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Technical Report

Factor analyses for the Örebro Musculoskeletal Pain Questionnaire for working and nonworking patients with chronic low back pain

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Abstract

BACKGROUND CONTEXT: The Örebro Musculoskeletal Pain Questionnaire (ÖMPQ) has good psychometric properties to predict return to work in patients with acute low back pain. Although it is used in patients with chronic back pain and nonworkers, there is no evidence on the factor structure of the ÖMPQ in these populations. This is deemed an important prerequisite for future prediction studies.

PURPOSE: This study aimed to analyze the factor structure of the ÖMPQ in working and nonworking patients with chronic back pain.

STUDY DESIGN/SETTING: This is a cross-sectional study in a university-based spine center.

PATIENT SAMPLE: The patient sample consists two cohorts of working and nonworking adult patients (>18 years) with specific and nonspecific chronic back pain.

OUTCOME MEASURES: The Örebro Musculoskeletal Pain Questionnaire.

METHODS: Exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) were performed in working (N=557) and nonworking (N=266) patients for three, four, five, and six factors identified in literature. A goodness of fit index was calculated by a chi-square. Root mean square error of approximation (RMSEA) was calculated, and the number of factors identified was based on RMSEA values <.05. A Tucker-Lewis index (TLI) and a normed fit index (NFI) >0.90 are considered to indicate acceptable fit.

FDA device/drug status: Not applicable.

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RESULTS: In working patients, a five-factor solution had the best fit (RMSEA<0.05; NFI and TLI >0.90), but substantial adaptations should be made to get proper fit (removal of the work-related items). In nonworking patients, a four-factor analysis had the best fit (RMSEA<0.05). For both samples, items related to duration could not fit in the overall model.

CONCLUSIONS: Factor structure of the ÖMPQ was not confirmed in working and nonworking patients with chronic back pain. Substantial adaptations should be made to obtain a factor structure with acceptable fit.

Keywords: Spinal pain; Confirmatory factor analyses; Disability; Musculoskeletal pain; Psychometric properties; Psychosocial factors

Introduction

Prediction of chronic pain in patients with acute low back pain is known to be mediated by various biopsychosocial factors [1]. As such, several questionnaires have been constructed as tools to predict and identify patients who are at risk for chronic back pain (CBP). Examples include the STarT Back Screening Tool [2] or the Örebro Musculoskeletal Pain Questionnaire (ÖMPQ) [3]. For the population of patients who already have CBP, in which it is known that complex phenomena such as central sensitization or comorbidity may appear, a number of prognostic factors for recovery were identified including personal, health, social factors, work status [4,5], and psychological factors [6]. For prediction of recovery in patients with CBP, the ÖMPQ or the STarT Back Screening Tool have no proven additional value, but good alternatives appear nonexistent. In a recent focus article, the National Institutes of Health task force on research standards for chronic low back pain composed a minimal dataset to close this gap and validated this on construct validity and responsiveness [7]. First results indicate a better responsiveness than the Roland Morris Disability Questionnaire but the cutoff points for an impact stratification scale, which was defined by pain intensity, pain interference, and physical function, were not studied and stated as relatively arbitrary [7]. Currently, it is insufficiently clear how to predict recovery in patients with CBP by a screening list and which underlying constructs appear to be of importance.

The ÖMPQ covers many of the factors predicting recovery in patients with CBP identified in previous studies and may therefore be an appropriate questionnaire to identify patients at risk for non-recovery. The predictive validity and reliability was reported as sufficient for clinical use in patients with acute and subacute back pain [3,8]. Additionally, a few studies reported on a subsample of patients with chronic pain [8–11], but only in the study of Grotle et al. the chronic pain subgroup was reported on as an individual group [11]. Consequently in that study, the outcome of interest for that subgroup shifted toward prediction of (non-)recovery, which was different from the objective for which the ÖMPQ was intended for (prediction of chronic pain).

