The joint contribution of physical pathology, pain-related fear and catastrophizing to chronic back pain disability.

Citation for published version (APA):


Document status and date:
Published: 01/01/2005

DOI:
10.1016/j.pain.2004.09.033

Document Version:
Publisher's PDF, also known as Version of record

Document license:
Taverne

Please check the document version of this publication:

- A submitted manuscript is the version of the article upon submission and before peer-review. There can be important differences between the submitted version and the official published version of record.
- People interested in the research are advised to contact the author for the final version of the publication, or visit the DOI to the publisher's website.
- The final author version and the galley proof are versions of the publication after peer review.
- The final published version features the final layout of the paper including the volume, issue and page numbers.

Link to publication

General rights
Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain.
- You may freely distribute the URL identifying the publication in the public portal.

If the publication is distributed under the terms of Article 25fa of the Dutch Copyright Act, indicated by the “Taverne” license above, please follow below link for the End User Agreement:
www.umlib.nl/taverne-license

Take down policy
If you believe that this document breaches copyright please contact us at:
repository@maastrichtuniversity.nl
providing details and we will investigate your claim.

Download date: 16 Sep. 2023
The joint contribution of physical pathology, pain-related fear and catastrophizing to chronic back pain disability

Madelon L. Peters*, Johan W.S. Vlaeyen, Wim E.J. Weber

*Department of Medical, Clinical and Experimental Psychology, Maastricht University, P.O. Box 616, 6200 MD Maastricht, The Netherlands
bDepartment of Neurology, University Hospital Maastricht, Maastricht, The Netherlands

Received 27 July 2004; received in revised form 17 September 2004; accepted 27 September 2004

Abstract

The present study examined the contribution of physical pathology, pain-related fear and catastrophizing cognitions to pain intensity and disability in 100 patients with non-specific low back pain. Self-report instruments were completed as part of the intake procedure of patients, while physical pathology was quantified from medical charts using the MEDICS procedure. Results of the multiple regression analyses, adjusted for relevant demographic variables, pain intensity and pain duration, indicated that physical pathology was associated with pain intensity, but not with self-reported physical disability. Disability showed the strongest association with pain intensity. However, pain-related fear and catastrophizing contributed 4–10% additional explained variance to the regression models for pain intensity and disability. Thus, this study confirms the relationship between biological and psychological variables in determining the severity of low back pain complaints, and underscores the necessity for a multidisciplinary approach to diagnostics and intervention.

© 2004 International Association for the Study of Pain. Published by Elsevier B.V. All rights reserved.

Keywords: Biopsychosocial model of chronic pain; Physical pathology; Catastrophizing; Pain-related fear; Pain intensity; Disability

1. Introduction

According to biopsychosocial models of chronic pain, low back pain disability is the result of multiple influencing variables (Novy et al., 1995; Turk and Okifuji, 2002; Waddell, 2004a). During the last decade the contribution of psychological factors to physical disability and the process of chronicization in low back pain has been firmly established. Especially pain-related fear and catastrophizing (an exaggerated negative appraisal of pain and its meaning) appear to be prominent factors hampering functional recovery form an acute back pain episode (Burton et al., 1995; Fritz et al., 2001; Klenerman et al., 1995; Picavet et al., 2002) and augmenting disability (McCracken et al., 1992, 1996; Sullivan et al., 2001).

To do justice to the biopsychosocial perspective, studies on back pain disability should include both psychosocial and medical–physical factors. Most studies on the role of psychosocial factors have indeed adjusted their analyses for demographic factors and pain intensity and then established the additional variance explained by entering the relevant psychological predictors. Few studies have tried to include other medical–physical factors, like the degree of objectively assessed physical pathology (Mannion et al., 2001), possibly due to problems with quantification. Several attempts have been made to objectively assess the extent of physical pathology, but there is no consensus with respect to the best measure. Rudy et al. (1990) have proposed the MEDICS as a simple, reliable and unbiased index of pathology. It is based on a weighted score of 18 common biomedical procedures for chronic pain.

