241.07$, $P < 0.001$) revealed three out of seven items not fitting (Table 2). Deleting these items and running the Rasch analysis with four items (5, 7, 9, and 10), provided low power of analysis as well as indicating additional misfit of item 9 and 10. Item 3 and 4 in the FABQ-P subscale and item 6 and 8 in the FABQ-W subscale showed local dependency with residual correlations above 0.2, and there were in total 16 negative residual correlations, all confined to the FABQ-P subscale. All items revealed invariance to age, but DIF by sex was found for item 2 and 9. DIF was identified by the ARIS/Hysnes project in item 2, 9, and 11. Hence, the Rasch analysis was conducted separately for the ARIS (n = 398) and Hysnes (n = 324) without identifying items fitting the FABQ total scale or its subscales FABQ-P and FABQ-W and with similar results.

The Linear Regression Analyses

Two models containing single items (Q10 and Q11) from the questionnaire showed greater explained variance in future sickness absence days than the other items and the FABQ subscales (Table 3). The model including the question "I do not think that I will be back to my normal work within 3 months" (Q11) had the highest adjusted R^2 (0.116), closely followed by the question "I should not do my normal work with my present pain" (Q10) ($R^2 = 0.115$). The model including the whole FABQ-W subscale was slightly poorer with an adjusted R^2 of 0.111.

Combining the two questions with the highest adjusted R^2 in the same model provided greater explained variance ($R^2 = 0.150$) than including the items separately. Adding more items only negligibly increased the explained variance (Table 3). The sensitivity analyses stratified for project showed in general larger explained variances for the Hysnes project than ARIS, but the conclusions did not change (results not shown).

DISCUSSION

Based on the results of the Rasch analysis, the FABQ does not represent a unidimensional construct, neither do the FABQ-P- nor the FABQ-W subscale. Two of the single items explained more variance in future sickness absence than the subscales. The item "I do not think that I will be back to my

TABLE 1. Baseline Characteristics of the Participants			
	Total Sample (n = 722)	**ARIS (n = 398)**	**Hysnes (n = 324)**
Age mean (SD)	43 (9.9)	41 (9.9)	45 (9.4)
Women %	61%	47%	79%
Higher education* (%)	34%	27%	43%
Pain level mean (SD)			
Strongest pain last week (0–10)	6.3 (2.2)	6.5 (2.1)	6.0 (2.3)
HADS mean (SD)			
Anxiety (0–21)	7.4 (4.1)	7.1 (4.1)	7.8 (4.2)
Depression (0–21)	5.7 (4.0)	5.3 (3.9)	6.2 (4.2)
FABQ mean (SD)			
Work (0–42)	25.0 (11.1)	27.7 (10.0)	21.3 (11.5)
Physical activity (0–24)	11.6 (6.6)	13.8 (5.6)	8.9 (6.8)

*Higher (tertiary) education (college or university).
FABQ indicates fear-avoidance beliefs questionnaire; HADS, the Hospital Anxiety and Depression scale.

normal work within 3 months," explained most of the variance in future sickness absence. The model was only slightly improved by adding the item "I should not do my regular work with my present pain."

The lack of fit of FABQ to the Rasch model in this study is in line with a previous Rasch analysis by Meroni *et al*,[15] on the Italian version of FABQ for patients with low back pain. They also found that the FABQ does not represent a unidimensional construct, but rather multidimensional constructs. The results of the present study corroborate these results in a broader target population, including participants with both musculoskeletal complaints and mental health problems. More recent studies based on conventional factor analysis also do not support a two-factor structure of FABQ.[6,31,32] From a measurement point of

view, there are several challenges with the FABQ. Invariance of a measurement to demographic characteristics of a population is necessary to provide a valid sum score across these factors.[33,34] FABQ was invariant to age, whereas two of the items revealed sex differences. Invariance can be overcome by splitting the item and may not necessarily be replicated in another population sample. A larger problem for FABQ was overlapping content of items which contributed to lack of fit to the Rasch model.[35] Item 3 "I should not do physical activities which make my pain worse" and item 4 "I cannot do physical activities which make my pain worse" in the FABQ-P subscale had a residual correlation above 0.2 indicating overlap in content of these two items. The same problem was revealed for item 6 "My work aggravated my pain" and item 8 "My work

TABLE 2. Rach Analysis of the Thresholds Between the Seven Points Scoring of the 11 Items of the Fear Avoidance Beliefs Questionnaire (FABQ) With its Subscales Physical activity (FABQ-P) and Work (FABQ-W)				
	Item Score	**FitResid**	**ChiSq**	**Prob**
FABQ-P				
Q1. Physical activity makes my pain worse	1 (0–3),2 (4–6)	6.09	68.04	<0.001*
Q2. Physical activity might harm my back	1 (0–2),2 (3),3 (4–6)	0.04	12.76	0.05
Q3. I should not do physical activities which make my pain worse	1 (0–2),2 (3),3 (4–6)	−1.37	35.29	<0.001*
Q4. I cannot do physical activities which make my pain worse	1 (0–2),2 (3),3 (4–6)	0.27	25.00	<0.001*
FABQ-W				
Q5. My pain was caused by my work or by an accident at work	1 (0–3),2 (4–6)	2.72	16.01	0.07
Q6. My work aggravated my pain	1 (0–2),2 (3–4),3 (5–6)	−2.48	30.74	<0.001*
Q7. My work is too heavy for me	1 (0–2),2 (3–4),3 (5–6)	−1.42	22.50	0.007
Q8. My work makes or would make my pain worse	1 (0–2),2 (3–4),3 (5–6)	−4.04	40.55	<0.001*
Q9. My work might harm my back	1 (0–2),2 (3–4),3 (5–6)	−2.07	23.35	0.005
Q10. I should not do my regular work with my present pain	1 (0–2),2 (3),3 (4–6)	−2.01	13.56	0.14
Q11. I do not think I will be back to my normal work within 3 months	1 (0–2),2 (3),3 (4–6)	8.22	94.34	<0.001*

