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Early Identification of Patients at Risk of Developing a Persistent Back Problem: The Predictive Validity of The Örebro Musculoskeletal Pain Questionnaire

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Abstract:

Objective: To test the predictive utility of the Örebro Musculoskeletal Pain Screening Questionnaire in identifying patients at risk for developing persistent back pain problems.

Design: Prospective, where participants completed the questionnaire and their cases were followed for 6 months to assess outcome with regard to pain, function, and absenteeism due to sickness.

Participants: One hundred seven patients, recruited from seven primary care units.

Results: Discriminant analyses showed that the items on the questionnaire were significantly related to future problems. For absenteeism due to sickness, 68% of the patients were correctly classified into one of three groups, whereas an even distribution would have produced 33%. The analyses for function correctly classified 81%, and for pain 71%, into one of two groups, compared with a chance level of 50%. A total score analysis demonstrated that a cutoff score of 90 points had a sensitivity of 89% and a specificity of 65% for absenteeism due to sickness, and a sensitivity of 74% and a specificity of 79% for functional ability.

Conclusions: The results underscore that psychological variables are related to outcome 6 months later, and they replicate and extend earlier findings indicating that the Örebro Screening Questionnaire is a clinically reliable and valid instrument. The total score was a relatively good predictor of future absenteeism due to sickness as well as function, but not of pain. The results suggest that the instrument could be of value in isolating patients in need of early interventions and may promote the use of appropriate interventions for patients with psychological risk factors.

Key Words: Absenteeism—Back pain—Early identification—Predictive—Questionnaire—Screening.

This article reports on the utility of a questionnaire in identifying patients at risk for developing persistent back pain problems. Tools for assessing psychosocial factors for patients with spinal pain are important for several reasons. First, reviews of the literature have concluded that psychological variables are clearly associated with the development of chronicity.[1–6] Some reviews have concluded that psychosocial factors are particularly potent risk factors, especially in the transition from an acute to a chronic problem.[1,2,5] Linton suggested that such variables might be used for the early identification of patients who risk developing a persistent pain problem.[1] These psychological factors have also been conceptualized as "yellow flags" indicating a possible hindrance for recovery.[7] In this view, "red flags" represent the rare but important biologic risks factors that need immediate attention (e.g., fractures, infections, and tumors), whereas the yellow flags represent factors that may impede recovery (e.g., emotional state, fear-avoidance beliefs, or poor coping strategies).

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Another reason that tools for evaluation are necessary is that primary health care is often poorly equipped to assess these variables. Such services may lack personnel who have sufficient training or the time to conduct a full assessment. Further, many psychological variables have been identified, making interview assessments cumbersome and time consuming. Finally, interview techniques are subject to several biases and their predictive ability is not yet known.[8,9] Therefore, a screening instrument to provide a first assessment of these factors is needed.

Without the aid of screening procedures, primary care facilities might be overwhelmed with a large number of patients since back pain is a frequent reason for seeking care. Indeed, treating every patient seeking care for back pain with a secondary preventive intervention would require enormous resources. Screening, in contrast, would enhance the allocation of resources to those most likely to benefit from them.

The Örebro Musculoskeletal Pain Screening Questionnaire (ÖMPSQ) was developed to assist health care providers in assessing yellow flags as a complement to the standard medical examination. This instrument has 25 items and is self-administered by the patient, for example, while waiting to see a health care professional. This screening instrument was found to have satisfactory test–retest reliability (0.83) and validity in a study of 142 patients where the outcome was absenteeism due to sickness.[8,9] Using a cut-off score of 105, the specificity was found to be 0.75 and the sensitivity 0.88. Hurley et al.[10] investigated the predictive ability of the instrument with regard to returning to work after physical therapy. They reported that a cut-off point of 112 correctly identified 80% of patients failing to return to work at the end of treatment. Since the population used may influence the distribution of scores, replications are needed. In addition, studies to date have only used return-to-work (sick leave) as the outcome variable. Although this is a key outcome variable, many clinicians are also concerned about outcomes such as function and pain.

