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Original experimental

Developing a model for measuring fear of pain in Norwegian samples: The Fear of Pain Questionnaire Norway

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HIGHLIGHTS

- A model for measurement of FOP in Norwegian samples is built and validated.
- The FPQ-NOR had better model fit than FPQ-III and FPQ-SF.
- FPQ-NOR is sex neutral.
- Cultural variations in FOP stress the need to explore FOP models in given country.
- Explorative analysis is important when applying FOP in new samples.

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ABSTRACT

Background: Fear of pain is highly correlated with pain report and physiological measures of arousal when pain is inflicted. The Fear of Pain Questionnaire III (FPQ-III) and The Fear of Pain Questionnaire Short Form (FPQ-SF) are self-report inventories developed for assessment of fear of pain (FOP). A previous study assessed the fit of the FPQ-III and the FPQ-SF in a Norwegian non-clinical sample and proved poor fit of both models. This inspired the idea of testing the possibility of a Norwegian FOP-model.
Aims and methods: A Norwegian FOP-model was examined by Exploratory Factor Analysis (EFA) in a sample of 1112 healthy volunteers. Then, the model fit of the FPQ-III, FPQ-SF and the Norwegian FOP-model (FPQ-NOR) were compared by Confirmatory Factor Analysis (CFA). Sex neutrality was explored by examining model fit, validity and reliability of the 3 models amongst male and female subgroups.
Results: The EFA suggested either a 4-, a 5- or a 6-factor Norwegian FOP model. The eigenvalue criterion supported the suggested 6-factor model, which also explained most of the variance and was most interpretable. A CFA confirmed that the 6-factor model was better than the two 4- and 5-factor models. Furthermore, the CFA used to test the fit of the FPQ-NOR, the FPQ-III and the FPQ-SF showed that the FPQ-NOR had the best fit of the 3 models, both in the whole sample and in sex sub-groups.
Conclusion: A 6-factor model for explaining and measuring FOP in Norwegian samples was identified and termed the FPQ-NOR. This new model constituted six factors and 27 items, conceptualized as Minor, Severe, Injection, Fracture, Dental, and Cut Pain. The FPQ-NOR had the best fit overall and in male- and female subgroups, probably due to cross-cultural differences in FOP.
Implications: This study highlights the importance on exploratory analysis of FOP-instruments when applied to different countries or cultures. As the FPQ-III is widely used in both research and clinical settings, it is important to ensure that the models construct validity is high. Country specific validation of FOP in both clinical and non-clinical samples is recommended.

1. Introduction

Measuring fear of pain (FOP) is challenging due to the multi-faceted and subjective nature of both fear and pain. Developing measurement inventories applicable across sex and cultures is

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demanding due to psychosocial and cultural differences that can influence the understanding of and responses to FOP-items. This issue has shown to be salient in the cross-cultural application of the Fear of Pain Questionnaire III (FPQ-III) [1–7]. The current study therefore sought to test if revising current FOP-models could help explain FOP in the Norwegian population better than the existing FPQ-III and FPQ-SF.

The FPQ-III was developed by McNeil and Rainwater [2]. The questionnaire has become widely used, but studies show varying levels of validity and consistency. The Fear of Pain Questionnaire Short Form (FPQ-SF) was more recently suggested by Asmundson and colleagues [8], as an alternative and sex neutral questionnaire for FOP-measurements. The FPQ-SF has received little attention, and thus, little knowledge about the scale's reliability and validity exist. In a recent study the FPQ-III and the FPQ-SF were compared [6]. The data were derived from a Norwegian sample of healthy volunteers, and the results revealed that none of the models had good fit. However, the FPQ-SF had a better fit overall, compared to the FPQ-III. Comparison of the two models' applicability across sex revealed that the FPQ-III had a better fit for males, whereas the FPQ-SF had a better fit for females. Thus, questioning the two models' sex neutrality. Invariance across sex is recommended for optimizing measurement inventories [8]. The present study therefore aimed to: a) test the possibility of a Norwegian FOP-model (FPQ-NOR), b) compare the FPQ-NOR against the FPQ-III and the FPQ-SF, and c) evaluate the three models' fit amongst male and female subgroups. We hypothesized that the FPQ-Norway would have the best overall fit and display most sex neutrality amongst the three models. Furthermore, we hypothesized that the FPQ-SF would display more sex neutrality than the FPQ-III.