Two previous studies have examined the contribution of physical pathology as assessed by the MEDICS to self-reported disability and pain intensity in chronic pain patients. In a study with 33 low back pain patients, Vlaeyen et al. (1995) found that physical pathology was not predictive of disability, whereas pain-related fear was.
Severeijns et al. (2001) studied a group of 211 patients with heterogeneous pain complaints (54 of whom had back pain). The contribution of catastrophizing and physical pathology to pain intensity, pain interference, life control and psychological distress was examined. Catastrophizing proved to be the most potent predictor of each of the outcome variables but physical pathology did make a modest contribution to the explained variance in pain intensity and pain interference.

The present study further examines the contribution of physical pathology and pain-related fear/catastrophizing in explaining pain intensity and disability in low back pain patients. As a secondary issue, the interrelationship between physical pathology and pain-related fear and catastrophizing is examined. It may be proposed that knowing that one has a structural or functional abnormality can provoke fearful cognitions about pain (e.g. ‘My pain will never go away’; ‘I should avoid activities in order to prevent further damage to my body’).

Pain-related fear, catastrophizing, pain intensity and disability were assessed with self-report questionnaires as part of the intake procedure. Physical pathology was scored from patients’ medical charts.

2. Methods

2.1. Subjects

One hundred patients (44 males, 56 females) with non-specific low back pain who presented themselves to the outpatient’s clinic for pain management of the University Hospital Maastricht enrolled in this study. Mean age of patients was 49.9 years (range 22–82), 81% were married or living together with a partner and 78% had children. Educational level was as follows: 55% of patients attended elementary school or lower vocational training, 19% attended lower secondary education, and 16% higher secondary education. Mean duration of pain complaints was 6.5 years (range 1–34 years).

2.2. Measures

2.2.1. Physical pathology

The Medical Evaluation and Diagnostic Information Coding System (MEDICS) was used to quantify biomedical signs and symptoms. The MEDICS consists of 18 biomedical procedures commonly used in the examination of chronic pain patients. Procedures were selected and given a weight according to their relevance in chronic pain on the basis of consensus judgement by physicians specialized in pain treatment (Rudy et al., 1988). Research on the reliability of the MEDICS demonstrated that the weighted aggregation of the 18 items into a total pathology index had an inter-rater reliability of >0.80 (Rudy et al., 1990).

For the present study, a medical student, supervised by a neurologist (W.E.J.W.), examined the medical chart of each patient and entered the absence or presence of positive findings in the MEDICS computer program (Rudy, 1993). In developing the instrument, Rudy and colleagues have demonstrated that the dichotomous judgements that form the basis of the total pathology score can reliably be made from the patient chart without prior training (Rudy et al., 1990). The computer generated T-score of total pathology has a mean of 50 and SD of 10, based on 1604 MEDICS scores from a heterogeneous group of pain patients from the University of Pittsburg Pain Evaluation and Treatment Institute (Rudy, 1993).

2.2.2. Disability

Self-reported disability was measured by the Quebec Back Pain Disability Scale (QBPDS) (Kopec et al., 1995). Patients score perceived difficulty with simple physical activities (e.g. getting out of bed, climbing a stair, standing for 30 min). The questionnaire consists of 20 items which are grouped into six areas: rest/bed, sit/stand, walk, range of motion, bending and lifting/carrying. Each activity is scored on a 6-point scale (0= not difficult at all; 5= unable to do), giving the QBPDS a theoretical range of 0–100. Higher scores denote more disability. Test–retest reliability and construct validity of the English, French and Dutch versions of the questionnaire are good (Kopec et al., 1995; Schoppink et al., 1996; Yvanes Thomas et al., 2002). For the Dutch version, a test–retest reliability of 0.90 (ICC) was reported, and the agreement with the more widely used Roland Disability Questionnaire (Roland and Morris, 1983) was high, ranging from 0.80 to 0.91 (Schoppink et al., 1996).