The purpose of this study was to examine the clinical utility of the ÖMPSQ in a population of primary care patients. An overriding goal was to attempt to replicate the results of the first report.[8] The aim was therefore three-fold: first, to evaluate the utility of the ÖMPSQ in identifying patients that take sick leave; second, to explore discriminative analyses as a way of providing converging information about the questionnaire's ability to predict outcome; and finally, to extend previous work by including pain and function as outcomes in addition to work disability as measured by sick leave. This is important because pain, physical function, and work disability may not be highly related.

MATERIALS AND METHODS

Overview of the design

This investigation used a prospective design, where participants completed the ÖMPSQ and their cases were then followed for six months, to assess outcome with regard to pain, function, and absenteeism due to sickness.

Subjects

Subjects were recruited from 7 primary care clinics via a general practitioner or a physical therapist. The inclusion criteria were: (1) acute or subacute pain (duration less than 3 months) in the back or neck; (2) less than 6 months of accumulated sick leave during the past year; and (3) sufficient language skills to complete the questionnaire.

One hundred and twenty-two patients who consecutively fulfilled the criteria were invited to participate in the study. Of these, 107 (88%) completed both assessments and were included in the data analyses. The average age of the participants was 41 years old (range, 22–66), 48% were women, and 93% were born in Sweden. Participants could report multiple pain sites, and 56% reported low back pain, 44% shoulder pain, and 44% reported neck pain.

All patients had an examination and were provided care. The County Council's Board on Research Ethics approved this research.

The Örebro Musculoskeletal Pain Screening Questionnaire

The ÖMPSQ is a self-administered instrument containing 25 items.[11] The reliability and validity of the ÖMPSQ has been tested previously, and the purpose of this study was to further assess the instrument's predictive validity. The items and the variable names are summarized in Table 1. An item concerning the patient's employment status was added to the unscored background questions. All ratings were made on a 0-to-10 scale with the exception of questions pertaining to background, previous sick leave, pain sites, and pain duration, where category scales were used. In addition to the individual scores on items, a total score is calculated. This is achieved by inverting some items (16,17,21–25) so that higher ratings always indicate higher levels of risk. The ratings on the 21 scored items (4–25) are subsequently summed to form a total score.

Follow-up questionnaire

The follow-up questionnaire was designed to assess outcome with regard to the key variables of absenteeism due to sickness, function, and pain. Since the ÖMPSQ contains items that assess pain and function, it was used

TABLE 1. *The Örebro Musculoskeletal Pain Screening Questionnaire for problematic back pain: results at the initial visit*

