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Validity and Reliability of the Fear-Avoidance Beliefs Questionnaire (FABQ) in Workers with Upper Extremity Injuries

Taucha Inrig · Bev Amey · Cheryl Borthwick · Dorcas Beaton

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Abstract *Introduction* Fear Avoidance Beliefs (FAB) have been associated with increased pain, dysfunction and difficulty returning to work in Upper Extremity (UE) injures. The FABQ is used to assess FAB, but its measurement properties have not been established in UE. The purpose of this study is to evaluate the reliability and validity of the FABQ to screen UE compensated injured workers for FAB. *Methods* Consenting workers attending a specialty clinic completed a modified FABQ, QuickDASH (Disability), SPADI Pain Score and von Korff Chronic Pain Grade (Pain), SF-36v2 (General Health), and Work Instability Scale (Job Instability). A sub-sample of workers ($n = 48$) completed the FABQ 2 weeks later for test–retest reliability. *Results* 187 workers; 54.0% male; mean age 45.2 (sd 9.68); 56% were currently working. Mean subscale scores (FABQ-Work [FABQ-W]/FABQ-Physical Activity [FABQ-PA]) were 35/42 and 20/24. Ceiling effects (23%/38%) existed in both subscales. Cronbach's alphas were 0.75/0.78. Test–retest analysis (ICC(2,1)) was lower than desired (0.52/0.59). Construct validation was supported by a moderate correlation between FABQ-W/FABQ-PA and QuickDASH Work Module (0.51/0.42) and WIS (0.46/0.38) in those currently working. Low correlations were found between the subscales measures of pain (SPADI: 0.24/0.23; Chronic Pain Grade: 0.25/0.25), and SF-36 MCS (−0.25/−0.30). *Conclusions* Although FAB is an important concept to measure in compensated UE injured workers, the FABQ had limitations in this population as there was a high ceiling effect, and lower than desired reliability for individual discrimination. A priori hypotheses around construct validity were rejected for 16/22 concepts tested.

Keywords Measurement · Reliability and validity · Fear avoidance · Workers' compensation

T. Inrig (✉) · D. Beaton
Mobility Program Clinical Research Unit, St. Michael's Hospital, 30 Bond St. (193 Yonge St., 6th floor), Toronto, ON M5B 1W8, Canada
e-mail: inrigt@smh.ca

T. Inrig · D. Beaton
Keenan Research Centre of the Li Ka Shing Knowledge Institute, St. Michael's Hospital, Toronto, ON, Canada

B. Amey · C. Borthwick
Holland Orthopaedic and Arthritic Centre, Sunnybrook Health Sciences Centre, Toronto, ON, Canada

D. Beaton
Institute for Work and Health, Toronto, ON, Canada

D. Beaton
Health Policy Management and Evaluation, University of Toronto, Toronto, ON, Canada

Introduction

Clinicians involved in the rehabilitation of injured workers can encounter what has been described as 'fear avoidance behaviours', particularly in those workers who have a prolonged course of recovery. In the Fear Avoidance Model of Exaggerated Pain Perception described by Slade and Lethem et al. [1], an adaptive response to pain is characterized by the avoidance of noxious stimulus, whereas maladaptive avoidance is characterized by an emotional reaction to pain and the resultant avoidance of any potential cause of pain. Rather than confront and manage pain, Lethem et al. [2] describe a cycle of fear and anxiety. Often it has been said that fear of pain and re-injury can be more disabling than pain itself [3, 4].

This maladaptive anxiety and avoidance of activities that are perceived as a potential cause for increased pain or injury is debilitating, and has been linked in the fear avoidance literature to ongoing chronic pain-related disability, prolonged work absence and depression [5, 6]. However, models of fear avoidance also point to modifiable pathways whereby clinical interventions can assist those living with chronic pain to better understand the nature of their pain and promote a healthier response to potentially painful activities [7, 8]. Such interventions are contingent on accurately identifying those at risk for fear avoidance beliefs and related behaviours so that they might be directed to optimal care and treatment, such as cognitive-behavioural therapy.

One scale, the Fear Avoidance Beliefs Questionnaire (FABQ), has gained popularity through the work of Waddell [3] and subsequent researchers in chronic and acute low back and neck pain, though its validity in painful conditions of the upper limb has not been tested. There has also been some testing in populations covered by workers' compensation insurance (see Table 1) [9–15].

