Determinants of disability and functional capacity in patients with chronic low back pain
Schiphorst Preuper, Henrica Rosalien

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

Publication date:
2011

Link to publication in University of Groningen/UMCG research database

Citation for published version (APA):
Chapter 6

Psychological factors unrelated to activity level in patients with chronic musculoskeletal pain

Abstract

Background: Enhancement of physical activities is an important goal in rehabilitation programs for patients with chronic musculoskeletal pain (CMP). A relationship between activity level and psychological factors is suggested, but studied scarcely.

Aim: To explore the relationship between the activity level and psychological factors in patients with CMP.

Methods: Study design: cross-sectional, explorative. Participants: patients with CMP, admitted to outpatient multidisciplinary pain rehabilitation. Measures: activity level was measured by the RT3-accelerometer during one week; pain intensity was measured with a 100 mm VAS; depression, somatisation and distress were measured with Symptom Checklist-90-Revised (SCL-90-R); coping strategy with the Utrecht’s Coping List (UCL; scales active coping, passive coping, avoiding); fear of movement measured with Tampa Scale of Kinesiophobia (TSK), scale activity avoidance. Depending on data distribution, correlations between the mean number of activity counts and psychological factors were tested with Pearson or Spearman correlation coefficients.

Results: Fifty three patients were included: age mean 39.9 years (SD 11.3); activity counts per day mean 198243 (SD 78000); pain intensity mean 58 mm. (SD 27.7); SCL-90-R mean 149.4 (SD 42.5); UCL active coping mean 17.9 (SD 3.7); UCL passive coping mean 12.3 (SD 3.7); UCL avoiding mean 15.3 (SD 3.0); TSK total mean 35.4 (SD 7.4); TSK activity avoidance mean 16.9 (SD 4.7). Correlations between psychological factors and the mean number of activity counts per day ranged from $r = -0.27$ to 0.01 and were all non-significant ($p \geq 0.05$).

Conclusion: Psychological factors and activity level were unrelated in patients with CMP.
Introduction

Multidisciplinary pain rehabilitation programs (PRP) are effective in patients with chronic musculoskeletal pain (CMP) to improve level of activities, participation and general well-being [7,10,17,34]. Enhancement of physical activities is an important goal in PRP for patients with CMP. This is partly based on the hypothesis that physical deconditioning is related to the chronicity of pain [44]. The fear-avoidance theory [52] and avoidance-endurance theory [12] are models used to explain chronicity of pain and activity limitations. In the fear-avoidance model it has been postulated that a subgroup of patients with CMP is afraid of increasing physical activity level because they fear an increase of pain or (re)injury. These negative, catastrophizing thoughts will potentially lead to avoidance of physical activity [51]. In the long run, avoidance behavior may result in negative health consequences as disability, depression and disuse, which in turn may lower the threshold at which subsequent pain will be experienced [20,51]. The avoidance-endurance model identifies behavior, in which patients with CMP ignore pain in order to finish the activities they started. According to this model this will lead to an overuse of muscles and joints with a repetitive combination of muscular hyperactivity and pain [12]. These patients are likely to persist their activities until increasing pain prevents further activity [11,24] which subsequently can result in a low level of activity in the end too [45,51]. However, a relatively high activity level and little avoidance behaviour in patients with CMP demonstrated better physical and emotional functioning [22]. Psychosocial variables, such as depression, anxiety, distress, a passive coping style and fear avoidance beliefs, have been reported to be related to disability in patients with CMP, and are generally suggested to have more impact than biomedical or biomechanical factors on back pain disability [12,18,21,25,40]. Although there seems to be a relationship between psychological variables and activity limitation in patients with CMP robust evidence on the strength of these relations is unavailable.