Question	Response format	Variable name	Mean	SD
1. What year were you born?	Fill in blank	Age	41.1	Range 22–66
2. Are you	Male/female	Gender	48% Female	
3. What is your current employment status?	Categories	Employed	84% Working	
4. Are you born in Sweden?	Yes/no	Nationality	93% Born in Sweden	
5. Where do you have pain?	Categories	Pain site	56% Lower back, 44% neck, 44% shoulder	
6. How many days of work have you missed (sick leave) because of pain during the past 12 months?	Categories (days)	Sick leave	49% 0 days	
7. How many weeks have you suffered from your current pain problem?	Categories (weeks)	Duration	43% >24 weeks	
8. Is your work heavy or monotonous?	0–10	Heavy work	5.1	3.0
9. How would you rate the pain you have had during the past week?	0–10	Current pain	6.2	2.1
10. In the past 3 months, on average, how intense was your pain?	0–10	Average pain	5.1	2.2
11. How often would you say that you have experienced pain episodes, on average, during the past 3 months?	0–10	Frequency	6.1	2.9
12. Based on all things you do to cope or deal with your pain, on an average day, how much are you able to decrease it?	0–10	Coping	5.0	2.3
13. How tense or anxious have you felt in the past week?	0–10	Stress	5.0	3.0
14. How much have you been bothered by feeling depressed in the past week?	0–10	Depression	3.4	3.0
15. In your view, how large is the risk that your current pain may become persistent (may not go away)?	0–10	Risk chronic	6.3	2.9
16. In your estimation, what are the chances that you will be working in 6 months?	0–10	Chance working	0.9	1.6
17. If you take into consideration your work routines, management, salary, promotion possibilities, and work mates, how satisfied are you with your job?	0–10	Job satisfaction	2.9	2.6
18. Physical activity makes my pain worse.	0–10	Belief: increase	6.1	3.4
19. An increase in pain is an indication that I should stop what I am doing until the pain decreases.	0–10	Belief: stop	6.9	2.9
20. I should not do my normal work with my present pain.	0–10	Belief: not work	5.1	3.4
21. I can do light work for an hour.	0–10	Light work	3.3	2.9
22. I can walk for an hour.	0–10	Walk	3.2	3.3
23. I can do ordinary household chores.	0–10	Household work	3.5	2.9
24. I can do the weekly shopping.	0–10	Shopping	3.6	3.4
25. I can sleep at night.	0–10	Sleep	4.0	2.9

High scores indicate increased risk.
SD, standard deviation.

in its entirety. One item concerning the number of days off work due to spinal pain during the follow-up period (i.e., the last 6 months) was added. Self-reports of sick leave have been shown to be relatively reliable.[12,13] Consequently, outcome for pain was assessed with items 10 and 11 from the ÖMPSQ, whereas the outcome of function was assessed using the 5 activity items (21–25). Absenteeism due to sickness, however, was measured with the additional question noted previously.

The outcome variables were defined as follows. For absenteeism due to sickness the reported amounts at follow-up were divided into three classes. This reflects the fact that a limited amount of sick leave may be necessary. Thus "no sick leave" during the follow-up (0 days; 60% of the distribution), would be an excellent outcome. We also included "short-term sick leave" (1–30 days; 23% of the distribution) and "long-term sick leave" (>30 days; 17% of the distribution).

For function, the outcome was split to form a "recovered" and a "nonrecovered" group based on the five "activity of daily living" questions described previously (items 21–25). Scores were summed (possible range, 0–50) and a score of 45 was selected as a cut-off point because this represents normal, unrestricted function. Using this criterion, 40% of the sample were in the recovered group and 60% were deemed not to have fully recovered.

A similar procedure was used for pain at the follow-up. To form recovered and nonrecovered groups, an "experienced pain" index was used, created by multiplying

the average pain intensity during the last 3 months by the frequency of pain. The recovered group comprised those having 16 points or less (52% of the sample), the nonrecovered group 17 or more points.

Procedure

Patients seeking health care for spinal pain and fulfilling the aforementioned criteria were informed about the study and asked to participate by completing the self-administered ÖMPSQ. After informed consent was obtained, patients were provided with the questionnaire to be completed and a prepaid envelope. Patients completed the ÖMPSQ, sealed it in the envelope, and returned it by post to the research team. Consequently, health care personnel did not have access to the questionnaires. Two to four weeks later, participants again were asked to complete the ÖMPSQ to evaluate test–retest reliability.

Six months later, the follow-up questionnaire was sent to participants to assess outcome. Completed questionnaires were returned by prepaid post, and a reminder was sent out if the questionnaire had not been returned within 2 weeks. If the questionnaire was not returned in an additional 2 weeks, the participant was contacted by telephone. Eight people were called; they completed a shortened version of the outcome questionnaire described.

Data analysis

To evaluate the predictive utility of the ÖMPSQ, a series of statistical analyses were conducted. Preliminary analyses showed that the individual items were related to the outcome variables in univariate analyses. The mean scores for the outcomes were statistically compared across groups (e.g., "recovered," "not recovered") with ANOVA or *t* tests.

