Accepted Manuscript

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PII: S1529-9430(17)31148-8
DOI: https://doi.org/10.1016/j.spinee.2017.10.071
Reference: SPINEE 57531

To appear in: *The Spine Journal*

Received date: 30-6-2017
Revised date: 18-10-2017
Accepted date: 26-10-2017

Please cite this article as: Kika Konstantinou, Kate M. Dunn, Reuben Ogollah, Martyn Lewis, Danielle van der Windt, Elaine M. Hay, on behalf of the ATLAS study team, Prognosis of sciatica and back-related leg pain in primary care: the ATLAS cohort., *The Spine Journal* (2017), https://doi.org/10.1016/j.spinee.2017.10.071.

Title page

Prognosis of sciatica and back-related leg pain in primary care: the ATLAS cohort.

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Funding

This paper presents independent research funded by the National Institute for Health Research (NIHR) under its Programme Grants for Applied Research Programme (Grant Reference Number RP-PG-0707-10131). K M Dunn has been supported by a Wellcome Trust Fellowship. K Konstantinou is funded by a HEFCE CAT Clinical Senior Lecturer Award. E M Hay is an NIHR Senior Investigator. The views expressed are those of the author(s) and not necessarily those of the NHS, the NIHR or the Department of Health.

Acknowledgements

We would like to thank the members of the ATLAS study research team, all the participating patients, clinicians and managers, and the funders. Danielle van der Windt is a member of PROGRESS; Medical Research Council Prognosis Research Strategy (PROGRESS) Partnership (G0902393/99558).

Ethics

Ethical approval for the ATLAS study was obtained from the South Birmingham Research Ethics Committee (REC ref. 10/H1207/82).

Abstract

Background context: Evidence is lacking on the prognosis and prognostic factors for back-related leg pain and sciatica in patients seeing their primary care physicians. This could guide timely appropriate treatment and referral decisions.

Purpose: To describe prognosis and prognostic factors in primary care patients with low back-related leg pain, and sciatica.

Study Design: Prospective cohort study

Patient Sample: Adults visiting their family doctor with back-related leg pain in the United Kingdom.

Outcome Measures: Information was collected on pain, function, psychological and clinical variables. Good outcome was defined as 30% or more reduction in disability (Roland-Morris Disability Questionnaire).

Methods: Participants completed questionnaires, underwent clinical assessments, received an MRI scan, and were followed-up 12-months later. Mixed-effects logistic regression evaluated the prognostic value of six a-priori defined variable sets (leg pain duration, pain intensity, neuropathic pain, psychological factors, clinical examination and imaging variables). A combined model including variables from all models examined independent effects. The National Institute for Health Research funded the study. There are no conflicts of interest.

Results: 609 patients were included. At 12-months, 55% improved in both the total sample and the sciatica group. For the whole cohort, longer leg pain duration (OR 0.41; CI 0.19 to 0.90), higher identity score (OR 0.70; CI 0.53 to 0.93) and patient's belief that the problem will last a long time (OR 0.27; CI 0.13 to 0.57) were the strongest independent prognostic factors negatively associated with improvement. These last two factors were similarly negatively associated with improvement in the sciatica subgroup.

Conclusions: This study provides new evidence on the prognosis and prognostic factors of back-related leg pain and sciatica in primary care. Just over half of patients improved at 12-months. Patient's belief of recovery timescale and number of other symptoms attributed to the pain are independent prognostic factors. These factors can be used to inform and direct decisions about timing and intensity of available therapeutic options.

Keywords: low back pain, sciatica, prognosis, prognostic factors, primary care

Introduction

Low back pain (LBP) is the leading cause of years lived with disability worldwide [1] and one of the most common reason for seeking healthcare for musculoskeletal pain [2]. Approximately 60% of those visiting primary care with LBP report back-related leg pain [3]. Some will have symptoms of nerve root entrapment (commonly described as sciatica), and

some will have referred leg pain which does not involve a nerve root. Both presentations are associated with worse overall outcomes compared to LBP alone [3,4]. The course of back-related leg pain and sciatica in primary care is often conflated with that of non-specific LBP, as most LBP cohorts include patients with and without leg symptoms [5] and initial management advice is similar for both non-specific and sciatica presentations [6].

Given the high probability of long-standing pain and disability in non-specific LBP, and limited potential for diagnostic information to guide clinical decision-making, much research has focused on describing prognosis and identifying prognostic factors [7,8] which supports planning of healthcare resources and can underpin appropriate management decisions. Knowledge about prognostic factors in LBP seems to have led to better treatment decision making and improved health and cost outcomes [9]. Such evidence is scarce for patients resenting to primary care with back-related leg pain and sciatica [10,11]. The limited, and sometimes conflicting, evidence regarding prognostic factors in patients with sciatica hampers effective targeting of available treatments [10-14], hence the current model of care is a 'stepped' escalation of available interventions [15].

Systematic reviews of predominantly secondary care cohorts indicate that factors such as age, gender, smoking, occupational workload and neurological deficits are unlikely to be associated with outcome in sciatica [10-12]. High leg pain intensity predicted surgical intervention (which is a proxy for poor outcome with conservative management) [11], although this factor was not significantly associated with outcome in recent research [16]. For sciatica in particular, authors have suggested that clinical decision making is hampered by the lack of evidence on prognostic factors and the almost non-existent evidence from primary care, the setting where most patients are assessed and managed [11]. Studies investigating prognosis and prognostic factors in back-related leg pain including sciatica, with a focus in primary care, are therefore needed.

The aims of this study were: a) to describe the overall prognosis, b) better understand the associations between potentially important prognostic factors and disability, and c) identify the strongest factors independently associated with disability.