It appears that the reported decline in physical activity, more than the actual level of physical activity, may be important in the self-reported disability of patients with low back pain [46]. The level of activities is often measured by questionnaires. Compared to healthy controls, measured activity levels of patients with CMP vary between normal [55] and low [36,37,41]. Because there is a discrepancy between self-report and more objective performance based measurements [9,26,44,56], it is recommended to perform objective measurements of physical activity [47]. Accelerometry (triaxial) is considered as the preferred method to measure daily physical activity [53]. The purpose of our study was to study the relationship between the activity level of patients with CMP and psychological variables. We hypothesized that higher levels of depression, somatisation and distress, passive or avoidant coping strategies and kinesiophobia would negatively relate to activity level, and that more active and confronting coping styles would positively relate to activity levels.
Methods

Study design
A cross-sectional and explorative study was performed. Patients were included by three physiatrists of the pain rehabilitation team. Data were collected prior to the pain rehabilitation program during regular intake procedures (care as usual).

Study sample
Hundred and nine patients with CMP, admitted to outpatient treatment by the multidisciplinary pain rehabilitation team of a university based rehabilitation clinic in the North of the Netherlands, were potentially included in this study. Inclusion criteria were: CMP existing longer than 6 weeks; indicated for pain rehabilitation; age older than 18 years; motivated to participate in the multidisciplinary outpatient pain rehabilitation program. Because data collection was part of regular clinical procedures, involvement of ethics committee was not needed. All patients provided written informed consent that their data could be used for research. Exclusion criteria were: co-morbidity with negative consequences for physical or mental functioning (i.e. cardiopulmonary problems, addiction, and psychiatric co-morbidity); insufficient knowledge of the Dutch language and ongoing treatment elsewhere for CMP. Inclusion took place from March 2007 to July 2008.

Measures
Physical Activity in daily life was measured with the RT3-accelerometer (Stayhealthy inc). The triaxial accelerometer is a valid instrument to measure activity counts in daily life in patients with chronic low back pain (CLBP) [43]. The correlation of the RT3 monitor to oxygen consumption measurement during physical activities is good ($r=0.85$) [32]. Inter-instrument reliability is sufficient (ICC=0.75; 95% confidence interval 0.46-0.95) [28]. Trunk acceleration is used as a measure of activity level. The vector sum of the acceleration in three orthogonal directions during one minute is expressed in a number of ‘counts’. Size and mass (including battery) of the RT3 were 7.1 x 5.6 x 2.8 cm and 65.2 g. It was attached to a belt, worn around the waist. Patients were instructed to wear the RT3 during waking hours, for seven days except during bathing, showering, or swimming. During this week patients performed their usual activities. In addition, patients recorded in a diary the moment of attaching the RT3 to the body in the morning and the moment of taking it off in the evening. In case they had to remove the RT3 during the day, the reason and the exact time-period was registered. Output was stored in a data memory chip within the accelerometer and was downloaded into computer after one week. To estimate habitual physical activity, at least five complete measuring days were required. One of these days had to be a weekend-day [39]. The first measuring day was not included in the calculations. The minimum number of hours of a day to be deemed complete was 12. ‘Complete’ was defined as having non-missing counts over
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at least 80% of a standard measurement day; with a standard measurement day defined as the length of time in which at least 70% of sample participants were wearing the monitor [4]. Physical activity in daily life was expressed as the total sum of counts registered per day [46].

Pain intensity was measured with a 100-mm VAS. The endpoints of the scale were anchored at zero with the words ‘no pain’ and at 100 mm with ‘unbearable pain’. Patients were asked about pain intensity on the moment they were filling out the scale, and the highest and lowest pain intensity during the last week.

Self-reported disability due to low back pain was measured by the Roland Morris Disability Questionnaire (RMDQ). Only the subgroup of patients with chronic low back pain (n=25) filled out this questionnaire. The RMDQ consists of 24 items. Each item is qualified with the phrase ‘because of my back pain’. Patients were asked to check if it applied to them past days. The items focus on a limited range of physical functions, such as walking, bending over, sitting, lying down, dressing, sleeping, self-care, and daily activities. The RMDQ score is calculated by summing the items checked. Items are not weighted. The scores range from 0, representing no disability, to 24, representing severe disability. The RMDQ is short, simple to complete, and readily understood by patients. Also, for the RMDQ score, cut-off scores are used; a RMDQ score equal to or higher than 15 is interpreted as high limited functioning. Construct validity, internal consistency and reproducibility of the RMDQ are good [2]. The Dutch version of the RMDQ has proven to be a reliable instrument to measure self-reported functional status in CLBP patients [3].

