Personal and Societal Impact of Low Back Pain

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Personal and Societal Impact of Low Back Pain; the Groningen Spine Cohort

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Abstract

STUDY DESIGN: cross-sectional study

OBJECTIVE: To study the personal and societal impact of low back pain (LBP) in patients admitted to a multidisciplinary spine center.

SUMMARY OF BACKGROUND DATA: The socioeconomic burden of LBP is very high. A minority of patients visits secondary or tertiary care because of severe and long lasting complaints. This subgroup may account for a major part of disability and costs, yet could potentially gain most from treatment. Currently, little is known about the personal and societal burden in patients with chronic complex LBP visiting secondary/tertiary care.

METHODS: Baseline data were acquired through patient-reported questionnaires and health insurance claims. Primary outcomes were LBP impact (Impact Stratification, range 8-50), functioning (Pain Disability Index, PDI; 0-70), quality of life (EuroQol-5D, EQ5D; -0.33-1.00), work ability (Work Ability Score, WAS; 0-10), work participation, productivity costs (Productivity Cost Questionnaire, iPCQ), and healthcare costs one year prior to baseline. Healthcare costs were compared with matched primary and secondary care LBP samples. Descriptive and inferential statistics were applied.

RESULTS: In total 1502 patients (age 46.3±12.8 years, 57% female) were included. Impact Stratification was 35.2±7.5 with severe impact (≥35) for 58% of patients. PDI was 38.2±14.1, EQ5D 0.39 (interquartile range, IQR: 0.17;0.72); WAS 4.0 (IQR: 1.0;6.0) and 17% was permanently work disabled. Mean total healthcare costs (€4875, 95% CI: 4309;5498) were higher compared to the matched primary care sample (n=4995) (€2365, 95% CI: 2219;2526, p<0.001), and similar to the matched secondary care sample (n=4993) (€4379, 95% CI: 4309;5498).
Productivity loss was estimated at €4315 per patient (95% CI: 3898;4688) over six months.

CONCLUSION: In patients seeking multidisciplinary spine care, the personal and societal impact of LBP is very high. Specifically, quality of life and work ability are poor and healthcare costs are twice as high compared to patients seeking primary LBP care.

**Keywords:** chronic pain, multidisciplinary care, tertiary care, questionnaire, self-report, functioning, disability, quality of life, work ability, productivity loss, healthcare costs, health economics

**LEVEL OF EVIDENCE:** 3
Key points

1. Patients presenting in multidisciplinary secondary and tertiary spine care were severely impacted by their low back pain. Specifically, quality of life and work ability were poor.

2. Healthcare costs were twice as high compared to patients seeking primary LBP care.

3. Productivity costs were on average €4315 per patient, with 43% of employed patients reporting sick leave in the past six months.

4. Patients referred to multidisciplinary spine care by a medical specialist were more severely impacted than those referred by their GP.
Introduction

Low back pain (LBP) is the leading cause of disability in Western countries. Years lived with disability caused by LBP increased with 54% between 1990 and 2015 and continue to increase due to a growing and ageing population[1]. Although most people recover rather quickly from a new episode of LBP, one in five adults develops chronic disabling LBP[2]. As a result, the socioeconomic burden of LBP is very high. In Western countries the societal costs for back pain are estimated to be 1-2% of the gross national product[3-5]. The majority of these costs (80-90%) is caused by productivity loss and disability[3,6].

A minority of patients with LBP account for the majority of disability and it may be assumed that they account for the majority of costs as well. Less than 28% of LBP cases fall in severe categories, but are responsible for 77% of all years lived with disabilities[7]. This subgroup of patients with persistent disabling LBP has potentially most to gain from effective treatment. Current guidelines recommend multidisciplinary biopsychosocial treatment programs for patients with LBP who have not responded to first-line treatment[8-10]. However, for both multidisciplinary pain treatment and more invasive approaches, such as spinal surgery, there is only low to moderate level of evidence that intervention treatments are effective in the short and medium term. Furthermore, effect sizes are small to moderate and very little is known about the effectiveness of low back pain treatments in the longer term[11-14].