2. Methods

2.1. Participants

In total 1112 healthy respondents were included in this study (485 males, 18–40 years (M_{age} = 23.5, SD = 4.1) and 627 females, 18–40 years (M_{age} = 22.3, SD = 3.6). The subjects were screened for medical history of serious diseases or injuries prior to inclusion. Somatic and psychiatric disorders, medication use and pregnancy led to exclusion. The respondents had to speak Norwegian due to use of Norwegian questionnaires, instructions and consent form. Data from 10 different study-samples were pooled. All participants filled in the FPQ-III and an informed consent form. The studies were approved by the Regional Committee for Medical Research Ethics North Norway (project numbers: 2013/966; 2012/1888; 2610.00001; 49/2005; 5.2006.2452; 20277; 17/2006; 30/2008; 31/2008).

SPSS version 24 was used to randomly divide the whole sample into two samples by random split, in preparation of the factor analysis. Sample 1 included 570 participants [255 males, 18–40 years (M_{age} = 23.3; SD = 4.0) and 315 females, 18–40 years (M_{age} = 22.2; SD = 3.7)], and this sub-sample was applied in the EFA. Sample 2 included 542 participants [230 males, 18–40 years (M_{age} = 23.8; SD = 4.3) and 312 females, 18–40 years (M_{age} = 22.4; SD = 3.4)], and this sub-sample provided an independent sample for confirming proposed factor structures revealed by the EFA as well as testing the model fit of the newly developed FPQ-NOR, the FPQ-III and the FPQ-SF.

2.2. Measures

The Fear of Pain Questionnaire III assesses fear related to pain, and is used in both basic [9] and applied research [10]. The scale has 30 items, each presenting a situation involving pain. Responders score their FOP for each item on a 5-point Likert scale (1 = not afraid at all, 5 = extremely afraid). The FPQ-III has three factorially derived subscales: Severe pain (having a terminal illness that causes you daily pain), Minor pain (burning your fingers) and Medical pain (receiving an injection in your arm). Each of the subscales has 10 items. A Norwegian version of the FPQ-III, translated into Norwegian by Lyby and colleagues [9], was administered to the participants included in the present study.

The Fear of Pain Questionnaire Short Form is a revised version of the FPQ-III, reduced to 20 items, and extended to 4 subscales: Severe, Minor, Injection (having an injection in the hip) and Dental pain (having a tooth drilled). The Severe pain subscale has 6 items, the Minor pain subscale has 8 items, and the Injection and Dental pain subscales both have 3 items. Similarly to the FPQ-III, scores on the FPQ-SF are indicated on a 5-point Likert scale.

2.3. Procedure

Responders were undergraduate students recruited from the University of Tromsø, The Arctic University of Norway, UiT. Responders had all participated in various pain studies and filled in the FPQ-III and a written informed consent form as part of the experimental procedure, prior to pain testing. Pain data obtained from the experiments are published elsewhere [9,11–16].

2.4. Statistical analyses

EFA was performed using SPSS version 24. CFA was performed using AMOS 21. Sample 1 was applied in the EFA. Sample 2 was applied in the CFA. EFA with Direct oblim (oblique) rotation was used to explore the Norwegian FOP model. CFA (maximum likelihood estimation) were applied to confirm the model revealed in the EFA and test the fit of the FPQ-III, FOP-SF and the Norwegian FOP model. Furthermore, CFA was also applied to test the fit among male and female sub-groups in Sample 2. The fit of these models was evaluated by the χ^2/degrees of freedom ratio, the root mean square error of approximation (RMSEA), the goodness-of-fit index (GFI), and the comparative fit index (CFI). Traditionally, a good fit model should have 2:1 or 5:1 χ^2/degrees of freedom ratio, GFI > .90, CFI > .90 (preferably > .95), and RMSEA < .08 or .10 (preferably < .05) indices [17,18]. Lastly, Cronbach's alpha values for the factors in the Norwegian FOP model were calculated, as well as the correlation between sum-scores of factors in the Norwegian FOP model.