The FABQ has demonstrated good psychometric properties in numerous international studies and has been validated in several different language groups [16–22]. The FABQ has two subscales related to fear avoidance beliefs about work (FABQ-W) and physical activity (FABQ-PA). The FABQ-W has seven items, and the FABQ-PA has four. In addition, five items are fielded in the FABQ, but not used in the scoring of the sub-scales. Responses range from 0 (strongly disagree) to 6 (completely agree) on a seven point scale. Items are summed for the respective sub-scale scores for a maximum score of 42 for the FABQ-W and 24 for FABQ-PA; higher scores represent more fear avoidance beliefs. Waddell has reported Cronbach's alpha coefficients of 0.77 (FABQ-W) and 0.84 (FABQ-PA) [3] which is an acceptable reliability for analyses in grouped data [23–25]. Cut-offs for patients with low back pain require further validation to identify patients at risk [26], though a cut-off of >29/42 on FABQ-W has been shown to be predictive of poor outcomes in patients receiving workers' compensation benefits [10] and related to a higher risk for prolonged work restrictions [11]. Likewise, scores >13 on the FABQ-PA are considered high and have been predictive of poor outcome in patients receiving workers' compensation [10]. Minimal Detectable Change for the FABQ was found to be 12/42 for FABQ-W and 9/24 for the FABQ-PA [19]; though the Minimally Clinically Important Difference (MCID) has been defined as low as 4/24 for the FABQ-PA [27]. No Clinically Important Difference (CID) has been proposed for the FABQ-W [28].

Other investigations have suggested alternate scoring of the FABQ subscales [16, 18, 20]. Factor analysis has identified up to four factors, which was not considered to be practical in implementation. It has also been suggested that a single overall FABQ score is less prone to ceiling effect [22]. Results in this paper will use the 'standard' two subscale scoring system proposed by Waddell et al. [3] for comparability.

The purpose of our study was to evaluate the measurement properties of the FABQ in a population of upper extremity injured workers attending a Workplace Safety and Insurance Board (WSIB) Shoulder and Elbow Specialty Clinic.

Methods

Study Design

A cross sectional survey of 187 injured workers attending the WSIB Shoulder and Elbow Specialty Clinic for an accepted work-related claim was completed. Workers attending this clinic come from a variety of occupational backgrounds. Most people referred to this clinic have experienced a prolonged or complicated course of recovery and are sent for an interdisciplinary evaluation. Prognosis, recommendation for investigations, and treatment as appropriate are provided. The survey was completed during the course of the clinic visit, and a random subset ($n = 48$) repeated the survey by mail 2 weeks later in order to obtain test–retest data.

Inclusion/Exclusion Criteria

Injured workers attending the clinic who were able to complete questionnaires/informed consent in English were invited to participate in the study. We excluded only those who refused to provide written consent or who were unable to complete questionnaires/informed consent in English. Approval from the Sunnybrook Health Sciences Research Ethics Board (REB) was obtained before beginning the study (Sunnybrook REB: 313-2005).

Measures

Workers meeting the inclusion criteria were provided a copy of the FABQ that was modified, with the developer's (Waddell's) permission, to read "shoulder and/or elbow problem" in questions 3 and 11. All workers also completed the Upper Extremity Workers' Survey (UEWS) as part of routine care during a worker's first visit to the clinic. This survey contains patient-reported outcomes that have good measurement properties and are predictive of future course in chronic pain populations (see Table 4). These covered constructs well suited for the construct validation of the FABQ including the *Shoulder Pain and*

Table 1 Studies using FABQ in workers

Study	Population	*n*=	Mean FABQ-W/42	Mean FABQ-PA/24	Cronbach's α	Test–retest	Study findings
VanVuuren et al. [41]	LBP	366	10.17/19.73 (low/high fx rat index[a])	11.60/16.20 (low/high fx rat index[a])			Significant associations between LBP and FABQ-W
Swinkels-Meewisse et al. [42]	LBP	555 (40.2% working)	12.1 Working 16.7 Not working	12.4 Working 14.5 Not working	FABQ= 0.85[b]		FABQ-PA and FABQ-W predict perceived disability
Storheim et al. [43]	LBP	93	25.5 RTW 33.6 not RTW				FABQ-W is good predictor for RTW
Kovacs et al. [44]	LBP	209 (57.9% working)	FABQ total mean 66/96[b]				FAB does not explain mental quality of life, nor does it predict disability or quality of life
Staal et al. [45]	LBP	134 Randomized to graded activity or usual care	Baseline 21.8/22.0 (graded activity/usual care)	Baseline 16.9/15.3 (graded activity/usual care)			Improved FABQ scores in graded activity group
VanVuuren et al. [46]	LBP	109	14.38/24.1 (low/high fx rat index[a])	10.57/14.38 (low/high fx rat index[a])			Prevalence of LBP
Grotle et al. [13]	LBP	233/123 Chronic/acute	26.7/13.2 Chronic/acute	14.0/12.3 Chronic/acute			FABQ-PA associated with disability (ODI) in acute FABQ-W significantly associated with work loss in chronic
Vowles et al. [15]	Chronic Pain from work-related injuries	65	34.8/28.5 pre/post intervention	18.9/11.1 pre/post intervention			FABQ-W score related to changes in work capacity (more so than pain severity or fear of physical activities) Work-specific fears associated to work-related physical capability (more than fears about general physical activities or pain severity)
Fritz et al. [11]	LBP	78	27.9	18.9			FABQ-W score ≤29 may estimate risk of prolonged work restrictions
George et al. [12]	L/C spine pain	163	14.5 c-spine 17.3 l-spine 21.6 c-spine WCB 27.9 l-spine WCB	14.2 c-spine 16.1 l-spine 16.6 c-spine WCB 18.2 l-spine WCB			Relations between FAB, pain and disability weaker in cervical pain than lumbar pain Significant FAB differences based on gender, symptom onset and payer source Workers receiving compensation/lumbar pain had higher FAB than cervical pain
Fritz et al. [6]	Work- related LBP	78	27.9	18.9			FABQ subscales highly correlated to baseline measures of pain, disability (OSW), follow-up disability and somewhat to baseline depressive symptoms