In 2015 the Groningen Spine Cohort (GSC) was initiated to gain a better understanding of the course and prognosis of pain, disability, quality of life, work participation, and medical consumption, as well as the quality and effectiveness of care in patients with LBP seeking multidisciplinary secondary or tertiary care. Data on short, medium, and long-term outcomes
of LBP are collected using medical records, health insurance data, and patient self-report. The GSC will serve as basis for multiple future studies.

In this first paper we present an extensive overview of all baseline patient characteristics. We also present healthcare costs and productivity costs to answer the following question: what is the personal and societal impact of LBP in patients presenting in multidisciplinary secondary and tertiary spine care?

**Materials and methods**

**Study design**

The GSC study is a ten year prospective cohort study of patients with LBP referred to a university-based multidisciplinary secondary (patient referred by general practitioner, GP) and tertiary (patient referred by medical specialist, MS) care spine center, the Groningen Spine Center, in the north of the Netherlands. Inclusion of patients ran from July 2015 to July 2018. Baseline and follow-up data are acquired through digital questionnaires and health insurance claims. Prior to first consultation, all patients digitally filled out a comprehensive set of baseline questionnaires (± 45 min). The present study reports results of the baseline questionnaires and presents an overview of health insurance costs one year prior to baseline and costs of productivity loss 6 months prior to baseline. The Medical Ethical Committee of the University Medical Center Groningen, the Netherlands provided a waiver (M15.169472) for this study with respect to medical ethical permission. Handling of the data was done in accordance with the guidelines for Good Research Practice[15].

**Patients and setting**

Patients referred to the Groningen Spine Center, between 18-65 years old, with LBP and/or leg pain were eligible for inclusion. All patients were informed on the purpose of the study
and signed an informed consent for the use of their health and insurance data based on anonymity. Patients who did not understand Dutch language or had no internet access were excluded. All patients received care as usual, and inclusion or exclusion did not change content of the treatment. Treatment could consist of minimal intervention only (reassurance, pain education and information), or could be combined with surgery, multidisciplinary rehabilitation, pain anesthesiology treatment, and/or other if needed (for example referral and treatment by a rheumatologist). Optimal triaging and treatment modalities of patients was discussed in a weekly multi-specialist meeting with neurosurgeons, neurologists, rehabilitation physicians, radiologists, orthopedic surgeons, anesthesiologists, and physician assistants.

Measures

Questionnaires

National Institutes of Health (NIH) Minimal Dataset

The NIH minimal dataset includes 40 items on patient characteristics, medical history, and self-reported symptoms and functioning[16]. Nine of these items (Numerical Rating Scale, NRS, pain, range: 0-10; 4 items on pain interference, range: 1-5; and 4 items on physical function, range: 1-5) were used to create an outcome score, the Impact Stratification. The total score on the Impact Stratification ranges from 8 (least impact) to 50 (most impact) and is classified by the NIH Research Task Force as mild (8-27 points), moderate (28-35 points), or severe impact (≥ 35 points)[16]. The Impact Stratification strongly correlates with measures such as the Roland Morris Disability Questionnaire and the Oswestry Disability Index[16].
Disability

The Pain Disability Index (PDI) measures self-reported disability for 7 categories of daily life activities; family/home responsibilities, recreation, social activity, occupation, sexual behavior, self-care, and life support activity. Each item is constructed on a numeric rating scale with 0 indicating no disability and 10 indicating maximum disability revealing total scores from 0 to 70. The Dutch version of the PDI is responsive and two-week test-retest reliability is good[17,18].

Quality of Life

Quality of life was measured with the three-level version of the Euroqol-5D (EQ5D) questionnaire[19]. Five dimensions (mobility, self-care, usual activities, pain/discomfort, and anxiety/depression) are measured on three levels each (no problems, some problems, extreme problems). Using a validated algorithm[20] the EQ5D scores can be converted into a utility value (ranging from -0.33 to 1). Validity, reliability, and responsiveness of the EuroQol-5D are sufficient[21,22]. In addition, patient-reported health status is measured on a visual analogue scale (EQ-VAS, range 0 – 100, worst to best health status).