3. Results

3.1. Factor structure in the Norwegian sample

Direct oblimin (oblique) rotation was used since the correlation between the factors ranged from 0.150 to 0.486. The Kaiser-Meyer-Olkin measure verified that the sample was adequate for the analysis (.886). Bartlett's test of sphericity $x^2(435) = 6975.157$, $P > .001$ indicated that the correlations between the FPQ items were sufficiently high for an EFA. Initial factor structure was assessed with eigenvalues > 1 and Catell's scree test. The screeplot was slightly ambiguous and revealed either a 4-, a 5- or a 6-factor Norwegian FOP model. Eigenvalue > 1 supported the 6-factor model, however a Parallel Analysis supported the 4-factor model. The 6-factor structure was found most interpretable, however to confirm the model, a CFA on Sample 2 was performed to test model fit of the 4-, the 5- and the 6-factor models. The 6-factor model had the best fit (6-factor: χ^2/df = 692.178/194, GFI = .898, CFI = .887, RMSEA = .069 (.063–.074), ECVI = 1.498 (1.356–1.653); 5-factor: χ^2/df = 1509.34/340, GFI = .826, CFI = .790, RMSEA = .080 (.076–.084), ECVI = 3.034 (2.818–3.263); 4-factor: χ^2/df = 1168.055/293, GFI = .854, CFI = .830, RMSEA = .074

(.070–.079), ECVI = 2.373 (2.186–2.575). Thus, neither the 3-factor structure of the FPQ-III nor the 4-factor structure of the FPQ-SF was supported by the EFA. The 6-factor model explained 56.86% of the variance. Loadings less than 0.3 were omitted for the sake of clarity. This resulted in removal of item 7 (hitting the elbow), 20 (stitches in the lip) and 27 (vomiting after food poisoning). Factor loadings of the 6-factor structure are displayed in Table 1. Items loading on the same factor constitute six different factors, conceptualized as Minor, Severe, Injection, Fracture, Dental, and Cut Pain.

3.2. Inter-correlations and reliability analysis of the Norwegian FOP model

Inter-correlations and alpha values of the factors can be seen in Table 2. All correlations were significant at the 0.01 level. The correlation between the Minor factor and the Cut factor were higher than between any of the other factors (−.552). Fracture and Severe also had a high correlation (−.539). The lowest correlation was between Injection and Severe, Fracture and Injection, and Fracture and Dental. All factors had acceptably high alpha values, >0.7 [19], showing good internal consistency. Alpha values are affected by the number of items in a factor [19]. However, the Fracture factor with only two items still showed the highest internal consistency, whereas the Minor and Dental factors had the lowest internal consistency (see Table 2). The alpha values of the Minor, – the Dental, – and the Cut factors are slightly below the alpha values of the factors in the two previous studies. McNeil and colleagues [2] lowest alpha value was 0.87, Asmundson and colleagues [8] lowest alpha value was 0.83 and the lowest alpha value in the present study was 0.719.

Table 1
Factor structure and loadings of the FPQ items.

FPQ items	Factors					
	M	S	I	F	D	C
24 soap in the eyes	.764					
22 shaving cut	.514					
23 hot drink	.510					
21 remove foot wart	.484					
12 burn fingers	.464					
15 remove splinter in foot	.457					
28 sand eyes	.429					
30 muscle cramp	.381					
13 break neck		.743				
1 car accident		.633				
25 terminal illness		.625				
5 heavy object in the head		.614				
10 fall down stairs		.565				
9 slam car door on the hand		.454				
16 remove particle from eye		.323				
18 face burned by cigarette		.306				
11 injection arm			.906			
14 injection hip			.771			
8 blood sample			.760			
3 break arm				−.851		
6 break leg				−.787		
29 tooth drilled					−.756	
26 tooth pulled					−.711	
17 injection mouth					−.306	
4 cut tongue on an envelope						−.900
19 paper-cut on a finger						−.572
2 bite the tongue						−.437

Note. Principal axis factoring, rotation method: Oblimin with Kaiser Normalization. Loadings lower than .03 were omitted for the for the sake of clarity. M = minor, S = severe, I = injection, F = fracture, D = dental, C = cut.