Despite proven sufficient psychometric qualities of the ÖMPQ for the (sub)acute population, there are controversies on the outcome of interest [12]. Additionally, there appears to be an inconsistency in the factor structure. In the original study, the questionnaire was constructed from four questionnaires, grouped into five factors, which were used for discriminant analyses. These five factors concerned daily activities, coping with pain, fear-avoidance beliefs, likelihood of recovery, and miscellaneous [3]. In another study, a three-factor structure was found [11]. In two other studies, a six-factor structure was found in a slightly adapted version of the ÖMPQ [9,10]. One of the hypothesized differences between these studies may also be the difference in sample characteristics: patients with acute and chronic pain, and workers and nonworkers. Originally, the ÖMPQ was constructed to predict work status [13], but the ÖMPQ is less responsive on outcomes pain and disability [12]. Thus, the predictive validity depends on the outcome of interest, and to be able to make logically sound predictions, the outcome of interest should be related to the underlying response sets of the questionnaire [14]. Additionally, for nonworking samples including students, housewives, or retired patients, the ÖMPQ will have a considerable amount of nonrelevant items because of the inclusion of work-related items. In previous research, it was stated that all work-related items could be replaced by the mean of the item score [13], but it is unclear how this affects the factor structure and if removal of these work-related items leads to reliable results. Consequently, there is insufficient evidence about the factor structure in working and nonworking patients with CBP. The factor structure, a part of structural validity [15], should therefore be studied in the chronic and nonworking population before it can be used in prediction studies.

The objective of this study is to investigate the factor structure separately for a working and a nonworking patient sample with a wide range of CBP admitted to a multispecialist university-based spine center. In the latter sample, factor structure will be evaluated after removal of work-related items.

Materials and methods

Procedures

Patients with CBP, who were assigned to the Groningen Spine Center in The Netherlands, were included in this study. Patients were selected from a larger database and were included when they visited the spine center between January 2009 and June 2012; had specific or nonspecific back pain; had CBP to the neck, thoracic spine, or lower back (duration >12 weeks); were aged >18 years; and were working or nonworking. Excluded were patients whose Dutch reading skills were insufficient to fill out the questionnaire by themselves or who were diagnosed with severe psychiatric comorbidity. All patients filled out a comprehensive set of questionnaires including the ÖMPQ at baseline, before first consultation. Data were collected within care as usual. Patients gave signed informed consent for using their anonymized data for study purposes. Based on patients' work status, patients were divided in two samples of workers and nonworkers.

Design

Patients filled out the questionnaire once before treatment. Scores were used for descriptive and factor analyses.

Measurements

The Dutch-language version of the ÖMPQ (ÖMPQ-dlv) was administered in both the working and the nonworking group. The ÖMPQ consists of 25 items. Twenty-one of 25 items are scored on a 0–10 scale, with scores ranging from 0 to 210, and higher scores indicate a more complex situation. Four items concern demographic data. Predictive validity and factor structure was reported sufficient for clinical use with a 73% correct classification [3,8]. Originally, items were grouped into five factors [3]. Internal consistency of the ÖMPQ-dlv was 0.81, and construct validity was confirmed by moderate correlation coefficients with the Fear-Avoidance Beliefs Questionnaire, the Tampa Scale of Kinesiophobia, the Pain Coping Inventory, Quebec Back Pain Inventory, and the visual analog scale for pain intensity (r=0.38 to 0.64) [16]. The ÖMPQ is highly correlated to the STarT Back Screening Tool [17].

The Pain Disability Index was administered as baseline characteristic. Workers and nonworkers can be compared with this measure on self-reported disability. The Pain Disability Index Dutch-language version has been shown reliable and valid among patients with CBP [18].

Statistics

Missing data

For nonworkers, it was previously proposed to impute all work-related items by the mean item score [13]. This, however, does not suit the objectives of our study and may bias the content and number of the factors in the nonworking cohorts. It was therefore chosen to exclude the work-related items by removal of work-related items. Five out of 25 items (items 6, 8, 16, 17, and 20) were removed (remaining score range from 0 to 160). Other missing values were resolved by imputation of the missing item by the mean item score of the group. If more than two items were missing, the case was excluded from the analyses.