Work Ability

The Work Ability Score (WAS) measures the self-reported current work ability compared to lifetime best. Scores range from 0 to 10, classified as excellent (10 points), good (8-9 points), moderate (6-7 points) and poor (0-5 points) work ability[23]. The WAS has been demonstrated to be a good quick alternative for the Work Ability Index (WAI) for assessing work ability in occupational and primary health care[24]. Convergent validity between the WAS and WAI is acceptable[25].
Psychosocial Work Environment

Psychosocial work environment was measured with a customized version of the short Copenhagen Psychosocial Questionnaire (COPSOQ II)[26]. Twenty-five items on a five-point Likert scale cover domains such as (mental) work demands, work organization and job contents, interpersonal relationship and leadership, and the work-individual interface. Test-retest reliability is adequate to good for the selected items of the customized version[27].

Productivity loss

Health related productivity losses were measured with the Institute for Medical Technology Assessment Productivity Cost Questionnaire (iPCQ)[28]. The iPCQ has a recall period of 4 weeks. Two modules measure productivity losses of paid work due to absenteeism and presenteeism. For the present study, the module on absenteeism was expanded with items specifying whether the absence of work was due to low back pain. The items on absenteeism and presenteeism have been validated[29].

Additional items

Additionally, at baseline patients answered medical and job-related questions about previous hospital visits and imaging for their current LBP (hospital, year, specialty, imaging type), LBP red flags (previous history of cancer, unexplained weight loss, pain worse at night, systemically unwell, prolonged use of corticosteroids, morning stiffness > 1 hour, recent trauma, predominant leg pain), use of pain medication (paracetamol, non-steroidal anti-inflammatory drugs, opioids, other), and job characteristics (weekly hours, responsibilities, physical demands, adjustments due to health concerns etc.)
Health insurance claims

Medical costs were obtained from patients who were insured with one of the main Dutch health insurance companies. We expected about 40% of GSC patients to be insured by this company. The Dutch health insurance system is based on managed competition and Dutch citizens are required to obtain a basic insurance package from a health insurer of their choice[30]. Out-of-pocket medical costs were not collected. Health insurance claims were collected one year retrospectively before inclusion. A 14-month delay in retrieving cost data was permitted to ensure that all claims were collected.

Data analyses

Health insurance costs

Both total health insurance costs and LBP related costs were calculated. LBP related costs were acquired by taking the sum of all health insurance claims that were likely to be related to LBP, e.g. claims for pain medication, physiotherapy, medical specialist consults, back related surgery, or other interventions. Health insurance costs of GSC patients were compared to health insurance costs of patients with LBP who did not seek tertiary LBP care. The health insurance company provided one year total health insurance costs for two matched (age/gender) samples of patients seeking primary (n=4995) or secondary care (n=4993) for LBP.

Costs of productivity loss

For the absenteeism module of the iPCQ patients reported the number of sick days in the past 4 weeks[28,31]. If a patient was on sick leave since before the 4-week recall period they also filled out the date the sick leave started. The number of sick days in the 4-week recall period were extrapolated to 6 months (26 weeks) before baseline by multiplying it by 6.5.
Absenteeism costs were then calculated by multiplying the total number of sick days by mean daily working hours and by costs of production loss per hour (2015; €31.80 for women, €38.10 for men)[31]. Absenteeism costs were calculated using the friction cost method (FCM), which assumes that after a period of 85 days another worker has fully replaced the absent patient[31-33]. This implies that patients who are disabled for work do not incur productivity costs anymore since they have been out of the productive process for more than 85 days. Costs of productivity loss due to presenteeism, i.e. working while sick, were calculated using the number of affected work hours, an efficiency score (numerical rating scale, 0-10) that patients ascribed to their ability to work during those hours, and by the costs of production loss per hour. The sum of costs due to absenteeism and presenteeism represents the total costs of productivity loss for paid work. Missing data on weekly work hours (in 14% of employed patients) and weekly work days (in 7% of employed patients) were handled with multiple imputation. Constraints were set on the minimum and maximum number of work hours (between 2 and 40 hours) and work days (between 1 and 5) per week.