2.2.3. Pain intensity

Present pain intensity was rated on a 10 cm visual analog scale (VAS) with the anchors ‘no pain at all’ and ‘unbearable pain’.

2.2.4. Pain catastrophizing

A Dutch version of the Pain Catastrophizing Scale (PCS) was used, a 13-item questionnaire measuring exaggerated negative thoughts about the meaning of pain (Sullivan et al., 1995). Items are scored on a 5-point scale and scores range from 0 to 52. In addition to a total PCS scale, three subscale scores can be obtained: rumination, magnification and helplessness. The three subscales have been confirmed for the Dutch version of the PCS (Van Damme et al., 2002).

2.2.5. Pain-related fear

The Pain Anxiety Symptoms Scale (PASS) is a 40-item questionnaire (McCracken et al., 1992). Items are scored on a 6-point scale and a total PASS score and four subscales can be derived: fearful appraisal, cognitive anxiety, physiological anxiety and escape and avoidance, with each subscale ranging from 0 to 50. The psychometric properties of the Dutch version of the PASS were found to be satisfactory (Roelofs et al., 2004a).

The Tampa Scale of Kinesiophobia (TSK, Kori et al., 1990) is a 17-item questionnaire measuring fear of movement and (re)injury. Items are scored on a 4-point scale giving a theoretical range on the TSK of 17–68. Reliability and validity have been confirmed for the Dutch version of the TSK (Roelofs et al., 2004b).

2.2.6. Procedure

Self-report instruments were completed as part of the intake procedure. Patients referred to the university pain clinic received a set of questionnaires by mail that had to be returned before their first appointment at the clinic. Of the 642 consecutive referrals that returned the questionnaires, 583 gave permission to use their data.
for research purposes by means of written informed consent. The total dataset included 219 patients with back pain as the primary complaint, and the medical charts of these patients were examined in order of appearance in the file until 100 valid cases for inclusion in the present study were found (i.e. patients for whom diagnostic procedures were completed and without indication of a specific condition, e.g. malignant disease, Bechterev disease). A total of 128 charts had to be screened to obtain 100 valid cases.

3. Results

3.1. Descriptive data

Patients reported a mean pain intensity of 69 on the VAS (SD = 20.3). The mean disability score on the QBPDS was 61.5 (SD = 15.9), which is considerably higher than previously reported for a sample of chronic low back pain patients in the Netherlands (Reneman et al., 2002: mean = 37.8, SD = 15.7; Schoppink et al., 1996: mean = 33.0, SD = 18.5). The score can be interpreted as signifying that patients experience ‘a fair amount of difficulty’ in performing simple tasks (mean item score of 3).

The average number of diagnostic procedures performed for the patients in the study was 12 (range 7–17), with an average of three procedures showing abnormal findings (range 0–7). The weighted total pathology score on the MEDICS was 41.1 (SD = 7.24; range: 23–56) demonstrating that most patients in the present sample had a level of objectively identified pathology that was lower than that of a heterogeneous group of North American pain clinic patients, which constituted the original norm group (Rudy, 1993; T-score with mean = 50, SD = 10) and lower than what has been found for fibromyalgia patients (mean = 50.7, SD = 11.1; Turk and Okifuji, 1997).

There were no significant differences between male and female patients in pain intensity, disability or physical pathology.

3.2. Zero-order correlations

Table 1 shows simple correlations between physical pathology, pain intensity and disability and the psychological variables. Physical pathology showed significant but modest correlations with disability but not with pain intensity, pain-related fear or pain catastrophizing. Disability was significantly associated with pain intensity and with the PCS, PASS and TSK.

3.3. Prediction of physical pathology

Linear regression analysis indicated that physical pathology was not significantly predicted by demographic variables (age, sex and education) or by duration of complaints.