Psychosocial distress was measured with the Symptom Checklist-90–Revised (SCL-90-R) [1,5]. Patients were instructed to indicate the amount they were bothered by each of the distress symptoms during the preceding week. Patients rated 90 distress symptoms on a 5-point Likert scale with 1 being ‘not at all’ and 5 being ‘extremely’. Total scores can range from 90 to 450. A higher score means a patient experiences more distress. The statements are assigned to 8 dimensions reflecting various types of psychopathology: anxiety, agoraphobia, depression, somatisation, insufficiency, sensitivity, hostility, and insomnia. The Dutch Language Version was used [48]. In the general Dutch population, mean GSI score is 118 (SD=32). Reliability is good (r=0,97) [1,23].

Coping styles were measured with the Utrecht’s Coping List (UCL). This questionnaire consists of 47 questions concerning how patients deal with problematic situations in general. The following subscales are distinguished: palliative reaction, active coping, social support, avoidance, expression of emotions, passive coping, and coping self-statements. Scales active coping, passive coping, and avoidance were used in this study. A higher score means that a patient uses that specific coping style predominantly. Construct validity and reliability are
moderate to good ($r=0.64$ to 0.83) [35]. The UCL has been validated for patients with chronic pain [42].

Fear of (re)injury by physical movement or activity was measured with the Tampa Scale of Kinesiophobia (TSK) [38,49]. Items are rated on a 4-point scale from ‘strongly disagree’ to ‘strongly agree’. Total scores range from 17 to 68. Higher scores indicate stronger fear of (re) injury. The TSK has shown to be a reliable assessment tool for patients with chronic pain [50] and studies have supported a two-factor solution with subscales for activity avoidance and somatic focus [29,30]. Test-retest ICC coefficients ranged from 0.90 to 0.96. The TSK was significantly correlated to other fear avoidance questionnaires as Fear-Avoidance Beliefs Questionnaire (FABQ), Fear of Pain Questionnaire (FPQ) and Pain Catastrophizing Scale (PCS) [8].

Statistical analysis
The Kolgomorov-Smirnov test was performed to examine distribution of the variables. To examine the association between physical activity in daily life and psychological variables Spearman rank correlation coefficient was calculated in case of not-normally distributed data; Pearson’s correlation coefficient was calculated in case of normally distributed data. To test differences between two groups (included versus excluded patients) the independent T-test was used in case of normally distributed data. The Mann-Whitney U test was used in case of not-normally distributed data. A $p$ value of $p<0.05$ was considered statistical significant. All statistical analyses were performed using SPSS software.

Results
Study Sample
Out of a total of 109 patients who participated, data of $n=53$ patients could be used for this study. Patients were excluded for various reasons: 26 patients did not fill out the psychological questionnaires; 24 patients carried the accelerometer for less than 5 valid measuring days; 6 patients had technical problems with the accelerometer. The characteristics (age, gender, all psychological variables) of the excluded patients were not significantly different from the characteristics of the included patients.

Patient Characteristics
The study sample consisted of 37 females (70%) and 16 males (30%). Patient characteristics are shown in Table 1 (clinical variables) and Table 2 (psychological variables). All variables showed a normal distribution, with the exception of SCL-90-R-total, UCL passive coping, VAS Pain best moment and VAS Pain worst moment. Descriptive variables pain and RMDQ showed missing
data. Analysis revealed that differences in activity counts of patients with or without missing descriptive data were non-significant.