Statistical analyses

Descriptive statistics were applied to present baseline patient characteristics. Continuous data are reported as means and standard deviations or medians and interquartile range (IQR), depending on the distribution of the data. Categorical data are presented as frequencies with percentages. Cost data are presented as means with 95% bootstrapped confidence intervals. Additionally, results on clinical and work-related primary outcome measures and health insurance data are presented separately for patients who were referred to the Groningen Spine Center by their GP or by an MS. Between group differences for the two referral subgroups were tested with an independent t-test, Mann-Whitney U, or Pearson Chi-Square depending on level of measurement and distribution of data. SPSS software (version 23.0, IBM Corp.,
Armonk, N.Y., USA) was used for data analysis. A p-value of \( \leq 0.05 \) was considered statistically significant.

**Results**

A total of 1502 patients from the Groningen Spine Cohort were included in this study (Figure 1 and Table 1). An extensive overview of patient characteristics and clinical baseline results per item can be found in Appendix 1, http://links.lww.com/BRS/B448. Patients had an average age of 46.3 ± 12.8 years and the majority (57%) was female. Apart from 41 patients, all patients had developed chronic (> 3 months) LBP. Exercise therapy was the most common type of treatment used (at any point in time) for LBP (88%), followed by opioids (53%), and low-back pain operation(s) (26%). The majority of patients (58%) had a score \( \geq 35 \) as measured with the Impact Stratification (severely impacted by the LBP). Quality of life was low with a median EQ5D utility score of 0.39 (IQR: 0.17;0.72) and a health state (EQ-VAS) score of 52.9 ± 19.7 out of 100. Patients scored their work ability a 4.0 (IQR: 1.0;6.0) out of 10 and 17% of patients were permanently work disabled (i.e. absenteeism exceeds two years). Compared to patients who were referred by their GP (57%), patients who were referred by an MS (43%) were older, lower educated, had more often received treatment in the form of surgery, opioids, or injections for LBP, were more disabled and more severely impacted by their LBP, scored lower on quality of life and were more often unemployed or on permanent work disability.

Health insurance costs were available for 436 patients (29%) (Table 2). Mean costs for the total GSC sample (€4875; 95% CI: 4309;5498) were significantly higher than for the matched primary care sample (€2365; 95% CI: 2219;2526; p<0.001) but did not differ significantly from the matched secondary care sample (€4379; CI: 4180;4590; p=0.23). Almost half (€2175; 95% CI: 1852;2547) of the total health insurance costs of GSC patients
in the year before visiting the Groningen Spine Center were back pain related. GSC patients who were referred to the Groningen Spine Center through their GP had significantly lower costs (€3458; 95% CI: 2898;4077) than those that were referred by an MS (€6851; 95% CI: 5648;8017; p<0.001).

A total of 387 out of 901 employed patients in the GSC reported sick days in the six months prior to visiting the Groningen Spine Center, which resulted in mean (friction) costs of €1615 (95% CI: 1392;1882) per GSC patient (Table 3). For 85% of patients LBP was the cause of their sick day(s) (€1380; 95% CI: 1181;1598). A total of 566 patients were affected by reduced productivity while at work, resulting in mean costs of €2700 (95% CI: 2442;2969) per GSC patient. Costs for absenteeism, absenteeism due to LBP, presenteeism, and total productivity loss were lower for patients referred by an MS than by their GP (presenteeism: p<0.05, absenteeism and total productivity loss: p<0.001).

Discussion

The objective of this study was to assess the personal and societal impact of LBP in patients seeking multidisciplinary secondary and tertiary spine care. We found that patients had an extensive medical history related to their LBP and presented with very low functioning and quality of life. A third of patients was either on sick leave or was permanently work disabled. Health insurance costs were twice as high compared to patients seeking primary LBP care and most employed patients reported productivity loss. Patients who were referred to the Groningen Spine Center by an MS were more severely impacted by their LBP than those referred by their GP.