The rescored points/values provided with the original scoring points in the bracket. The fit of the individual items to the FABQ-P and FABQ-W subscale reported with Fit Residual (FitResid), Chi square statistics (Chisq), and Probabilility (Prob).
*Significant probability level <0.003 for FABQ-P and <0.001 for FABQ-W.

TABLE 3. Explained Variance (Adjusted R^2) from the Regression Models With Number of Sickness Absence Days as Outcome-Including Separate Models for the Subscales, the Single Items and Models Combining Single Items	
	Sickness Absence Days* Adjusted R^2 (n = 672[†])
Subscales	
FABQ physical activity subscale	0.030
FABQ work subscale	0.111
Single items	
Q1: Physical activity makes my pain worse	0.031
Q2: Physical activity might harm my back	0.023
Q3: I should not do physical activities which (might) make my pain worse	0.017
Q4: I cannot do physical activities which (might) make my pain worse	0.019
Q5: My pain was caused by my work or by an accident at work	0.026
Q6: My work aggravated my pain	0.056
Q7: My work is too heavy for me	0.078
Q8: My work makes or would make my pain worse	0.058
Q9: My work might harm my back	0.054
Q10: I should not do my normal work with my present pain	0.115
Q11: I do not think that I will be back to my normal work within 3 months	0.116
Models combining single items[‡]	
Q11	0.116
Q11+Q10	0.150
Q11+Q10+Q7	0.153
Q11+Q10+Q7+Q8	0.154
Q11+Q10+Q7+Q8+Q6	0.153
Q11+Q10+Q7+Q8+Q6+Q9	0.152
Q11+Q10+Q7+Q8+Q6+Q9+Q1	0.153
Q11+Q10+Q7+Q8+Q6+Q9+Q1+Q5	0.152
Q11+Q10+Q7+Q8+Q6+Q9+Q1+Q5+Q2	0.152
Q11+Q10+Q7+Q8+Q6+Q9+Q1++Q5+Q2+Q4	0.152
Q11+Q10+Q7+Q8+Q6+Q9+Q1+Q5+Q2+Q4+Q3	0.153

**Linear regression adjusted for age, gender, education, and project.*

[†]*Participants with no missing data on the FABQ.*

[‡]*Starting with a model including the item with the largest explained variance, following items then added successively according to their explained variance (adjusted R^2).*

makes or would make my pain worse'' in the FABQ-W subscale. These overlaps in content may not be surprising, given the wording of these items. In addition, to contribute to misfit to the Rasch model, overlap between items reduces the variance in the measurement.[36] Furthermore, the 7-point scoring of the items was far too fine meshed. At least the data from the present population only supported a yes or no or a 3-point response option. These results may explain why previous studies have found low responsiveness for the FABQ.[12,13]

The findings of this study suggest the FABQ is not a suitable questionnaire for measuring fear avoidance beliefs. As the Tampa scale for kinesiophobia has been shown to capture a unidimensional construct,[37] it probably is a better choice regarding measurement properties. However, there is an ongoing debate for both measurements regarding which factors on the fear anxiety spectrum they capture.[16,38] On the other hand, none of them seems to correlate with more objective pain response measurements.[39]

The question exhibiting the largest explained variance for future sickness absence was the question "I do not think that I will be back to my normal work within 3 months." This is not surprising, as expectations repeatedly have been shown to predict future sick leave.[19–22] However, this might suggest that the predictive properties of the FABQ is not related to fear, but rather to expectations. The question with the second largest explained variance was "I should not do my normal work with my present pain." This question is more in line with the fear avoidance belief model.

The main strengths of this study are the large sample size and the use of registry data for sick leave measurements, ensuring no recall bias or loss to follow-up. A limitation in this study is the use of a modified version of the FABQ questionnaire in one of the projects (Hysnes). However, the performed sensitivity analyses stratified for project did not change any conclusions.

In summary, the FABQ does not represent a unidimensional construct for fear-avoidance beliefs about work or

physical activity. Two of the single items in the FABQ explain the most variance in future sickness absence. One of these items is a question about the patient's expectations about RTW, that is, the predictive property of the FABQ questionnaire is most likely related to expectations rather than fear. Based on these results, we do not recommend using the FABQ to measure fear-avoidance beliefs.

➢ Key Points

❑ A Rasch analysis did not support the FABQ as a unidimensional construct, that is, the FABQ questionnaire is not a good measure of fear-avoidance beliefs about work or physical activity.

❑ Two of the single items in the questionnaire showed a greater explained variance in future sickness absence than the FABQ subscales.

❑ One of these items is a question about the patient's expectations about return to work, that is, the predictive property of the FABQ questionnaire is most likely related to expectations rather than fear.

❑ We do not recommend using the FABQ questionnaire to measure fear-avoidance beliefs.

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