Table 2
Inter-correlations and alpha values.

M	S	I	F	D	C	Alpha values
1.000						.793
.401**	1.000					.806
.344**	.167**	1.000				.847
−.284**	.539**	.138**	1.000			.914
.441**	.294**	.495**	.192**	1.000		.719
.552**	.325**	.214**	.358**	.351**	1.000	.759
						.887 (whole scale)

Note. M = minor, S = severe, I = injection, F = fracture, D = dental, C = cut, ** = .01.

3.3. Fit of the three models

CFA was conducted to test the fit of the FPQ-III model, the FPQ-SF and the Norwegian 6-factor model revealed in the EFA. The factor structures respectively showed three, four and six factors that inter-correlated to explain FOP. No items loaded on more than one factor. Traditionally, a good fit model should have 2:1 or 5:1 χ^2/degrees of freedom ratio, RMSEA < .08 or .10 (preferably < .05), GFI > .90, ECVI-lower values indicate a closer fit, and CFI > .90 (preferably > .95) indices [17,18,20]. The goodness of fit indices suggests satisfactory, but not perfect fit for the Norwegian 6-factor model in the whole sample (6-factor model; χ^2/df 692.178/194, RMSEA = .069 (.063–.074), GFI = .898, ECVI = 1.498 (1.356–1.653), CFI = .887, see Table 3). However lower fit for the FPQ-III and the FPQ-SF, with a slightly better fit for the FPQ-SF (FPQ-3: χ^2/df = 2143.934/402; RMSEA = .089 (.086–.093), GFI = .782, EVCI = 4.196 (3.3935–4.471), CFI = .702; FPQ-SF: χ^2/df = 858.591/164, GFI = .860, RMSEA = .088 (.083–.094), ECVI = 1.757 (1.595–1.934), CFI = .822; see Table 3). Furthermore, the three models were applied to the data consisting of subgroups of sex (see Table 3). Results suggest that the 6-factor model had the best fit of the three models among both males and females. The FPQ-III was generally less fitting than the two other factor models. All models had better fit among females than males.

4. Discussion

The investigation into the possibility of a Norwegian FOP-model was spurred by previous findings that showed poor fit of the FPQ-III [1,6,21] and the FPQ-SF [6]. EFA disclosed either a 4-, a 5-, or a 6-factor model. Eigenvalue > 1 supported the 6-factor model. Although the Parallel Analysis supported the 4-factor model, the subsequent CFAs confirmed the 6-factor model. Removal of items loading below the predefined criteria resulted in a highly interpretable 6-factor model. The six emerging factors were Minor, Severe, Fracture, Cut, Dental and Injection Pain. This new model, referred to as the FPQ-NOR, was the most suited model for explaining and measuring FOP in this Norwegian sample.

The CFAs used to compare the FPQ-III and the FPQ-SF to the newly developed FPQ-NOR revealed that the FPQ-NOR had a better fit than the previously developed FPQ-III and the FPQ-SF. This was evident when fit indices were examined overall and across male and female sub-groups. The results suggest that FOP may differ across cultures and therefore highlight the importance of validation of FOP-measures.

4.1. Model structure in the FPQ-NOR, the FPQ-III and the FPQ-SF

The FPQ-NOR included 27 items loading on 6 different factors: Minor, Severe, Injection, Dental, Fracture, and Cut. McNeil and Rainwater [2] and Asmundson et al. [8] used a cut-off point of 0.50. A cut-off of 0.50 was considered too high for the present study as it resulted in many removed items, low interpretability [23–25] and a different factorial solution than presented by McNeil and Rainwater [2] and Amundson et al. [8]. The 3-factor structure identified by McNeil and Rainwater [2] included Minor, Severe and Medical Pain.