Table 1 continued

Study	Population	*n*=	Mean FABQ-W/42	Mean FABQ-PA/24	Cronbach's α	Test–retest	Study findings
Lötters et al. [14]	MSK-mostly LBP	187 workers	18.3/24[b]	Not measured			FABQ-W highly correlated to perceived physical workload, heavy loading at work, psychosocial demands at work, physical health, and pain FABQ-W and physical health highly correlated: difficult to isolate the effects of one over the other
Godges et al. [47]	Work-related LBP	34	30.8/31.5 intervention/control	19.3/18.7 intervention/control			Testing "Back Book" and counseling which reduced the number of days before RTW
Cleland et al. [10]	LBP	263 (191 private insurance, 72 WCB)	12.9/23.3 private insurance/WCB	14.6/14.4 private insurance/WCB			FABQ-W and FABQ-PA predictive of poor outcome in WCB patients *but not in patients receiving private insurance*
Ciccone et al. [9]	Acute/Chronic Pain	47 acute/56 chronic	23.8/27.5 acute/chronic	Not measured	0.74/0.82 acute/chronic	0.95	FABQ-W accounted for 10–12% of variance in work disability (Pain and injury expectations explained 35–40%)
Voerman et al. [48]	MSK - neck/shoulder pain	79 all work-related pain	Baseline Median 12 both treatment groups	Baseline Median 14.5 group 1 13 group 2	0.82 FABQ-W 0.83 FABQ-PA		Study intervention decreased catastrophizing
Lee et al. [49]	Neck pain	120 reduced work capacity due to pain	FABQ-work as cause = 19.8/30 FABQ-Prognosis Work=11.4/24[b]	19.6/30[b]			3 FABQ[b] subscales moderately correlated to baseline pain, disability and health measures Both FABQ-W[b] subscales had important relationship to RTW and predicting future disability
Kovacs et al. [50]	LBP	165	28.5	21.0			FABQ[b] not correlated with QOL and disability Each point on baseline FABQ increased odds of being on sick leave by 2.4% (≤60 days)/7.7% (<61 days)

[a] High fx rat index = high perceived disability

[b] Used alternate method to score FABQ

Disability Index pain subscale (*SPADI*) [29, 30] and the *Von Korff Chronic Pain Grade* (*CPG*) [31] (*Pain Intensity*); the *QuickDASH* (*Physical Function*) including optional work module (*difficulty performing tasks at work*) that is common to both the *Quick*DASH and DASH [32]; the *Short Form-36* (*SF-36v2*) [33] (*Mental Health*); a *Self-Administered Comorbidity Questionnaire* [34] and demographic questions including questions about the *number of days off work* and *current work status*. Injured workers who had been able to participate in some paid employment in the past month also completed work-related measures. The *Work Instability Scale* (*WIS*) is a 23 item yes/no scale that measures the degree of discord that may exist between the worker's functional abilities and the demands of their job (*amount of job instability*). The WIS has been validated in a Rheumatoid Arthritis population [35] and was favourably received in a previous unpublished study of this clinic's injured worker population.

Data Collection and Management

The FABQ (baseline and retest) was collected by pen and paper on scan-able forms (TeleForm). Data from the UEWS was collected by pen and paper on scan-able forms (TeleForm) or by a touch-screen computer interface (Ortech) in the clinic, as per the worker's preference. Data entry of the paper forms was completed using TeleForm v8.2 software and stored in a Microsoft Access database. Data from Ortech was entered by the workers using the touch-screen interface. Data from the two sources was merged in Microsoft Access and imported into SAS for analysis.

Retest data was collected from a random subset of workers. A table of 50 random numbers was generated in SAS for the first 100 workers recruited in the study and used to identify those who would be asked to participate in the retest portion of the study. Retest subjects were provided a copy of the FABQ and a single-item indicator of change (five response categories, 3 = no change) which asked if the worker's concerns about how pain was affecting them, their work and their physical activity had changed in the past 2 weeks. Workers were instructed to mail their response back in 2 weeks in a stamped envelope that was provided. If the response had not been received at the end of 3 weeks, the research team contacted participants by phone to remind them to mail back their response and to offer replacement questionnaires. Forty-nine workers mailed back a retest questionnaire, though only 48 had completed the FABQ at baseline. Workers who had both baseline and retest data were included in the retest analysis.