**Table 1.** Descriptive statistics of study sample: pain, self-reported disability and activity counts

<table>
<thead>
<tr>
<th></th>
<th>Mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years) n=53</td>
<td>39.9 (11.3)</td>
</tr>
<tr>
<td>VAS-Pain at present (scale 0-100 mm) n=38</td>
<td>58 (28)</td>
</tr>
<tr>
<td>VAS-Pain best moment (scale 0-100 mm) n=34</td>
<td>46 (32)</td>
</tr>
<tr>
<td>VAS-Pain worst moment (scale 0-100 mm) n=35</td>
<td>73 (27)</td>
</tr>
<tr>
<td>RMDQ (scale 0-24) n=25*</td>
<td>13 (4.7)</td>
</tr>
<tr>
<td>Mean number of counts per day n=53</td>
<td>198243 (78000)</td>
</tr>
</tbody>
</table>

VAS: Visual Analogue Scale; RMDQ: Roland Morris Disability Questionnaire
*Only the subgroup of patients with chronic low back pain (n=25) filled out the RMDQ

**Correlations**

Correlations between the psychosocial variables and the mean of the total amount of counts per day were very weak and non-significant (Table 2). Correlations between the sub-scales of the SCL-90-R, the sub-scales of the UCL and the mean of the total amount of activity counts per day were also non-significant (subscales not presented in the Table). Potential confounding factors gender and age did not independently associate significantly with physical activity.

**Table 2.** Descriptives of the psychological variables and correlations of psychological variables with activities (n=50-52)

<table>
<thead>
<tr>
<th></th>
<th>Descriptives Mean (SD)</th>
<th>Correlations with mean counts/day r_p or r_sp</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCL-90-R total (scale 90-450)</td>
<td>149.4 (42.5)</td>
<td>-0.24</td>
<td>0.10</td>
</tr>
<tr>
<td>UCL active coping (scale 7-21)</td>
<td>17.9 (3.7)</td>
<td>0.17</td>
<td>0.24</td>
</tr>
<tr>
<td>UCL avoiding (scale 8-28)</td>
<td>15.3 (3.0)</td>
<td>-0.27</td>
<td>0.05</td>
</tr>
<tr>
<td>UCL passive coping (scale 7-21)</td>
<td>12.3 (3.7)</td>
<td>-0.14</td>
<td>0.33</td>
</tr>
<tr>
<td>TSK total (scale 17-68)</td>
<td>35.4 (7.4)</td>
<td>-0.05</td>
<td>0.75</td>
</tr>
<tr>
<td>TSK activity avoidance (scale 8-32)</td>
<td>16.9 (4.7)</td>
<td>-0.04</td>
<td>0.79</td>
</tr>
</tbody>
</table>

SCL-90-R: Symptom Checklist-90– Revised; UCL: Utrecht Coping List; TSK: Tampa Scale of Kinesiophobia
Discussion and conclusions

This study was performed to explore the relationship between activity level and psychological factors (general distress, passive, avoiding or active coping style and fear-avoidance beliefs). Results revealed that psychological factors were unrelated to activity level in patients with CMP. All our predefined hypotheses were rejected.

One of the aims of PRP is to enhance physical activities, based on the hypothesis that physical deconditioning contributes to the chronification of CMP [49]. Psychological factors that are assumed to influence activity are treated in order to provide patients with healthy cognitions and coping styles to be able to be physically active despite of having pain. Our finding that distress, coping styles, fear of movement and physical activity level in patients with CMP are unrelated, may implicate that the influence of these psychological factors on activity level is overestimated.

All patients in this study were admitted to PRP, which implicates that they reported pain-related disabilities. Consequently patients with CMP without disabilities were not included, and this means that the results of this study can only be generalized to patients with CMP who are admitted to PRP. Similar cross-sectional studies have been done on this subject; the findings are not conflicting with our findings. A former study showed that the relationship between psychological factors and performance based and self-reported disability in patients with CLBP was non-significant or weak [33]. The relationship between pain and pain related fear and capacity, measured by the functional capacity evaluation, was weak or non-existent [27]. In order to find significant relationships between psychological factors and activity level it might be useful to distinguish relevant subgroups of patients with chronic pain [13].

In this study activity level was expressed as mean total sum of counts per day, which was found to be 198243 counts. Normative data are scarce. The activity level in the present study is similar to activity levels in a different study of 123 patients with sub-acute low back pain, in which the RT3 accelerometer was also used. The total group of patients was divided in two groups based on their score on the Baecke questionnaire: ‘formerly sedentary’ versus ‘formerly active lifestyle’. The first group showed a mean total amount of activity counts per day of 191812 counts; the second group: 216973 counts. The difference between these two groups was non-significant [46]. Study samples were not completely similar because patients of the latest study were in the sub-acute phase (i.e. having pain for 4-7 weeks) of back pain, while patients in our study were in the chronic phase (i.e. having pain for more than 3 months), and patients with different kinds of chronic musculoskeletal pain were included in the present study.