Almost all patients referred to the Groningen Spine Center presented with chronic (>3 months) LBP. A wide variety of interacting biopsychosocial factors have been recognized to contribute to chronic disabling LBP and could have potentially played a role in the recurrence
and complexity of LBP in our patient sample[6]. Most notable in our cohort were the presence of leg pain[34,45], multi-site pain[34,36], catastrophizing[34], and feelings of depression and/or anxiety[34,36] (Appendix 1, http://links.lww.com/BRS/B448). Still, many factors and underlying mechanisms associated with the transition to persistent disabling LBP are yet unknown[6].

Two thirds of patients reported severe pain (NRS pain: >7), which aligns with other Dutch LBP and chronic pain samples in primary, secondary, and tertiary care[37-41]. Disability scores, as measured with the PDI, where also similar to those of Dutch chronic pain patients in secondary care[39,42]. Quality of life, however, was very low among GSC patients. The EQ5D utility score for the general Dutch adult population is approximately 0.91[43]. Patients with LBP in primary care scored on average between 0.61 and 0.67[37,40]. Higher scores were also observed in cancer studies, where the median utility score was 0.75[44]. While other studies have reported on one or few characteristics, this is the first study we know of that reported on multiple characteristics, all showing high personal impact, thus physical, psychological, social, and economic consequences of LBP for the individual patient. In addition, this study adds health insurance and productivity data, demonstrating high societal impact, as well.

Patients’ health insurance costs in the year prior to visiting the Groningen Spine Center were slightly higher compared to patients with LBP seeking secondary care, but twice as high compared to patients seeking primary LBP care. Healthcare consumption for the general Dutch population aged 20-65 years old is lower at approximately €2100 per year (source: www.vektis.nl/streams/open-data). Almost half of the insurance costs in our sample could be contributed to LBP related care. Higher LBP related costs (€4015) were reported in patients with discogenic LBP referred to specialized pain care[38]. However, that study also included direct non-medical costs such as travel costs. Overall, in the year leading up to seeking
multidisciplinary LBP care, GSC patients were likely to have already spent over two thousand euros on back pain related care.

The work ability of patients in the GSC was poor (median WAS: 4.0). Seventeen percent of patients were on permanent work disability, while on average 6% of the working age population in the Netherlands rely on disability benefits[45]. Return to work is associated with significant improvements in health[46,47], but unfortunately the probability of returning to work for patients on permanent work disability is low[48]. Work ability was higher, but still poor, for employed patients (median WAS: 5.0) and moderate for employed patients who were working fully (median WAS: 7.0). The average WAS score for non-sicklisted workers from a variety of work fields is 8.0 (SD: 1.1)[49].

Productivity loss costs due to absenteeism were €1615 per patient over six months. The majority (85%) of patients reporting sick leave did so due to back pain. Cost-of-illness studies are notoriously difficult to compare due to little standardization across studies and international variations in health economic guidelines. In the Netherlands, we have endorsed the FCM, which typically produces smaller estimates of productivity losses compared to the human capital method (ranging from twice to 19 times less costs)[50]. Using the FCM, a German study on patients with chronic LBP in primary care found significantly lower absenteeism costs of €577 over six months[51]. Assuming relatively constant productivity costs in the year before visiting a spine center, a Dutch study on patients in specialized LBP care, using the FCM, reported higher absenteeism costs (€3778) over a period of 12 months[38].

This study demonstrates that in higher levels of care there is a higher burden of LBP for patients. The impact on quality of life, work ability, and medical consumption is highest for patients seeking tertiary care (referred by MS), followed by secondary (referred by GP), and
primary LBP care. Results on societal costs on the other hand show that patients referred by their GP accrued higher costs than patients referred by an MS, as a result of productivity loss in the six months before baseline. This may seem counterintuitive, but can be partly explained by the fact that among the patients referred by their MS, the percentage not working and disabled was higher than in patients referred by the GP. Productivity costs can only be incurred by those currently having a paid job. Furthermore, a higher percentage of employed patients in the MS group compared to the GP group (28% vs 13%) were on sick leave for longer than 267 days (six months before baseline plus the 85 days friction period), which also lead to zero productivity costs within the applied FCM.