Statistical Analysis

Sample Description

Univariate analyses and frequency distributions were used to describe the demographic features of the sample as well as the core measures used in the analysis. Significance was set at $P < 0.05$. SAS 8e was used for all analysis. Workers' self-reported occupational backgrounds were classified according to the National Occupational Classification Matrix [36].

Fear Avoidance Beliefs Questionnaire Descriptive Statistics

Item (frequency of responses, missing data, item to total correlations) and scale (mean, median, floor, ceiling) level description was done for FABQ-W and FABQ-PA. The Wilk Shapiro statistic was used to evaluate the normality of the FABQ subscale scores with $P > 0.05$ indicating agreement with the null hypothesis of normality. Floor and ceiling effects were considered to be present if >15% of the sample had the maximum/minimum possible score for the FABQ-W and FABQ-PA [23, 24].

Reliability of the FABQ

Internal Consistency

The internal consistency was measured using Cronbach's alpha, seeking ≥0.9 [23–25] for subscale scores. Test–Retest reliability was measured from data collected on a random subset of the sample. Testing was performed on subscale scores using the intraclass correlation coefficient (ICC(2,1)) INTRACC macro in SAS, which is based on the methodology of Shrout and Fleiss [37]; we sought an ICC of >0.90 [23–25]. Test–Retest reliability was assessed on the subset of the sample submitting retest data ($n = 48$) and then again specifically on those who said they were stable on the single indicator of change ($n = 23$). The Minimal Detectable Change (MDC_{95}) was calculated for both the FABQ-W and FABQ-PA.

Construct Validity

Several theories were proposed to evaluate construct validity. Concurrent validity was assessed using Spearman rank correlations (r_s) as many of the constructs were not normally distributed. We interpreted the correlations as reflecting an excellent relationship, $r_s \geq 0.8$; good, r_s 0.6–0.79; moderate, r_s 0.4–0.59; low, $r_s \leq 0.39$. We set a priori expectations for the correlations between FABQ-W

and FABQ-PA with related constructs including *Pain intensity* (a priori: $r_s > 0.4$) using the SPADI pain subscale [29, 30], and Von Korff Chronic Pain Grade [31]; *Physical function* (a priori: $r_s > 0.6$) using QuickDASH [32], *Mental health* (a priori: $r_s > -0.4$) using the Mental Health (sf-MH) and Role-Emotional (sf-RE) Scales and the Mental Health Summary Measure (MCS) of the SF-36 [33]. A priori expectations for work constructs included the self-reported *number of days off work* (a priori: $r_s > 0.4$); *current work status* (a priori: those who have not returned to work will exhibit more FAB); and *amount of job instability* (a priori: $r_s > 0.4$) using the WIS. Finally the *difficulty performing tasks at work* was assessed using the Work module from the QuickDASH (a priori: $r_s > 0.4$). The WIS and Work module of QuickDASH were only available in those who were working at the time of assessment.

Results

Sample Description

Two hundred and fifteen workers attending the WSIB Shoulder and Elbow Specialty Clinic were invited into the study and completed the questionnaire. Twelve did not sign the required consent form and were therefore excluded from analysis. Sixteen workers did not complete the Upper Extremity Workers' Survey: five could not complete the survey in English, four were attending the clinic for a reassessment and thus did not complete the UEWS which is only collected during a worker's first clinic visit, three were unable to complete the survey due to pain or the nature of their injury, and four did not complete the survey for other reasons, leaving 187 workers available for analysis. Forty-eight workers completed both a baseline and retest FABQ questionnaire.

The mean age of the workers was 45.2 years, 54.2% were male, and 56.0% reported having performed some paid work in the past month. Workers came from a variety of occupational backgrounds, with 40.7% representing jobs from Trades, Transport and Equipment Operators and Related Occupations, 18.0% from Sales and Service Occupations, and 16.7% from Occupations Unique to Primary Industry and to Processing, Manufacturing and Utilities. In terms of their overall general health, 79.9% of workers self-reported themselves to be at least good (SF-36); mean PCS/MCS scores were 38.5/43.1. Physical function, as measured by the *Quick*DASH, had a mean score of 59.18; the Interquartile Range (IQR) for this sample was 45.45–75.0, representing moderate to high disability. Details of the demographic characteristics of the workers are shown in Table 2.

Fear Avoidance Beliefs Questionnaire Descriptive Statistics

Item distribution, missing items, and item to total correlations are presented in Table 3. Many responses were found in the 'completely agree' column, particularly for FABQ-W subscale and the first two items in the FABQ-PA subscale, which led to low variance and low item to total correlations. The two questions that had the highest number of missing responses were "I do not think that I will be back to my normal work within 3 months" and "I do not think that I will ever be able to go back to that work". Item to subscale correlations were higher for FABQ-PA (0.49–0.66, median 0.61) than FABQ-W (0.10–0.68, median 0.54).