Exploratory factor analyses (EFA) and confirmatory factor analyses (CFA) were used to test the factor structure of the ÖMPQ in workers and nonworkers. To perform both a CFA and an EFA, the sample size-to-item ratio of 10:1 was used [19], meaning that for the workers cohort at least 420 workers are required to perform a factor analyses on a 21-item scale with two groups. For the nonworking cohort, additional 320 nonworkers were included to perform both an EFA and a CFA (16 items for two groups). The first step of this research was to explore and confirm the factor structure for a working subsample with CBP. The second step was to remove work-related items of the ÖMPQ and to perform an exploratory factor analysis on a group of nonworking patients with CBP. Confirmatory factor analysis was performed with the three-, five-, and six-factor solutions as reported in previous studies [9–11]. Workers with CBP were randomly split in two groups in which subsequently, on the first group, an EFA and on the second group a CFA was performed. A number of factors were explored in an EFA by model comparison with chi-square and an oblique rotation was performed. A goodness of fit index was calculated by a chi-square. The root mean square error of approximation (RMSEA) was used as an absolute fit index and was used to judge the models. The number of factors identified was based on RMSEA values; when this value decreased below 0.05, the corresponding number of factors was selected. For the second group, a CFA was performed. Additional to RMSEA values, the Tucker-Lewis index (TLI) and comparative fit index (CFI) were calculated as incremental fit indices. Tucker-Lewis index and CFI values >0.90 are considered to indicate acceptable fit, and values >0.95 indicate good fit [20,21]. Descriptive variables were calculated with SPSS Statistics 22 (IBM Corp., Armonk, NY, USA). All factor analyses were performed with Mplus 7.1 (Muthén & Muthén, Los Angeles, CA, USA).

Results

Patients

Included in this study were 823 patients divided in two samples of 557 workers and 266 nonworkers. In the nonworking sample, 26 patients were excluded because more than two of the nonworking items on the ÖMPQ were missing. Twenty patients in the working sample were excluded because of more than two missing items on the ÖMPQ. Because data were gathered within care as usual, we did not select patients <18 years of age and patients who could not fill out the baseline questionnaire because of insufficient Dutch language skills. In the nonworking cohort, 91% of patients were considered to have nonspecific complaints, and 93% of patients in the working cohort were considered to have nonspecific complaints. The percentage of men was significantly higher in the working sample than that in the nonworking cohort. Nonworkers had a significant higher age and longer duration of pain (Table 1).

Table 1
Patient characteristics

	Workers (N=557)	Nonworkers (N=266)
Gender (male/female)‡	271/286	103/163*
Age (y; sd)§	47.7 (10.3)	62.3 (16.2)*
Duration of pain (y; sd)§	9.8 (10.7)	10.4 (12.1)
Pain site (%)‖		
Cervical	33	32
Thoracic	21	22
Lumbar	86	89
Marital state (%)		
Single	47	43
Married	30	37
Living with parents	10	7
Other	13	13
Status (%)		
Student	N/A	7
Housewife/man	N/A	32
Unemployed	N/A	9
Retired	N/A	39
Full - time job	61	N/A
Part-time job	30	N/A
Self-employed	8	N/A
Freelance	2	N/A
Other	0	13
ÖMPQ score (sd)†,§	113.7 (24.9)	86.2 (11.8)*
Pain Disability Index§	34.7 (13.8)	39.4 (13.1)*

* p<.05.
† ÖMPQ score is score without work-related items.
‡ Chi-square test.
§ *t* test.
‖ Patients reported to have pain at multiple sites.

Factor analyses of workers

Five factors were identified by EFA with an RMSEA value of 0.05. The factors could be best related to pain, duration, psychological, activities of daily life, and work. Chi-square test of model fit was 1805 (p<.01). Comparative fit index was 0.94 and TLI was 0.89. Significant loadings are presented in Table 2. A six-factor solution significantly increased the model fit (p-value for chi-square <0.01; df=129) but would have no significant loadings (p<.05) on one of the factors. It was decided that a five-factor model had a fit that was most clinically relevant.