3.4. Prediction of pain intensity

Hierarchical linear regression analysis was used to establish which factors contributed to present pain intensity. In the first step, control variables were entered (age, sex, education and pain duration). In the second step, the physical pathology score was added to the model and finally, in the last step the psychological predictors (TSK, PASS and PCS). Multicollinearity statistics (VIF < 3) indicated a problem when PASS and PCS were entered simultaneously in a single analysis, and therefore in step 3 either PCS and TSK or PASS and TSK were entered. Table 2 shows the results of these analyses.

Table 1

<table>
<thead>
<tr>
<th>Physical pathology (MEDICS)</th>
<th>Disability (QBPDS)</th>
<th>Present pain</th>
<th>PCS</th>
<th>PASS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disability (QBPDS)</td>
<td>0.22*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Present pain</td>
<td>0.20</td>
<td>0.44**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PCS</td>
<td>0.04</td>
<td>0.33**</td>
<td>0.25*</td>
<td></td>
</tr>
<tr>
<td>PASS</td>
<td>-0.01</td>
<td>0.40**</td>
<td>0.30**</td>
<td>0.77**</td>
</tr>
<tr>
<td>TSK</td>
<td>-0.04</td>
<td>0.27**</td>
<td>0.12</td>
<td>0.63**</td>
</tr>
</tbody>
</table>

*p < 0.05.

Table 2

Results of hierarchical regression analysis with pain intensity as dependent variable

<table>
<thead>
<tr>
<th></th>
<th>Stand. β</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R² = 0.11, F = 2.82, P = 0.030</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td>-0.04</td>
<td>0.699</td>
</tr>
<tr>
<td>Age</td>
<td>-0.27</td>
<td>0.010</td>
</tr>
<tr>
<td>Education</td>
<td>-0.20</td>
<td>0.053</td>
</tr>
<tr>
<td>Pain duration</td>
<td>-0.09</td>
<td>0.362</td>
</tr>
<tr>
<td>Step 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R² = 0.16, F = 3.24, P = 0.010</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td>0.01</td>
<td>0.952</td>
</tr>
<tr>
<td>Age</td>
<td>-0.29</td>
<td>0.005</td>
</tr>
<tr>
<td>Education</td>
<td>-0.21</td>
<td>0.036</td>
</tr>
<tr>
<td>Pain duration</td>
<td>-0.07</td>
<td>0.490</td>
</tr>
<tr>
<td>MEDICS</td>
<td>0.22</td>
<td>0.037</td>
</tr>
<tr>
<td>Step 3a</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R² = 0.22, F = 4.06, P = 0.001</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td>0.01</td>
<td>0.937</td>
</tr>
<tr>
<td>Age</td>
<td>-0.32</td>
<td>0.002</td>
</tr>
<tr>
<td>Education</td>
<td>-0.16</td>
<td>0.131</td>
</tr>
<tr>
<td>Pain duration</td>
<td>-0.08</td>
<td>0.452</td>
</tr>
<tr>
<td>MEDICS</td>
<td>0.22</td>
<td>0.029</td>
</tr>
<tr>
<td>PCS</td>
<td>0.24</td>
<td>0.023</td>
</tr>
</tbody>
</table>

Step 3b: R² = 0.25, F = 4.67, P < 0.001

<table>
<thead>
<tr>
<th></th>
<th>Stand. β</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td>0.02</td>
<td>0.812</td>
</tr>
<tr>
<td>Age</td>
<td>-0.32</td>
<td>0.001</td>
</tr>
<tr>
<td>Education</td>
<td>-0.13</td>
<td>0.197</td>
</tr>
<tr>
<td>Pain duration</td>
<td>-0.04</td>
<td>0.698</td>
</tr>
<tr>
<td>MEDICS</td>
<td>0.23</td>
<td>0.018</td>
</tr>
<tr>
<td>PASS</td>
<td>0.31</td>
<td>0.002</td>
</tr>
</tbody>
</table>
Age and education were significantly related to pain intensity (step 1). The physical pathology score significantly added to total explained variance (step 2: $R^2$-change = 0.044, $P = 0.034$). In step 3, both the PCS and PASS added unique variance to the model (6 and 10%, respectively; $R^2$-change for step 3 = 0.049, $P = 0.023$ for PCS and $R^2$-change = 0.088, $P = 0.002$ for PASS). TSK score did not significantly contribute to the explanation of pain intensity and was removed from the model. The other significant variables in the final model were age and total physical pathology, explaining 10 and 5% of total variance in pain intensity.