To evaluate and replicate the ÖMPSQ's overall predictive validity, the specificity and sensitivity based on the total score was calculated for various cut-off scores with absenteeism due to sickness, function, and pain as the outcome variables.

Subsequently, subanalyses were conducted to ascertain which variables had the highest predictive value for each of the three outcomes as well as to provide an additional measure of predictive ability. Discriminant analyses were used to determine the best linear fit for the predictor variables. Details of how the analyses were conducted are available in the original articles.[8,9] A brief description is provided here. Because of likely intercorrelations and the large number of variables, the discriminant analyses were conducted in two steps. As in the original study, the predictor variables were the scores on the individual items in the ÖMPSQ. Outcome variables were absenteeism due to sickness, function, and pain, respectively. In the first step, individual items were entered concerning function, pain, psychological factors, and fear-avoidance (see original article for details). Some variables did not fit these groupings but were included if they were found to be significant in the univariate analysis. Those variables found to be significant in the first analyses were then entered into a second analysis to produce a final model and the percentage of patients correctly classified by this solution.

RESULTS

The data were first summarized and the distributions were examined. Total score analyses were then conducted for sick leave, function, and pain, and the discriminative analyses were calculated for the three outcomes. The percentage correctly classified as well as the sensitivity and specificity are reported for the total score analyses as well as the discriminative analyses. Since the total score includes all of the variables, the predictive power should be higher than for the discriminant analysis. To increase clinical utility, we also report cut-off points for the total score analysis.

Table 1 gives an overview of average scores and standard deviations of the individual items. The overall test–retest score for the questionnaire was 0.80. As seen in the table, the mean pain rating for those experiencing pain "in the past week" was 6.2; 43% reported pain lasting more than 24 weeks. Half the sample reported having missed at least one day of work during the past year because of the pain. Preliminary evaluation with univariate analyses demonstrated a relation between most of the individual items and the outcome variables sick leave, pain, and function.

Sick leave

To evaluate the potential of the ÖMPSQ as a screening instrument, an analysis of cut-off points based on total scores was calculated for sensitivity and specificity. Participants were divided into three classes of sick leave according to the criteria described previously (0 days, 1–30 days, >30 days). Total score distributions were then generated for each group, to compare and evaluate the overall differences and possible cut-off points.

For the whole sample, the mean total score was 95 (range, 32 to 166; SD, 28). An ANOVA comparison of the groups with no sick leave (mean score, 84), 1 to 30 days (mean score, 105), and greater than 30 days (mean score, 116) showed that they differed significantly in their total score ($P < 0.0001$), indicating a relation between scores and amount of sick leave.

Table 2 shows the results of different cut-off points on the accuracy of predicting sick leave. The table provides

TABLE 2. *Examples of the effect of different cut-off scores on the prediction of sicklisting*

Cut-off score	0 Days (specificity; %)	1–30 Days (sensitivity; %)	>30 Days (sensitivity; %)
90	65	67	89
100	74	45	76
105	81	40	67
110	86	38	63
120	94	28	36

TABLE 3. *Examples of the effect of different cut-off scores on the prediction of functional ability*

Cut-off score	Recovered (specificity; %)	Not recovered (sensitivity; %)
80	63	88
90	79	74
100	87	54
105	95	49
110	97	48

information concerning the numbers of "hits" and "misses" different cut-off points would entail. Higher cut-off points increase the percentage of correctly identified patients with a good prognosis, but at the same time decrease the percentage identified with a poorer prognosis. The table shows that a cut-off of 90 points has a specificity rate of 65% and a sensitivity rate for long-term sick leave of 89%. Increasing the cut-off to 100 points results in a specificity rate of 74% and a sensitivity rate for long-term sick leave of 76%. By comparison, if the patients were evenly divided into the three levels of sick leave (0 days, 1–30, >30) the result would be 33%.