From the CFAs, it appeared that three items could not be fit in any model: "Where do you have pain? (Q5)"; "How many weeks have you suffered from your current pain period? (Q7)"; and "In your view, how large is the risk that your current pain may become persistent (may not go away)? (Q15)." These items were removed and CFAs were performed on three, five, and six factors. The three-factor solution [11] had a model fit of RMSEA 0.09. The six-factor solution [9] could not be confirmed, because one of the factors contained only one item after deletion of items 3, 5, and 6. The five-factor model as explored in the current study had good fit, but factor 2 (Duration) gave no valid data because variance was too small within this factor. Factor 2 consisted of Q5, Q7, and Q15, which reflect duration and pain site. After removal of this factor, a four-factor solution was confirmed with RMSEA=0.05, TLI=0.92, and CFI=0.93 (see Table 3). This was considered as acceptable fit.

Factor analyses of nonworkers

The EFA for nonworkers determined five factors (RMSEA is 0.05); however, one factor contained only one item, namely Q7, which had a bad fit. After removal of this item, four factors were identified with RMSEA of 0.05. Factors were related to pain, fear avoidance, activities of daily life, and pain. Chi-square test of model fit was 83 (p<.01). A five-factor model did not significantly increase the model fit compared with the four-factor model (p=.09) (Table 4).

Discussion

In this study, the factor structure of the ÖMPQ was analyzed in workers and nonworkers with CBP as a prerequisite for prediction studies. The previously reported factor structure of the ÖMPQ was not confirmed in working and nonworking patients with CBP. These results indicate that the ÖMPQ, developed for patients with acute back pain, cannot simply be used for prediction of recovery in a chronic population without alterations. In the working sample, items 5, 7, and 15 do not fit into the confirmatory model and those items should be removed if clinicians are interested in screening for yellow flags in a working CBP population. Item 7 did not fit into the exploratory model and should be removed to get good fit. From a theoretical point of view, removal of these items appears logical. Two items (Q7 and Q15) concern duration and the change of acute into chronic pain. The CBP population already has chronic pain, with a mean duration of 9.1 years in workers and 10.4 years in nonworkers. The third item that should be removed (Q5) deals with the pain site. All patients experienced at least back pain and therefore, this item could not be scored on a continuous scale. After removal of these items, a four-factor structure was identified to have an acceptable fit in the working sample from CFA. In the analyses, only significant factor loadings were presented and no decisions were made based on the factor loadings. As a rule of thumb, a minimal criterion of 0.30 has previously been described [19]. From the results of this study, it can be concluded that the ÖMPQ has another item-based factor structure in workers with chronic pain compared with patients with acute pain, and the ÖMPQ has a differing factor structure for working compared with nonworking patients. Adaptation of the ÖMPQ to the targeted population is deemed to lead to better structural validity and will decrease the patient burden by excluding irrelevant items.

Several predictive questionnaires are not appropriate for heterogeneous populations. Especially elderly, single, or nonworking populations are not able to fill out many pain and disability questionnaires completely because they include, for example, work-related or sexual items. A large nonresponse bias has previously been reported for the Pain Disability Index

Table 2
Exploratory factor analysis of workers (only significant factor loadings are presented; p<.05)

	Factor				
Item	Pain	Duration	Psychological	Work	Activities of daily life
Q5. Where do you have pain?		.21			
Q6. How many days of work have you missed (sick leave) because of pain during the past 12 months?				.53	
Q7. How many weeks have you suffered from your current pain problem?		.75			
Q8. Is your work heavy or monotonous?				.42	
Q9. How would you rate the pain you have had during the past week?	.79				
Q10. In the past 3 months, on average, how intense was your pain?	.82				
Q11. How often would you say that you have experienced pain episodes, on average, during the past 3 months?	.53	.27			
Q12. Based on all the things you do to cope or deal with your pain, on an average day, how much are you able to decrease it?	.18		−.17		
Q13. How tensed or anxious have you felt in the past week?			.87		
Q14. How much have you been bothered by feeling depressed in the past week?			.77		
Q15. In your view, how large is the risk that your current pain may become persistent (may not go away)?		.45			
Q16. In your estimation, what are the chances that you will be working in 6 months?				.61	
Q17. If you take into consideration your work routines, management, salary, promotion possibilities, and workmates, how satisfied are you with your job?	−.22		.23	.31	−.18
Q18. Physical activity makes my pain worse	.19				.36
Q19. An increase in pain is an indication that I should stop what I am doing until the pain decreases	.17				
Q20. I should not do my normal work with my present pain				.56	
Q21. I can do light work for an hour.				.21	.54
Q22. I can walk for an hour					.53
Q23. I can do ordinary household chores					.94
Q24. I can do the weekly shopping					.88
Q25. I can sleep at night	.26				.21