Analyses were repeated for the subscales of the PCS and PASS separately. All PCS subscales had about equal predictive power for pain intensity ($\beta$s = 0.21–0.24; $P < 0.05$). For the PASS, there were small differences in predictive power between the four subscales, with the fearful appraisal and physiological anxiety subscales showing the strongest association ($\beta = 0.30$; $P < 0.05$ for both subscales) and cognitive anxiety and avoidance the least association with pain intensity (respective $\beta$s = 0.25 and 0.24; $P < 0.05$).

### 3.5. Prediction of disability

The next series of hierarchical regression analyses tested which variables predicted disability as measured with the QBPDS. Step 1 again included demographic variables and pain duration, step 2 the physical pathology score and in step 3, present pain intensity was added to the model. Finally, in step 4 the psychological predictors (PCS, PASS and TSK) were entered. Again, to avoid multicollinearity PCS and PASS were entered in separate analyses. Results are shown in Table 3. In steps 1 and 2, only education was significantly related to disability. Physical pathology showed a trend towards significance in step 2, but when in pain intensity was added to the model in step 3, the association between physical pathology and disability disappeared. In step 4, the TSK contributed 4% additional explained variance to the model, but pain intensity remained the strongest predictor of disability, explaining 17% of total variance in disability.

Neither PCS nor PASS significantly contributed to total explained variance and these variables were removed from the final model.

### 4. Discussion

The present study replicated previous findings that catastrophizing and pain-related fear are important predictors of present pain intensity and disability in patients with low back pain, after adjusting for relevant demographic and biomedical variables. For pain intensity, four significant predictors were identified: age (younger patients reported more pain), objectively assessed physical pathology, pain catastrophizing and fear of pain. Age and fear of pain appeared to be the most potent predictors, each explaining about 10% of the variance in pain intensity. Self-reported disability was mainly determined by pain intensity and fear of movement, with pain intensity explaining the largest part (i.e. 17%) of total variance in disability. Fear of movement contributed an additional 4%. There was no association between objective physical pathology and either pain-related fear or catastrophizing.

Our results are in accordance with the findings of a previous study by Severeijns et al. (2001) who also reported that both physical pathology as assessed by MEDICS and pain catastrophizing were significantly related to pain intensity. Our study also showed that fear of pain (PASS) was an even stronger predictor of present pain intensity than catastrophizing, while fear of movement/(re)injury was unrelated to present pain. This corresponds to the results reported by McCracken et al. (1996) that the PASS but not the Fear Avoidance Beliefs Questionnaire—which is rather similar in content to the TSK—was significantly related to pain intensity (McCracken et al., 1996). With regard to the four subscales of the PASS, the association with pain intensity was somewhat stronger for the fearful appraisal and physiological anxiety subscales than for the cognitive anxiety and avoidance subscales, which is also in accordance with previous studies (McCracken et al., 1992, 1996).
For disability, a somewhat different pattern of association was found than for pain intensity. Physical pathology was not significantly related to disability, while fear of movement/(re)injury did contribute to total explained variance, replicating the results by Vlaeyen et al. (1995). Also similar to this study, fear of movement/(re)injury proved to be a better predictor than catastrophizing, which had a non-significant contribution to disability. Other studies which have directly compared the predictive power of catastrophizing and fear of movement/(re)injury as measured by the TSK (Crombez et al., 1999) or fear-avoidance beliefs as measured by the FABQ (Woby et al., 2004) have similarly found that with simultaneous entry of both predictors in the regression analysis, only the fear measures were significantly related to disability.