The discriminant analyses were calculated as previously described to provide some convergent information on the utility of the items in the ÖMPSQ. The dependent variable was three classes of sick leave at follow-up (no sick leave, 0 days; short-term sick leave, 1–30 days; long-term sick leave, >30 days). The final solution was statistically significant (Wilks' $\lambda = 0.886$, $P < 0.003$). The three items most strongly related to future sick leave were (1) sex, (2) previous sick leave, and (3) difficulties in doing shopping. These three items correctly classified 68.3% of the subjects, whereas random assignment, given an even distribution, would have correctly classified 33%. The discriminant analysis shows, therefore, that the items in the ÖMPSQ are related to future sick leave.

Functional ability

To extend and compare the ÖMPSQ's potential as a screening instrument over all three main outcomes, a total score analysis of functional ability was performed. Participants were divided into recovered and not recovered groups according to the aforementioned criteria. Total score distributions were generated for each group, to compare and evaluate the overall differences and possible cut-off points.

The mean score for the recovered group was 74 as compared with 107 for the not recovered group, a difference that is statistically significant ($P < 0.0001$). Table 3 shows the results of different total score cut-off points on the accuracy of predicting functional problems at the 6-month follow-up. A total score cut-off of 90 points, for example, has a specificity (identify "recovered") of 79% and a sensitivity (identify "not recovered") of 74%. Increasing the cut-off to 100 points results in a specificity of 87%, but the sensitivity drops to 54%.

To provide further information, discriminant analyses were carried out with regard to functional recovery. Again, the individual items in the questionnaire were entered as predictor variables and functional outcome at the 6-month follow-up was the outcome. The final solution was statistically significant (Wilks' $\lambda = 0.570$, $P < 0.0001$), and four specific items were isolated: (1) sleep, (2) sick leave, (3) pain site, and (4) the patient's perceived chance of being able to work. With this solution 81% of the patients were correctly classified (sensitivity, 79%; specificity, 83%), which is, given an even distribution, higher than the chance rate of 50%. This indicates that the items in the ÖMPSQ are related to functional outcome and have substantial predictive potential.

Pain

Because pain is an important outcome, we analyzed the data to evaluate the utility of the ÖMPSQ in identifying patients who continue to experience pain 6 months later. We thus examined the total score and found that the recovered group had a significantly lower score (mean, 82) as compared with the not recovered group (mean, 106; $P < 0.0001$). Table 4 shows how various cut-off points affect the accuracy of predicting those patients who were not recovered at the follow-up. As indicated in the table, a score of 90 has a specificity of 70% and a

TABLE 4. *Examples of the effect of different cut-off scores on the prediction of pain*

Cut-off score	Recovered (specificity; %)	Not recovered (sensitivity; %)
80	50	87
90	70	76
100	78	56
105	82	46
110	84	43
120	92	25

sensitivity of 74%, while a score of 100 produced a specificity of 87% and a sensitivity of 56%.

The discriminant analysis was again calculated by using the individual items from the ÖMPSQ to predict pain 6 months later. The final solution produced a statistically significant result (Wilks' $\lambda = 0.789$; $P < 0.0001$) and isolated two main items: (1) sleep and (2) average pain. With this solution 71% of the patients were correctly classified (sensitivity, 72%; specificity, 70%), which is, given an even distribution, somewhat higher than the chance rate of 50%.

DISCUSSION

The results of this investigation underscore that psychological variables are related to outcome 6 months later. Indeed, the various items in the ÖMPSQ were relatively strongly related to future absenteeism due to sickness, function, and pain. In addition, our findings replicate and extend earlier findings indicating that the ÖMPSQ is a clinically reliable and valid instrument that may have utility in identifying patients at risk for developing persistent pain problems. We found that the instrument has utility in predicting future functional problems as well as absenteeism due to sickness. On the other hand, the predictive validity of the ÖMPSQ for pain relative to function or absenteeism due to sickness was lower. Taken together these results suggest that the instrument could be of value in isolating patients in need of early interventions and it may promote the use of appropriate interventions for patients with psychological risk factors.