There are some limitations and considerations to this study. First, since the majority of data were collected through patient questionnaires, a potential self-reporting bias could have occurred[52]. Second, the calculated health consumption is an approximation of total medical costs because we did not include direct non-medical costs or out-of-pocket medical costs. Also, LBP related health care costs were probably slightly overestimated. All claims with a high probability of being LBP related were labeled as such but could still be utilized for different reasons (pain medication, for example). Nevertheless, a strength of our approach was the use of objective cost data instead of self-report, which excludes recall bias. Productivity loss data could be subjected to recall bias and extrapolating from a 4-week period to six months could under- or overestimate productivity loss costs. However, almost all patients reported chronic LBP, so we have reason to believe that productivity loss would not vary greatly over the six months prior to baseline.

Conclusion

In patients seeking multidisciplinary secondary and tertiary spine care, the personal and societal impact of LBP is very high. Despite having exhausted a wide variety of healthcare
resources, as demonstrated by an extensive medical history and high healthcare costs, functioning, quality of life and work ability are still very poor. Multidisciplinary spine care should target those patients that are most likely to respond to treatment in order to reduce the personal burden of LBP and to prevent further accumulation of healthcare costs and productivity loss.
References


Figure 1: Flow chart of patient inclusion

3571 patients were referred to the Spine Center between July 1st 2015 and July 1st 2018

2169 patients were eligible for inclusion

1402 patients were ineligible:
- 708 no LBP and/or leg pain
- 694 too young (<18 y) or too old (>65 y)

564 patients declined to participate

103 patients were excluded:
- 56 rejected before first visit
- 23 treatment elsewhere
- 12 withdrawal
- 3 incomplete data
- 9 other

1605 patients gave informed consent

1502 patients were included
Table 1: Baseline Characteristics of the Groningen Spine Cohort, a Summary of Clinical and Work Related Outcome Measures