The strongest predictor of disability proved to be pain intensity, explaining 17% of the variance in disability after adjusting for demographic variables and physical pathology. There is some controversy in the literature concerning the relation between pain intensity and disability in non-specific low back pain. Some studies have found only a very modest association (Vlaeyen et al., 1995; Waddell et al., 1992, 1993) and it has been claimed that in general pain intensity accounts for not more than 10% of the variance in self-reported disability (Waddell, 2004b). However, other studies have reported that pain intensity does account for a relatively large proportion of variance in disability with percentages close to what we found in the present study (Mannion et al., 2001; van den Hout et al., 2001; Woby et al., 2004). Nevertheless, independent of the exact degree of association between pain intensity and disability, the large majority of studies, including the present one, demonstrate that pain-related fear explains additional variance and is indeed an important predictor of disability (Crombez et al., 1999; Mannion et al., 2001; McCracken et al., 1992, 1996; Pfingsten et al., 2000; Vlaeyen et al., 1995; Woby et al., 2004).

It should be noted that whereas physical pathology was significantly related to pain intensity, it was not a significant predictor of disability in the regression analysis. However, simple correlations did show an association between physical pathology and disability, and also in the second step of the hierarchical regression analysis a trend towards an association was found. After pain intensity was added to the model, this association disappeared. Therefore, it may be proposed that the (modest) contribution of physical pathology to disability is mediated by pain intensity.

We found no associations between PCS, PASS or TSK and physical pathology. It was speculated that knowing one has a structural or physiological abnormality could be a stimulus for inducing fearful cognitions about the meaning of pain (e.g. ‘movement sustains the harm to my body’). One study has indeed found findings from physical examination and catastrophizing were significantly related to each other (Main and Waddell, 1991), but the two previous studies using the MEDICS procedure did not find an association between physical pathology and catastrophizing or fear of movement (Severeijns et al., 2001; Vlaeyen et al., 1995). It may be proposed that the difference between studies can be traced back to the different methodology of assessing physical pathology. The method used by Main and Waddell includes both structural (e.g. spinal fractures, nerve compression) and functional (lumbar flexion, straight leg raising) characteristics, while MEDICS includes relatively little performance based assessment procedures. Functional performance based measures probably rely just as much on people’s cognitive and emotional reactions towards pain, and on motivation and effort, than on the underlying physical or physiological disorder (Waddell, 2004b).

It should be admitted that the total amount of variance in pain intensity and disability that could be explained by the variables included in the present study is still modest, i.e. 25% for pain intensity and 33% for disability. Other variables and complex interactions between variables are likely to be involved. Nevertheless, the present study testifies to the interplay of biological and psychological variables in determining low back pain complaints. Both objectively assessed physical pathology as well as pain-related fear and catastrophizing influenced pain intensity. Functional disability was affected by pain intensity and by fear of movement/(re)injury. The differential pattern of prediction we found for the psychological variables may indicate that catastrophizing about pain and fear of pain lead to a preoccupation with pain and a heightened awareness of pain signals, thereby directly increasing pain perception (cf. Sullivan et al., 2001). Fear of movement and getting (re)injured on the other hand may have mainly behavioral consequences, namely avoidance of movement to prevent the occurrence of harmful consequences to the body, finally leading to a state of disuse and increased disability (Lethem et al., 1983; Vlaeyen and Linton, 2000).

This study once more underscores the importance of cognitive behavioral interventions for chronic pain, and suggests that targeting maladaptive pain cognitions and affective responses to pain may impact both on the level of pain and on functional limitations.

Acknowledgements

This study was conducted with the support of The Dutch Council of Scientific Research (NWO, grant # 904-65-090). We thank Luke Schoenmakers for examining the patient charts and obtaining a MEDICS score.

References