Table 3
Fit indexes from CFA for all three models.

	3 factors					*4 factors*					*6 factors*				
	χ^2 (df)	GFI	RMSEA (CI)	EVCI (CI)	CFI	χ^2 (df)	GFI	RMSEA (CI)	EVCI (CI)	CFI	χ^2 (df)	GFI	RMSEA (CI)	EVCI (CI)	CFI
Sample 2 (n = 542)	2143.93 (402)	.782	0.089 (0.086–0.093)	4.196 (3.935–4.471)	.702	858.59 (164)	.860	0.088 (0.083–0.094)	1.757 (1.595–1.934)	.822	692.17 (194)	.898	0.069 (0.063–0.074)	1.498 (1.35–1.65)	.887
Sex															
Males (n = 230)	1259.11 (4020)	.726	0.096 (0.090–0.103)	6.049 (5.598–6.533)	.683	538.40 (164)	.815	0.100 (.091–.109)	2.753 (2.462–3.077)	.792	472.21 (194)	.853	0.079 (0.070–0.088)	2.577 (2.23 –2.28)	.853
Females (n = 312)	1500.72 (402)	.748	0.094 (0.089–0.099)	5.231 (4.861–5.624)	.664	535.28 (164)	.850	0.85 (0.077–0.093)	2.017 (1.804–2.255)	.826	533.21 (194)	.868	0.075 (0.067–0.083)	2.094 (1.88–2.32)	.863

Note: Good model fit should have 2:1 or 5:1 χ^2/degrees of freedom ratio, RMSEA < .08 or .10 (preferably < .05), GFI > .90, ECVI-lower values indicate a closer fit, and CFI > .90 (preferably > .95).

Asmundson and colleagues [8] did not find a Medical Pain factor, but identified two new factors; Dental and Injection Pain.

Four of the previously identified FPQ-SF factors (Minor, Severe, Injection and Dental Pain) also appeared in the present study. Moreover, two new factors, conceptualized as Fracture Pain and Cut Pain, were uncovered. Both factors included items loading highly on FOP, respectively with high and acceptable high alpha values, comprising independent factors. Thus, there are some distinctions in model structure and number of items in the FPQ-III, the FPQ-SF and the FPQ-NOR. The most stable factor distinction seems to be between Minor and Severe pain. This might be expected, as pain in a broad sense is classified on an intensity dimension (i.e. the Visual Analogue Scale and Numerical Rating Scale), and this difference in pain should also be salient across cultures. However, the distinction between the other FOP-subscales is not very stable, as different underlying FOP structures seem to appear when applying the FPQ in different countries.

Differences between the three FOP models were also present on an item level. Item 16 (have an eye doctor remove a particle stuck in your eye) was included in the Severe Pain subscale in the FPQ-NOR. By contrast, the FPQ-III included item 16 on the Medical Pain subscale, whereas the FPQ-SF excluded item 16. Item 15 (have a deep splinter in the sole of your foot probed and removed with tweezers) and 21 (have a foot doctor remove a wart with a sharp instrument) were included in the Minor Pain subscale in the FPQ-NOR. Both these items were included in the Medical Pain subscale in the FPQ-III, while both items were removed in the FPQ-SF. Moreover, the Injection Pain subscale was identical in the FPQ-NOR and the FPQ-SF, while the FPQ-NOR Dental Pain subscale included two of the three items included in the FPQ-SF Dental Pain.