The subscale scores follow a similar pattern except for one item "I do not think that I will be back to my normal work within 3 months", the mode and median responses scored at the ceiling (completely agree) for all items in FABQ-W, and were only slightly lower for FABQ-PA. The mean FABQ-W was 35.2/42 and mean FABQ-PA was 20.3/24. Both subscales had a Shapiro–Wilk P value of <0.05, representing a non-normal distribution. Both subscales had a high ceiling effect with FABQ-W having 22.9% of respondents scoring 42/42, and the FABQ-PA having 38.3% scoring 24/24. Neither scale had a single respondent scoring at the floor. Subscale score distributions are presented in Fig. 1a (FABQ-W) and Fig. 1b (FABQ-PA).

Reliability

Internal Consistency

Cronbach's α for both the FABQ-W and FABQ-PA were lower than our a priori threshold ($\alpha = 0.90$). Test–retest analysis as measured by an intraclass correlation coefficient for FABQ-W was 0.52 and for FABQ-PA was 0.59. Workers who participated in the retest portion of the study also completed a change in their concern about their condition question. Two workers (4.26%) reported being less concerned about their pain and its affect on their work and ability to perform physical activities on our global indicator of change, 23 (48.94%) reported feeling about the same as when they completed the FABQ at baseline, and 22 (46.80%) reported increased concern about their injury (note, one worker did not answer the change question). Of the 23 (48.94%) who reported no change in their level of

Table 2 Sample description

	Full sample $n = 187$	Sample participating in retest $n = 48$
Gender		
Men	$n = 97$ (54.2%)	46.3%
Women	$n = 82$ (45.8%)	(53.7%)
Missing	$n = 8$	$n = 7$
Mean age (range, standard deviation)	45.2 (20–65, 9.7)	45.9 (25–64, 9.6)
Missing	$n = 8$	$n = 7$
Occupational background		
Business, finance, and administrative	10.7%	
Natural and applied sciences	3.3%	
Health occupations	7.3%	
Social sciences/art/culture	3.3%	
Sales and service	18.0%	
Trades, transport and equipment operators	40.7%	
Primary industry/processing and manufacturing	16.7%	
Missing[a]	$n = 37$	
General health (self-reported)		
Excellent	17 (10.1%)	10 (43.5%)
Very good	48 (28.4%)	7 (30.4%)
Good	70 (41.4%)	3 (13.0%)
Fair	19 (11.2%)	2 (8.7%)
Poor	15 (8.9%)	1 (4.4%)
Missing	$n = 18$	$n = 11$
Mean PCS (standard deviation)	38.5 (6.7)	43.1 (5.9)
Mean MCS (standard deviation)	39.8 (13.6)	40.0 (13.3)
Self-reported presence of co-morbid conditions	101 (54.0%)	23 (47.9%)
Of the 54% reported co-morbid conditions:		
19% reported back pain		
12% reported high blood pressure		
12% reported depression		
Physical function		
Mean *Quick*DASH score (range, standard deviation)	59.18 (4.54–100,19.72)	54.86 (18.18–90.91,19.87)
Missing	$n = 18$	$n = 11$
Working status		
Working in some capacity (includes regular duties/hours, modified (light) duties, reduced hours)	56.0%	62.9%
Not Currently Working	44.0%	37.1%
Missing	$n = 19$	$n = 13$
Fear avoidance beliefs questionnaire		
FABQ-W (mean, standard deviation)	35.2 (6.7)	35.36 (6.6)
Missing	$n = 12$	$n = 3$
FABQ-PA (mean, standard deviation)	20.3 (4.4)	19.66 (5.1)
Missing	$n = 7$	$n = 1$

[a] Includes those whose self-described occupation was too broad to link to the NOC Matrix

concern related to their pain and its affect on their work and ability to perform physical activities, test–retest analysis as measured by an intraclass correlation coefficient for FABQ-W was 0.55 and FABQ-PA was 0.69 which was still lower than desired, but indicating more stability in the scores when compared to the whole follow-up sample. However, the MDC_{95} for the FABQ subscales were calculated to be FABQ-W = 13 and FABQ-PA = 8 which represent change scores equivalent to 30–33% of the scale length (see Fig. 2).