The present results generally replicate the two previous studies investigating the ÖMPSQ. Compared with the original study,[8,9] the results are similar with regard to test–retest reliability, the distribution of scores on the individual items, and the relation of the individual items to outcome. In addition, the discriminant analyses isolated similar—although not exactly the same—variables as in the original study. The overall predictive power according to the discriminant analyses was slightly lower for absenteeism due to sickness (68% compared with 73%) than in the original study, but still was substantially above the chance level of 33% if cases were evenly divided into the three outcome categories.

We found that, overall, the ÖMPSQ was relatively good at identifying people at risk for developing absences due to sickness. For example, the total score analysis shows that 83% of those with an absence due to sickness at follow-up were identified if the two categories of sick leave are collapsed. The optimal cut-off point in the present population was also somewhat lower than the original study, which may reflect the fact that the present population is somewhat different than that of the original study. With a total score cut-off of 90 points, the specificity is 65% (i.e., correctly identify those with no future sick leave). In addition, 67% of those with 1 through 30 days of future sick leave are identified, and 89% of those with more than 30 days of future sick leave are identified. Clearly, the total score on the ÖMPSQ is related to future sick leave.

This study extended findings to function and pain. An interesting finding was that the ÖMPSQ correctly identified many patients having future difficulties with function. Indeed, according to the results of the discriminant analyses, 81% of the sample was correctly identified as compared with a guessing level of 50%. A cut-off of 90 on the total score had a specificity of 79% and a sensitivity of 74%. With regard to pain, however, it was found that the predictive power of the questionnaire was somewhat limited. For example, the number correctly classified in the discriminant analysis was only 71% compared with a 50% chance rate if patients were evenly divided as to being recovered or not. Although this rate appears to be substantially higher than guessing, it is undoubtedly lower than for absenteeism due to sickness or function.

One weakness in the current evaluation was the method in which we assessed the outcome variables. For function and pain, we used the same variables as does the ÖMPSQ. This may inflate findings. Indeed, for the discriminant analysis for future pain, the item measuring pain intensity was an isolated predictor. For function, however, the picture was somewhat different. First, the screening physical function questions are correlated to other, independent measures. We found, for example, that the five items we used are relatively highly correlated with the Roland and Morris Disability Questionnaire (r, 0.66). Moreover, the five function items *were not* the best predictors of future functional problems. Thus, while independent measures should be used, the result seems plausible. Fortunately, sick leave was evaluated with an independent item.

Given the results for absenteeism due to sickness and function, the ÖMPSQ may have value as a tool for the early identification of patients at risk for developing long-term functional problems. The questionnaire should be used with some caution because it provides an *estimate* of risk. Used as a complement to a medical examination, it may help health care professionals to focus on patients likely to be at risk. Moreover, the format of the ÖMPSQ allows it to be used in a discussion of the problem with the patient. It may, therefore, promote the discussion of psychological factors influencing the problem, and it may help professionals to recommend treatments that would encompass psychological factors.

The present results point to the need for further research. In addition to testing the ÖMPSQ in different populations and settings, future research may need to focus on comparing the results of the ÖMPSQ with clinicians' ratings based on their usual clinical assessment. This would provide a valuable reference point from which to judge clinical utility. More work is also needed to evaluate the utility of the ÖMPSQ with regard to predicting physical function versus absenteeism due to sickness. Finally, another area for research is exploring possible subscales that may enhance isolating problem areas for individual patients.

In conclusion, this study replicates earlier findings demonstrating that self-reported answers to psychological factors are related to future functional problems, including absenteeism due to sickness. The ÖMPSQ may be recommended as a tool in the early identification of patients who risk developing long-term functional problems in relation to their pain.

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