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Total (n=1502)</th>
<th>Referred by GP (n=853)</th>
<th>Referred by MS (n=649)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, mean years ± SD</td>
<td>46.3 ± 12.8</td>
<td>45.3 ± 12.9*</td>
<td>47.5 ± 12.7*</td>
</tr>
<tr>
<td>Sex, n (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>857 (57)</td>
<td>474 (56)</td>
<td>383 (59)</td>
</tr>
<tr>
<td>Education level, n (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No education</td>
<td>29 (2)</td>
<td>19 (2)*</td>
<td>10 (2)*</td>
</tr>
<tr>
<td>Low</td>
<td>522 (35)</td>
<td>266 (31)*</td>
<td>256 (39)*</td>
</tr>
<tr>
<td>Middle</td>
<td>487 (32)</td>
<td>283 (33)*</td>
<td>204 (31)*</td>
</tr>
<tr>
<td>High</td>
<td>343 (23)</td>
<td>224 (26)*</td>
<td>119 (18)*</td>
</tr>
<tr>
<td>Other</td>
<td>121 (8)</td>
<td>71 (7)*</td>
<td>60 (9)*</td>
</tr>
<tr>
<td>Medical history</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Duration LBP, n (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 3 months</td>
<td>40 (3)</td>
<td>30 (4)</td>
<td>10 (2)</td>
</tr>
<tr>
<td>3 months – 1 year</td>
<td>240 (16)</td>
<td>139 (16)</td>
<td>101 (16)</td>
</tr>
<tr>
<td>1 – 5 years</td>
<td>527 (35)</td>
<td>278 (33)</td>
<td>249 (38)</td>
</tr>
<tr>
<td>&gt; 5 years</td>
<td>695 (46)</td>
<td>406 (48)</td>
<td>289 (45)</td>
</tr>
<tr>
<td>Previous medical imaging for current LBP, n (%)</td>
<td>1328 (88)</td>
<td>696 (82)*</td>
<td>632 (96)*</td>
</tr>
<tr>
<td>Visited medical specialist for current LBP, n (%)</td>
<td>822 (55)*</td>
<td>398 (47)*</td>
<td>424 (66)*</td>
</tr>
<tr>
<td>Previous low-back operation(s), n (%)</td>
<td>387 (26)</td>
<td>181 (21)*</td>
<td>206 (32)*</td>
</tr>
<tr>
<td>Treatment(s) used for LBP, n (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Opioids</td>
<td>803 (53)</td>
<td>418 (49)*</td>
<td>385 (59)*</td>
</tr>
<tr>
<td>Injections</td>
<td>328 (22)</td>
<td>147 (17)*</td>
<td>181 (28)*</td>
</tr>
<tr>
<td>Exercise Therapy</td>
<td>1316 (88)</td>
<td>785 (89)</td>
<td>558 (86)</td>
</tr>
<tr>
<td>Psychological counseling</td>
<td>222 (15)</td>
<td>128 (15)</td>
<td>94 (15)</td>
</tr>
<tr>
<td>Pain and functioning</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NRS score back pain (0-10), median (IQR)</td>
<td>7.0 (6.0;8.0)</td>
<td>7.0 (6.0;8.0)</td>
<td>7.0 (6.0;8.0)</td>
</tr>
<tr>
<td>PDI total (0-70), mean ± SD</td>
<td>38.2 ± 14.1</td>
<td>37.0 ± 14.1*</td>
<td>39.8 ± 13.8*</td>
</tr>
<tr>
<td>NIH minimal dataset Impact Stratification (8-50), mean ± SD</td>
<td>35.2 ± 7.5</td>
<td>34.7 ± 7.5*</td>
<td>36.0 ± 7.3*</td>
</tr>
<tr>
<td>Mild (8-27), n (%)</td>
<td>232 (16)</td>
<td>144 (17)*</td>
<td>88 (14)*</td>
</tr>
<tr>
<td>Moderate (28-34), n (%)</td>
<td>402 (26)</td>
<td>242 (28)*</td>
<td>160 (25)*</td>
</tr>
<tr>
<td>Severe (≥35), n (%)</td>
<td>868 (58)</td>
<td>467 (55)*</td>
<td>401 (62)*</td>
</tr>
<tr>
<td>Quality of life</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EQ5D: health state (0-100), mean ± SD</td>
<td>52.9 ± 19.7d</td>
<td>54.4 ± 19.8e*</td>
<td>51.1 ± 19.4d*</td>
</tr>
<tr>
<td>EQ5D: utility value (-0.33-1.00), median (IQR)</td>
<td>0.39</td>
<td>0.57 (0.19;0.73)*</td>
<td>0.30 (0.17;0.69)*</td>
</tr>
<tr>
<td>Work</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Work ability (0-10), median (IQR)</td>
<td>4.0 (1.0;6.0)</td>
<td>5.0 (1.0;6.0)*</td>
<td>3.0 (1.0;6.0)*</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>---------------</td>
<td>---------------</td>
<td>---------------</td>
</tr>
<tr>
<td>Work status, n (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not working</td>
<td>601 (40)</td>
<td>296 (35)*</td>
<td>305 (47)*</td>
</tr>
<tr>
<td>Permanent work disability</td>
<td>253 (17)</td>
<td>125 (15)*</td>
<td>128 (20)*</td>
</tr>
<tr>
<td>Employed</td>
<td>901 (60)</td>
<td>557 (65)*</td>
<td>344 (53)*</td>
</tr>
<tr>
<td>Working</td>
<td>409 (27)</td>
<td>271 (32)*</td>
<td>138 (21)*</td>
</tr>
<tr>
<td>Partial sick leave</td>
<td>260 (17)</td>
<td>161 (19)*</td>
<td>99 (15)*</td>
</tr>
<tr>
<td>Sick leave</td>
<td>232 (15)</td>
<td>125 (15)*</td>
<td>107 (17)*</td>
</tr>
</tbody>
</table>