Construct Validity

Validity results are summarized in Table 4. Of our 22 a priori theories of how a "good" measure of fear avoidance should behave, only six were confirmed. As found by Waddell, there was no correlation between FABQ-W/FABQ-PA and age ($r = -0.05/r = 0.01$) [3]. Lower than anticipated correlations were found between FABQ-W/FABQ-PA and *Pain intensity* (*SPADI* $r_s = 0.24/0.23$; *Von Korff* $r_s = 0.25/0.25$), *Physical function* (*Quick*DASH $r_s = 0.48/0.45$) and indices of *Mental health* (sf-MH $r_s = -0.18/-0.23$; sf-RE $r_s = -0.33/-0.26$; MCS $r_s = -0.25/-0.30$). Lower than anticipated correlations were also found between FABQ-W/FABQ-PA and the *number of days off work* ($r_s = 0.31/0.17$). However, some *work-related* constructs had anticipated correlations to the FABQ-W/FABQ-PA in terms of *current work status* (Wicoxon Rank Sum $Z = 3.0497$), the *amount of job instability* the worker perceived (WIS

Table 3 Univariate Description of FABQ

FABQ item	Missing	Response: 0 = completely disagree, 6=completely agree							Mean (0–6)	Item-to- total correlation
		0	1	2	3	4	5	6		
FABQ-W										
6. My pain was caused by my work or an accident at work	1	0	0	0	3	1	2	180	5.9	0.10
7. My work aggravated my pain	3	4	0	0	11	4	11	154	5.6	0.30
9. My work is too heavy for me	3	11	7	5	33	18	16	94	4.5	0.54
10. My work makes or would make my pain worse	2	3	1	5	19	16	14	127	5.2	0.68
11. My work might harm my [shoulder and/or elbow]	3	2	2	5	19	18	19	119	5.2	0.64
12. I should not do my normal work with my present pain	2	5	4	4	25	15	10	122	5.0	0.65
15. I do not think that I will be back to my normal work within 3 months	7	22	6	1	74	10	5	62	3.7	0.40
FABQ-PA										
2. Physical activity makes my pain worse	3	1	1	0	10	14	11	147	5.6	0.49
3. Physical activity might harm my [shoulder and/or elbow]	2	0	0	2	29	15	18	121	5.2	0.58
4. I should not do physical activities which (might) make my pain worse	4	4	4	4	30	19	23	99	4.8	0.63
5. I cannot do physical activities which (might) make my pain worse	2	9	7	6	22	15	29	97	4.7	0.66
Items not included in a sub-scale										
1. My pain was caused by physical activity	6	15	1	0	11	5	8	141	5.9	N/A
8. I have a claim for compensation for my pain	6	5	0	0	9	0	1	166	5.7	N/A
13. I cannot do my normal work with my present pain	4	13	4	6	9	10	15	126	5.0	N/A
14. I cannot do my normal work till my pain is treated	4	14	5	7	17	10	17	113	4.8	N/A
16. I do not think that I will ever be able to go back to that work	8	51	12	7	72	5	0	32	2.5	N/A

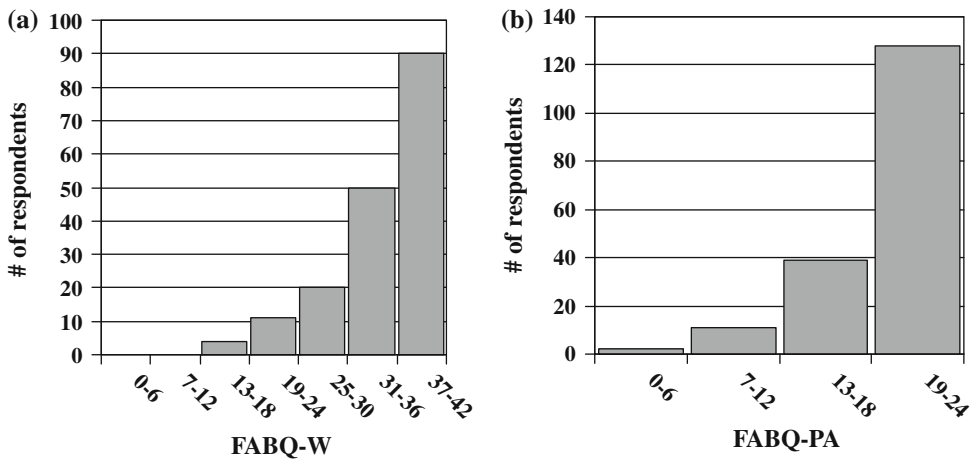
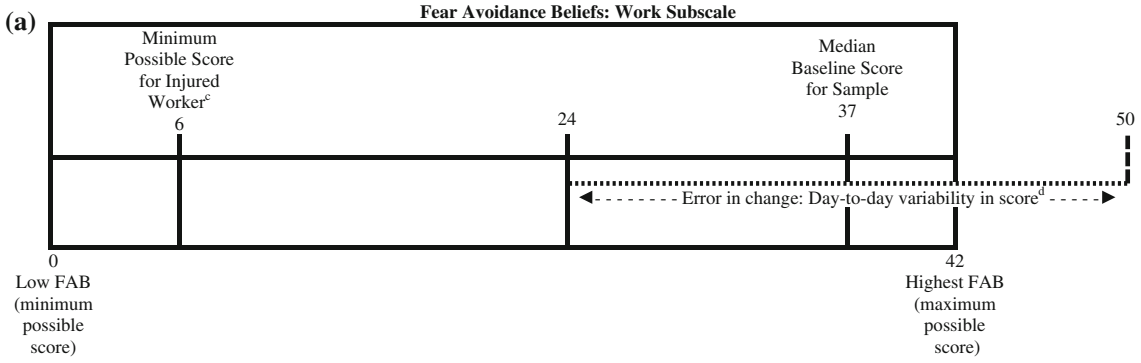