In the present study activity levels were measured, but not activity patterns. In other studies overall activity levels did not differ significantly between patients with CLBP and controls,
but the distribution of activities over the day seemed to differ. Patients with CLBP showed significantly higher activity levels in the morning (p<0.01) and significantly lower activity levels in the evening (p<0.01) compared to controls [54]. Fluctuations in (reported) activity level seemed more associated with the level of disability, compared to the mean (reported) activity level in patients with CLBP [15]. Because this finding has not been reproduced, care must be applied. However considering this finding, for future research it might be important to measure activity patterns in patients with CMP next to activity levels.

An important strength of our study is that activity level was objectively measured by the RT3 accelerometer, while other research on activity level in patients with CMP is mostly performed by using questionnaires, which show a discrepancy to more objective performance measurements [9,26,44]. Patients with CLBP with a higher level of depression, underestimated their daily activity level in a questionnaire, although their actual activity level was the same as the activity level of patients with a lower level of depression. Changes in mood may be related to patient’s reported activity level [16]. It seems therefore important to measure physical activity in daily life objectively. There may be several explanations for the non-existence of the association between psychological factors and activity level. The psychological variables ‘level of distress’, ‘active, passive, and avoiding coping styles’ and ‘fear of movement’ might have been inappropriately measured by the SCL-90-R, UCL scales ‘active coping’, ‘passive coping’ and ‘avoiding’, and the TSK. The SCL-90-R, UCL and TSK however may be considered among the standards to measure distress, coping styles and fear of movement. Reliability of the SCL-90-R and TSK is good. SCL-90-R and TSK were significantly positively associated to other self-reported pain-related measures [8]. The UCL has been validated for use in CMP patients in the Netherlands [42] and validity and reliability are moderate to good [35]. Other psychological factors such as self-efficacy, motivation, acceptance and catastrophizing also seem to be determinants of disability in patients with CLBP [6,19]. However it seems that we measured distress, coping styles and fear of movement on an adequate way, in future it might be considered to explore the relationship between self-efficacy, motivation, acceptance, catastrophizing and activity level.

Furthermore physical activity might not have been appropriately measured. Physical activity was measured by the RT3 monitor which is a valid and reliable instrument for measuring daily activity level [31]. Considering it has to be attached to a belt, it underestimates activities performed by the upper extremities and might be more adequate in measuring walking activities than household activities [14]. Patients were instructed to take the RT3 monitor off during swimming or bathing activities; this can also attribute to an underestimation of the level of daily activities. To diminish the possible effect of wearing the accelerometer in being more (or less) active, the first measuring day was not included in the calculations. We assumed
that this effect is not present anymore during the following days. A substantial amount of patients could be included. Unfortunately, n=56 patients were excluded; 30 of which due of accelerometer related reasons. One of the reasons was that patients seemed to easily forget to carry the accelerometer. To diminish this problem in future in a next study, patients should be remembered daily to carry the accelerometer.

Psychological factors measured with the SCL-90-R, UCL and TSK show a non-existing or weak relationship to activity level measured by the RT3 accelerometer in patients with CMP. This might implicate that the relationship between psychological factors and activity level is less strong and may be more complicated than was expected. In clinical practice it seems important to realize that treating a patient’s fear of movement, distress or coping styles might not have an effect on his daily activity level. Future research should be aimed at exploring the influence of other psychological factors, such as catastrophizing, acceptance, motivation and self-efficacy on objectively measured and perceived activity patterns in patients with CMP. Subgroups of patients with CMP should be distinguished to provide more individualized treatment programmes.
References


36. Smeets RJ, Wittink H, Hidding A, Knottnerus JA. Do patients with chronic low back pain have a lower level of aerobic fitness than healthy controls?: are pain, disability, fear of injury, working status, or level of leisure time activity associated with the difference in aerobic fitness level? Spine 2006;31:90-7.


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