N, number of patients; GP, general practitioner; MS, medical specialist; SD, standard deviation; LBP, low back pain; NRS, numerical rating scale; IQR, interquartile range: quartile 1 to quartile 3; PDI, pain disability index; NIH, National Institutes of Health; EQSD, Euroqol-5D
*p < 0.05

23 missing, b13 missing, c10 missing, d11 missing, e6 missing, f5 missing
Table 2: Health Insurance Costs in Euros One Year Prior to Receiving LBP Care

<table>
<thead>
<tr>
<th>Sample</th>
<th>N</th>
<th>Mean costs (CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Groningen Spine Cohort</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(secondary/tertiary care)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>All patients</td>
<td>436</td>
<td>4875 (4309;5498)</td>
</tr>
<tr>
<td>LBP related</td>
<td>435</td>
<td>2175 (1852;2547)</td>
</tr>
<tr>
<td>Patients referred by GP</td>
<td>254</td>
<td>3459 (2898;4077)</td>
</tr>
<tr>
<td>LBP related</td>
<td>253</td>
<td>1569 (1249;1947)</td>
</tr>
<tr>
<td>Patients referred by MS</td>
<td>182</td>
<td>6852 (5648;8017)</td>
</tr>
<tr>
<td>LBP related</td>
<td>182</td>
<td>3018 (2459;3719)</td>
</tr>
<tr>
<td>Matched controls</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary care</td>
<td>4995</td>
<td>2365 (2219;2526)</td>
</tr>
<tr>
<td>Secondary care</td>
<td>4993</td>
<td>4379 (4180;4590)</td>
</tr>
</tbody>
</table>

N, number of patients; CI, bootstrapped 95% confidence interval for mean: lower bound to upper bound; LBP, low back pain; GP, general practitioner; MS, medical specialist
| Table 3: Costs due to Productivity Loss in Euros Six Months Prior to Baseline (Friction Cost Approach) |
|---|---|---|---|
| | N | Mean costs per affected patient (CI) | Mean costs per GSC patient, n=1502 (CI) |
| Groningen Spine Cohort | | | |
| All employed patients (n=901) | | | |
| Absenteeism | Total | 387<sup>a</sup> | 6546 (5773;7305) | 1615 (1392;1882) |
| | LBP related | 328<sup>a</sup> | 6560 (5814;7269) | 1380 (1181;1598) |
| Presenteeism | Total | 566 | 7165 (6683;7683) | 2700 (2442;2969) |
| Total productivity loss | Total | 751<sup>a</sup> | 8773 (8190;9400) | 4315 (3898;4688) |
| Patients referred by GP (n=557) | | | |
| Absenteeism | Total | 231<sup>a</sup> | 7540 (6633;8469) | 1982 (1655;2328) |
| | LBP related | 196<sup>a</sup> | 7675 (6641;8823) | 1704 (1395;2065) |
| Presenteeism | Total | 357 | 7130 (6513;7807) | 2984 (2650;3312) |
| Total productivity loss | Total | 461<sup>a</sup> | 9300 (8423;10242) | 4966 (4435;5585) |
| Patients referred by MS (n=344) | | | |
| Absenteeism | Total | 156<sup>a</sup> | 5074 (4156;6017) | 1132 (866;1416) |
| | LBP related | 132<sup>a</sup> | 4903 (3859;5912) | 954 (710;1238) |
| Presenteeism | Total | 209 | 7225 (6388;8103) | 2327 (1968;2726) |
| Total productivity loss | Total | 290<sup>a</sup> | 7936 (6952;8985) | 3459 (2908;4059) |

N, number of patients; CI, bootstrapped 95% confidence interval for mean: lower bound to upper bound; LBP, low back pain; GP, general practitioner; MS, medical specialist

<sup>a</sup>Amount of patients that reported sick leave. Some patients still had zero costs as a result of their sick leave when using the friction cost method, which takes into account the replacement of absent workers after 85 days.