Fig. 1 **a**, **b** FABQ subscale score distributions

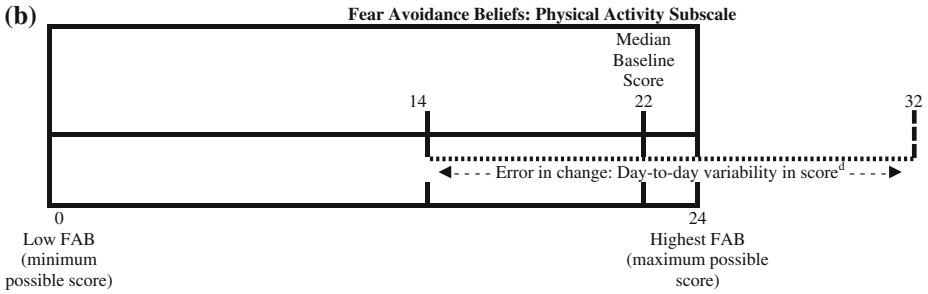
$r_s = 0.46/0.38$), and the amount of *difficulty performing tasks at work* the worker reported (*Quick*DASH, optional work module $r_s = 0.51/0.42$).

Discussion

High ceiling effects and lower than expected reliability and validity correlations result in our inability to confirm the reliability and validity of the Fear Avoidance Beliefs Questionnaire in our population. We studied injured workers with upper extremity musculoskeletal disorders within a workers' compensation system. We were interested in the FABQ because it has been widely used in rehabilitation clinics and studies with the chronic low back pain population, and has been frequently supported as a screen for patients at risk of poor outcomes related to fear avoidance beliefs [6, 10, 38]. Clinicians in our own clinic have observed 'fear avoidant' behaviours and beliefs and were eager to have an instrument to capture this. This concept remains, in their minds, a key predictor of outcomes after clinic



[c] Item 6 of the FABQ-W, "my pain was caused by work or by an accident at work," was scored as "strongly agree"=6 by 180/187 compensated workers in this sample.



[d] Any follow-up score falling within this range would be indistinguishable from "no change" or day-to-day variability in score.

Fig. 2 FABQ minimal detectable change @ 95%

attendance and an indicator of the need for cognitive behavioural intervention. The results of our survey unfortunately suggest the FABQ is not the correct instrument in this setting.

Although the FABQ has been used in other groups of injured workers [11], including those receiving workers' compensation benefits [10, 12, 15], the mean FABQ-W and FABQ-PA scores are higher in our study's population, and displayed higher significant ceiling effects [39] than was reported in these studies. The ceiling effect we observed could be explained by the content of the individual items in a workers' compensation context. For instance, an injured worker can only respond "strongly agree" to item 6 of the FABQ-W subscale "my pain was caused by work or by an accident at work" (item 6, FABQ-W) (see Fig. 2). This leads us to question whether the FABQ is measuring fear avoidance beliefs in this group, or the status of their claim. George found higher FAB scores in WCB patients than other payer sources, however they did not report ceiling effects at an item or scale level [12]. Cleland found WCB patients reported higher scores for the FABQ-W, but not for FABQ-PA when compared to patients from a private insurance group [10]. McHorney says a sample with >15% at the ceiling is concerning for both detecting change and distribution of error [24]. As has been previously suggested [40], simply changing the wording of the two questions in the FABQ may not be adequate to capture FAB in patients with shoulder and elbow disorders.

Furthermore, this study found a lower than desired Cronbach's alpha for reliability analysis in individual data, and a test–retest reliability that is lower than recommended for discriminative purposes [23]. FABQ-W was lower than Waddell's original findings ($\alpha = 0.75$ vs. $\alpha = 0.88$), and FABQ-PA was similar to Waddell's findings ($\alpha = 0.78$ vs. $\alpha = 0.77$) [3]. Test–retest analysis was complicated by the large number of people who reported increased concern during the retest questionnaire. This was likely due to the clinic setting in which this study was performed. The nature of the clinical assessment at the WSIB Specialty Clinic is to determine what, if any, further clinical investigations/interventions (including surgery) might benefit an injured worker. Workers were given these clinical interpretations between baseline and completing the retest questionnaire. However, even when considering only those who reported no change in concern, the reliability coefficients are still lower than desired. The MDC for the FABQ-W in this sample was 13, as was previously reported, however the MDC for FABQ-PA in this sample was lower than previously reported (8 vs. 9) [19]. However these results for the MDC are still very large, requiring an individual to go from 100% FAB to almost none before change can be detected.