The items that load highest on a given factor can be termed core items. Core items are the items that explain the most of that specific factor. When comparing the FPQ-III the FPQ-SF and the FPQ-NOR, some differences between the models' core items were found. McNeil and Rainwater [2] and Asmundson et al. [8] showed different core items explaining the Minor and Severe Pain factor than the present study. McNeil and Rainwater [2] reported two items loading equally high. In that study, item 7 (hitting a sensitive bone in your elbow) and item 19 (paper-cut on a finger) were the highest loading items on the Minor Pain subscale. Asmundon et al. [8] partly replicated this finding by also reporting that item 19 was the core item on Minor Pain subscale. The present study did not support those findings, and showed that item 24 (soap in the eyes) and item 22 (shaving cut) were the core items. In fact, item 7 was one of the low loading items in the present analysis, and was therefore removed from the model. The core Minor Pain items were not included as a Minor Pain subscale item in the FPQ-III or the FPQ-SF.

Contrary to our findings, McNeil and Rainwater [2] and Asmundson et al. [8] identified the same core item on the Severe Pain subscale: item 6 (breaking your leg). We identified item 13 (breaking your neck) as the core Severe Pain subscale item. Actually, item 6 was not included in the FPQ-NOR Severe Pain subscale. In this model, item 6 constituted the newly conceptualized Fracture Pain subscale. However, the present study replicated Asmundson et al.'s [8] finding on the core items representing the Injection and the Dental Pain subscales. Thus, both model structure and the core items of the present findings had more similarities and were more supportive of the FPQ-SF model than the FPQ-III model. The FPQ-NOR is however a more detailed model than the FPQ-III and FPQ-SF, indicating that the Norwegian sample separates between more pain sub-categories than the Dutch, Canadian and American samples.

It should also be noted that the different results obtained in the present and previous analysis of FOP-data [2,8] may partly be due to different statistical approaches. Different factor extraction methods and rotation techniques may explain why different models of FOP emerge in the EFAs. McNeil and Rainwater [2] applied Principal

Component Analysis (PCA) with orthogonal rotation, whereas the present study and Asmundson et al. [8] applied Principal Factor Analysis (PFA) with oblique rotation. PCA and PFA use different factor extraction methods, and item loadings become higher in PCA than in PAF because of higher communality estimates [18]. However, the literature in the field of factor analysis generally recommends PAF over PCA [18,26,27]. PAF was therefore chosen for data analysis in the present study.

4.2. Fit of the three models to the data

The CFA showed that the FPQ-NOR had the highest fit to the data of the three models, while the FPQ-III had the lowest fit. These results confirm the necessity of investigating a possible Norwegian FOP-model, and the hypothesis that FOP might look slightly different in the Norwegian than in the Dutch, Canadian and American samples. Different combinations of sex- and cultural differences pose challenges for the utilization of one standardized measure of FOP, applicable across cultures. It is not surprising that different FOP models are found in different countries as pain and fear of pain are influenced by multiple factors, such as age, sex and gender role expectations [11,22,28]. The fact that the present 6-factor structure resembles previously obtained factor structures, but not completely confirms the need to apply explorative analysis when a FOP questionnaire is used. A country or population's factor structure may be a good indicator of what sort of fear of pain the population has. Therefore, this information may be useful e.g. when treatment programs or preventive interventions are designed. Future studies would benefit from cross-cultural comparison of fear of pain measures.

As mentioned above, different combinations of sex differences may pose challenges for utilization of one standardized measurement of FOP. For example, the finding that sex differences in pain and pain-related behavior is explained by psychosocial factors has been reported repeatedly [28,29]. Robinson and colleagues [28] found that both sexes thought males were less willing to report pain, and that males were less sensitive and more enduring of pain, than females. Thus, indicating that gender role expectations are a central contributor to sex differences in measurements of pain and pain-related phenomena, such as measurements of FOP. Others have reported sex differences in FOP, displayed by lower FOP in males than in females [1–6]. Thus, there are differences in male and female responses to pain and fear of pain, which might also be salient in FOP models for the sexes.

In the present study, there were small sex differences in model fit. The newly developed FPQ-NOR showed nearly similar fit for males and females. Thus, indicating that the FPQ-NOR explains FOP equally well in males and females. Sex differences in model fit of the FPQ-III have previously been found [6]. However, these findings were not replicated in the present study. Asmundson et al. [8] reported that the FPQ-SF showed invariance across sex, but in the present and one previous study [6], some sex differences were found when applying the FPQ-SF.