Note: Root mean square error of approximation=0.05.

for the items *work* and *sexual behavior* [22]. Questionnaires such as the STarT Back or the EuroQol-5D are more focused on generalized activities and domains of functioning and probably suffer less from nonresponse, but do include work status, which has been identified as an important factor for functional capacity [23].

Predictive validity of the ÖMPQ has not been established in patients with CBP. It can be hypothesized that the predictive validity for functioning and pain, when calculated with receiver operating curves, will be lower compared with patients with acute complaints, because of a high sensitivity owing to high natural recovery rates. The data of the current study are presenting a first important prerequisite, namely identification of the structural validity of the ÖMPQ in populations of nonworking patients with CBP. Analyses with respect to prediction of (non-)recovery in these populations will be the next step and should be performed with an altered ÖMPQ as proposed.

A weakness of this study was the heterogeneity of the population. This may have affected the internal validity for specific target groups such as patient groups with specific or nonspecific complaints or low back or cervical back pain. Another weakness is related to the data as they were collected within care as usual. Patients were included retrospectively, based on eligibility. Exact numbers of patients with acute pain, patients younger than 18 years of age, or patients with comorbidity were therefore unknown.

Table 3
Goodness of fit indices of confirmatory factor analyses of the ÖMPQ for workers with chronic back pain

Statistic	Three-factor solution	Four-factor solution	Five-factor solution	Six-factor solution
RMSEA	0.11	0.05	Could not be computed	Could not be computed
CFI	0.60	0.93		
TLI	0.55	0.92		

RMSEA, root mean square error of approximation; CFI, comparative fit index; TLI, Tucker-Lewis index.

Conclusion

It is concluded that the factor structure of the ÖMPQ for patients with CBP is different from that of patients with acute back pain. Also, factor structure for working patients is different from that for nonworking patients. With the factor structure reported for the ÖMPQ in this study, an evaluation of the prognostic properties of the ÖMPQ in an employed and an unemployed CBP population can now be undertaken. Already, a revision of the ÖMPQ specifically for use in

Table 4
Exploratory factor analyses of nonworkers (only significant factor loadings are presented; p<.05)

Item	Factor			
	Pain	Psychological	Activities of daily life	Fear avoidance
Q5. Where do you have pain?	.20			
Q9. How would you rate the pain you have had during the past week?	.85			
Q10. In the past 3 months, on average, how intense was your pain?	.89			
Q11. How often would you say that you have experienced pain episodes, on average, during the past 12 months?	.56			
Q12. Based on all the things you do to cope or deal with your pain, on an average day, how much are you able to decrease it?	.16		.19	
Q13. How tensed or anxious have you felt in the past week?		.82		
Q14. How much have you been bothered by feeling depressed in the past week?		.86		
Q15. In your view, how large is the risk that your current pain may become persistent (may not go away)?	.16			
Q18.Physical activity makes my pain worse	.29			.71
Q19. An increase in pain is an indication that I should stop what I am doing until the pain decreases				.58
Q21. I can do light work for an hour			.70	
Q22. I can walk for an hour			.60	.21
Q23. I can do ordinary household chores		.09	.90	
Q24. I can do the weekly shopping			.84	
Q25. I can sleep at night	.17		.35	−.26

Note: Root mean square error of approximation=0.05.

patients with CBP seems called for on the basis of the current factor analysis.

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