Table 4 Construct validity

Construct	Hypothesis	Rationale	Results	Hypothesis confirmed?
Age	No correlation between age and FABQ subscales	Consistent with Waddell's findings [3]	FABQ-W $r_s = -0.05$, $P = 0.50$	Yes
			FABQ-PA $r_s = 0.01$, $P = 0.87$	
Pain intensity/ severity	SPADI pain subscale >0.4	Consistent with literature [4, 11, 21, 22, 50]	FABQ-W $r_s = 0.24$, $P = 0.0016$	No
			FABQ-PA $r_s = 0.23$, $P = 0.003$	
	Von Korff pain intensity scale >0.4		FABQ-W $r_s = 0.25$, $P = 0.0015$	No
			FABQ-PA $r_s = 0.25$, $P = 0.001$	
Physical function/ disability	QuickDASH >0.6	Consistent with literature [21, 22]	FABQ-W $r_s = 0.48$, $P = <0.0001$	No
			FABQ-PA $r_s = 0.45$, $P = <0.0001$	
Mental health	sf-MH >−0.4	Those living with significant mental health issues may experience greater FAB	FABQ-W $r_s = -0.18$, $P = 0.03$	No
			FABQ-PA $r_s = -0.23$, $P = 0.003$	
	sf-RE >−0.4	Those experiencing more difficulty performing daily activities as a result of emotional problems may also have higher FAB	FABQ-W $r_s = -0.33$, $P = <0.0001$	No
			FABQ-PA $r_s = -0.26$, $P = 0.001$	
	MCS >−0.4	Consistent with literature [22]	FABQ-W $r_s = -0.25$, $P = 0.0022$	No
			FABQ-PA $r_s = -0.30$, $P = 0.0002$	
Work related	# of days off work >0.4	Increase in length of time off work may indicate higher FAB	FABQ-W $r_s = 0.31$, $P = <0.0001$	No
			FABQ-PA $r_s = 0.17$, $P = 0.02$	
	Current work status	Those who have not been able to return to work in some capacity may have higher FAB	Wicoxon rank sum	FABQ-W
			FABQ-W $Z = 3.0497$, $P = 0.0027$	Yes
			FABQ-PA $Z = 1.545$, $P = 0.1223$	FABQ-PA No
	WIS >0.40	Those experiencing more work instability may have higher FAB	FABQ-W $r_s = 0.46$, $P = <0.0001$	FABQ-W Yes
			FABQ-PA $r_s = 0.38$, $P = 0.0002$	FABQ-PA No
	DASH work module >0.40	Those with more at-work disability may have higher FAB	FABQ-W $r_s = 0.51$, $P = <0.0001$	Yes
			FABQ-PA $r_s = 0.42$, $P = <0.0001$	

The FABQ subscales are somewhat supported by concurrent construct validity analysis, though this must be considered in light of the low reliability. Correlations between constructs of *pain intensity*, *physical function* and indices *mental health* were lower than anticipated in this study. Previous studies have found more significant relationships between the FABQ sub-scales and pain intensity [4, 11, 21, 22], disability [3, 4, 21], and indices of mental health [3, 21]. Construct validity of the FABQ-W was better supported by work-related constructs such as work instability (WIS) and work disability (*Quick*DASH-W).

Strengths

This study had a good sample size and excellent response rate for the retest portion of the study (48/50). This study

was also unique in its attempt to repeat the measure in a new population, and is one of a few studies that have fielded the FABQ in an exclusively compensated injured workers' sample.

Limitations

This study did not field a broad range of tools related to FAB. The FABQ may have better insight if compared to constructs such as catastrophizing and active coping. Instead, fear avoidance was measured by an indication of concern, which seemed unstable in this population; perhaps due to the treatment recommendations made during the clinic visit (surgical interventions, job retraining, and return to work). We do not know if the high levels of FAB are 'true' or are an artefact created by this scale, though our clinical team did not believe the prevalence of FAB to be this high, particularly since more than half (56.0%) of the sample were working at the time of the study. Recognizing that even within various occupational fields there is a range of physical demands, future studies should include a more in depth exploration of the physicality of workers' jobs to see if these impact FAB.

As our study only included compensated upper extremity injured workers, our findings cannot be generalized outside other such samples.

Conclusions

All research is dependent on the ability to measure our key variables. Our team is committed to the need to measure FAB in long-term compensated upper extremity injured workers. Our study has raised concerns about the ability of the FABQ to meet this need; concerns that we believe need to be addressed in a study comparing this measure with other FAB instruments and other psychometric instruments. The current study indicates that the FABQ does not meet statistical standards for individual use as a screen in a population of upper extremity injured workers.

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