4.3. Limitations

All the subjects included in this study responded to the FPQ-III. This represents a potential methodological limitation, e.g. the possibility that other results would emerge if the FPQ-SF also had been administered. It is therefore recommended that future investigations include samples in which both questionnaires are administered. Additionally, as only healthy and young volunteers were included in the study, the findings may be generalizable to young non-clinical samples only. The present study was unable to examine differences across age due to the sample's homogeneity in age. Future studies could examine FOP across age groups to uncover potential differences caused by age.

4.4. Conclusions

This study proposes a 6-factor model for measurements of FOP in Norwegian samples, referred to as The Fear of Pain Questionnaire Norway (FPQ-NOR). CFA revealed that the FPQ-NOR had a better fit to the data than both the FPQ-III and the FPQ-SF. Additionally, the FPQ-NOR had the best fit across sex subgroups, thus indicating sex neutrality. The reasons for the different models may be that cross-cultural variance influences FOP, and thereby FOP models in different countries. The FPQ-NOR is a detailed model including more sub-factors to explain FOP than the FPQ-III and the FPQ-SF. A more detailed model may enable differentiation of distinct types of FOP, and thus be useful in diagnostic circumstances and for improvement of clinical research. Thus, the present study highlights the relevance of explorative analysis when applying the Fear of Pain Questionnaire to a new country or culture. Future FOP-studies employing the FPQ-III or the FPQ-SF could benefit from testing the possibility of revised FOP models when exploring FOP in a given country. The FPQ-NOR should be validated in future studies. It would also be interesting to test the model's factor structure and psychometric properties in clinical samples.

Ethical issues

Informed consent for the studies were required and collected. The studies were approved by the Regional Committee for Medical Research Ethics North Norway.

Conflict of interest statement

The authors declare no conflict of interest.

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References

[1] Albaret MC, Sastre MTM, Cottencin A, Mullet E. The Fear of Pain questionnaire: factor structure in samples of young, middle-aged and elderly European people. Eur J Pain 2004;8:273–81, http://dx.doi.org/10.1016/j.ejpain.2003.09.005.

[2] McNeil DW, Rainwater AJ. Development of the Fear of Pain Questionnaire-III. J Behav Med 1998;21:389–410, http://dx.doi.org/10.1023/A: 1018782831217.

[3] Roelofs J, Peters ML, Deutz J, Spijker C, Vlaeyen JWS. The Fear of Pain Questionnaire (FPQ): further psychometric examination in a non-clinical sample. Pain 2005;116:339–46, http://dx.doi.org/10.1016/j.pain.2005.05.003.

[4] Solé E, Castarlenas E, Sánchez-Rodríguez E, Galán S, de la Vega R, Jensen MP, Miró J. The reliability and validity of the Spanish version of the Fear of Pain Questionnaire. J Health Psychol 2017:1–11, http://dx.doi.org/10.1177/1359105316686669, 1359105316686669.

[5] Vambheim SM, Øien RA. Sex differences in fear of pain: item level analysis of the FPQ-III. J Pain Res 2017;10:825–31.

[6] Vambheim SM, Lyby PS, Aslaksen PM, Flaten MA, Åsli O, Martinussen LM. The Fear of Pain Questionnaire III and the Fear of Pain Questionnaire Short Form: a confirmatory factor analysis. J Pain Res 2017;10:1871–8.

[7] Wijk AJ, Hoogstraten J. Dutch translation of the Fear of Pain Questionnaire: factor structure, reliability and validity. Eur J Pain 2006;10:479–86, http://dx.doi.org/10.1016/j.ejpain.2005.06.008.

[8] Asmundson GJG, Bovell CV, Carleton NR, McWilliams LA. The Fear of Pain Questionnaire-Short Form (FPQ-SF): factorial validity and psychometric properties. Pain 2008;134:51–8, http://dx.doi.org/10.1016/j.pain.2007.03.033.

[9] Lyby PS, Aslaksen PM, Flaten MA. Is fear of pain related to placebo analgesia? J Psychosom Res 2010;68:369–77, http://dx.doi.org/10.1016/j.jpsychores.2009.10.009.

[10] Hovi SL, Lauri S. Patients' and nurses' assessment of cancer pain. Eur J Cancer Care 1999;8:213–9.

[11] Aslaksen PM, Bystad M, Vambheim SM, Flaten MA. Gender differences in placebo analgesia: event-related potentials and emotional modulation. Psychosom Med 2011;73:193–9, http://dx.doi.org/10.1097/PSY.0b013e3182080d73.

[12] Lyby PS, Aslaksen PM, Flaten MA. Variability in placebo analgesia and the role of fear of pain—an ERP study. Pain 2011;152:2405–12, http://dx.doi.org/10.1016/j.pain.2011.07.010.

[13] Lyby PS, Forsberg JT, Åsli O, Flaten MA. Induced fear reduces the effectiveness of a placebo intervention on pain. Pain 2012;153:1114–21, http://dx.doi.org/10.1016/j.pain.2012.02.042.

[14] Aslaksen PM, Lyby PS. Fear of pain potentiates nocebo hyperalgesia. J Pain Res 2015;8:703–10, http://dx.doi.org/10.2147/JPR.S91923.

[15] Bjørkedal E, Flaten MA. Interaction between expectancies and drug effects: an experimental investigation of placebo analgesia with caffeine as an active placebo. Psychopharmacology 2011;215:537–48, http://dx.doi.org/10.1007/s00213-011-2233-4.

[16] Bjørkedal E, Flaten MA. Expectation of increased and decreased pain explain the effect of conditioned pain modulation in females. J Pain Res 2012;5:289–300, http://dx.doi.org/10.2147/JPR.S33559.

[17] Hu LT, Bentler PM. Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives. Struct Eq Model 2009;6:1–55, http://dx.doi.org/10.1080/10705519909540118.

[18] Russell DW. In search of underlying dimensions: the use (and abuse) of factor analysis. Per Soc Psychol Bull 2002;28:1629–46.

[19] Cortina JM. What is coefficient alpha? An examination of theory and applications. J Applied Psych 1993;78:98–104, http://dx.doi.org/10.1037/0021-9010.78.1.98.

[20] Browne MW, Cudeck R. Alternative ways of assessing model fit, vol. 154. Sage Focus Editions; 1993. p. 136.

[21] Osman A, Breitenstein JL, Barrios FX, Gutierrez PM, Kopper BA. The Fear of Pain Questionnaire-III: further reliability and validity with nonclinical samples. J Behav Med 2002;25:155–73, http://dx.doi.org/10.1023/A:1014884704974.

[22] Carr TD, Lemanek KL, Armstrong FD. Pain and fear ratings: clinical implications of age and gender differences. J Pain Symptom Manage 1998;15:305–13.

[23] Costello AB, Osborn JB. Best practices in exploratory factor analysis: four recommendations for getting the most out of your analysis. PARE 2005;10.

[24] Field A. Discovering statistics using SPSS. 3rd ed. London: SAGE Publications Ltd; 2009.

[25] Kline P. An easy guide to factor analysis. London: Routledge; 1994.

[26] Reise SP, Waller NG, Comrey AL. Factor analysis and scale revision. Psych Assessment 2000;12:287–97.

[27] Widaman KF. Common factor analysis versus principal component analysis: differential bias in representing model parameters? Multivar Behav Res 1993;28:263–311.

[28] Robinson ME, Riley JL, Myers CD, Papas RK, Wise EA, Waxenberg LB, Fillingim RB. Gender role expectations of pain relationship to sex differences in pain. J Pain 2001;5:251–7.

[29] Horn ME, Alappattu MJ, Gay CW, Bishop M. Fear of severe pain mediates sex differences in pain sensitivity responses to thermal stimuli. Pain Res Treat 2014:7, http://dx.doi.org/10.1155/2014/897953.