Methods

Study design and participant recruitment procedures

This is a prospective cohort study including patients aged 18 years and over, visiting their family doctor (general practitioner (GP)) with symptoms of low back-related leg pain, including sciatica, of any severity and duration. The project was approved in accordance with the agreed procedure with the South Birmingham Research Ethics Committee (REC ref. 10/H1207/82). The study protocol, baseline assessments and patients' characteristics are reported in detail elsewhere [17,18]. Here we give brief details of the recruitment process. Potentially eligible patients were identified consecutively at the GP consultation, and through weekly downloads of electronic records with a diagnostic code of low back-related leg pain. Patients were sent a letter with an invitation to telephone the research centre to make an appointment at the initial research clinic, information about the study, and baseline questionnaires capturing sociodemographic, pain, psychological and health variables. At the research clinic, patients underwent a standardised clinical examination by a physiotherapist with experience in assessment and management of LBP and sciatica, and eligibility was further assessed. Patients were diagnosed having sciatica or referred (non-specific) leg pain based on the examiner's clinical opinion. In the context of the study, sciatica diagnosis is indicative of radicular pain with or without radiculopathy (nerve root involvement/compression). A reliability study nested in this cohort, showed acceptable agreement on diagnosis [19]. Exclusion criteria were 'red flag' symptoms, language problems, previous spinal surgery, being pregnant, serious mental and/or physical disorders

and currently receiving treatment (other than GP care) for the same problem. Consenting, eligible patients without contraindications to magnetic resonance imaging (MRI) received a scan within 2 weeks of their baseline examination (details of the scan parameters and reporting are fully described elsewhere [17]). Patients completed self-reported questionnaires at baseline, 4 and 12-months. Patients received evidence-based care according to current national and international guidelines on the management of LBP and sciatica, which was recorded on case report forms, and their participation in the study did not confer any specific advantages or benefits as a result. The results of the MRI scan were not included in initial diagnosis and decisions about patient care, this reflects normal practice in primary care settings. However, the MRI findings for each patient were correlated with the clinical presentation for the MRI variable of 'presence/absence of nerve root compression'.

Primary outcome measure

The Roland-Morris Disability Questionnaire (RMDQ) leg pain version (23 items scored from 0 to 23 with higher scores indicating higher disability) was the primary outcome measure [20]. Improvement was defined as 30% or more decrease in an individual's RMDQ score between baseline and follow-up [21].

Potential prognostic factors

Prognostic factors to be examined were a priori selected based on evidence of their association with long-term outcome, building on exploratory evidence from existing studies in LBP and sciatica, and expertise within the study team. The self-reported and clinical assessment variables investigated in the study are summarised in Table 1.

Treatment pathways

Participants were managed according to one of three care pathways: (a) up to two physiotherapy sessions for those patients with improving or mild symptoms, (b) a course of physiotherapy treatment (three and over) for those patients with more troublesome pain, and (c) referral to secondary care; most patients in this pathway initially received a course of physiotherapy treatment. Secondary care options included referral to pain clinic for consideration of specialist analgesia review and/or injections, or to spinal orthopaedics for consideration of surgery and/or injections, or to chronic pain management services. Choice of pathway was based on clinician's judgment and patients' preferences.

Data analysis

The following analyses were conducted for the whole cohort, and separately for the subgroup clinically diagnosed with sciatica.

Overall prognosis

Descriptive analysis was performed to describe the course of patients' disability and pain using mean (SD) scores for RMDQ and pain intensity (LBP and leg pain) at baseline and each month, with 4 and 12-months the main follow-up points. The percentage of patients defined as improved on the RMDQ was calculated.

Analysis of prognostic factors

A mixed effect logistic regression model, which allows all available outcome data at all 3 time points to be used, accounts for autocorrelation due to repeated measures, and gives valid inferences when data are assumed missing at random, was used to estimate odds ratios (OR) and 95% confidence intervals (CI) for the association between each of the potential prognostic factors and the binary outcome of improvement in disability. The model included an interaction term between each predictor and time, to obtain estimates (and 95% CI) for

each point of follow-up (4 and 12-months).

Univariable associations were described, followed by a series of models evaluating the prognostic value of the six sets of variables relating to the 6 domains described in Table 1.

Previous research and expertise has highlighted these 6 domains as important, although it is unclear which factors specifically are most strongly associated with outcome within and between domains. Univariable analysis was first used to examine associations between each factor and outcome. Each model was then adjusted for: i) variables in the model only (for models with >1 factor), ii) age, gender, BMI, smoking, and comorbidities and iii) care pathways. Correlations between individual prognostic factors were investigated using bivariate associations and variance inflation factor (VIF) and if this was the case (VIF≥5) then only one of the variables (with higher OR) was included in analyses.

Finally, a combined model comprising all variables in the six models was fitted to identify the strongest factors from the 6 domains predicting long-term outcome. This was performed with a backwards approach by removing non-significant variables from the model one-by-one, until remaining variables had $p<0.05$ (using the Likelihood ratio test).

As a sensitivity analysis for addressing missing data, multiple imputation was employed by combining results from 40 multiply imputed datasets. Additional sensitivity analysis using linear mixed model was also performed by using numerical RMDQ, with adjustment for baseline RMDQ score, as the outcome, as opposed to the binary classification. In a further sensitivity analysis, a combined model using the subsample of participants with sciatica and confirmed nerve root compression on MRI, was fitted.

In this study, the total number of factors considered, complied with the rule of at least 10 events per variable in the logistic regression analysis [22].

Assessment of non-response

For primary follow-up time-points (4 and 12-months) we compared the key patient baseline characteristics (age, gender, area deprivation, pain intensity, leg pain duration and RMDQ scores) for those followed-up and those lost to follow-up.

Data was analysed using Stata 13 (StataCorp. 2013).

Results

Study sample

Six hundred and nine patients were included in the study. Response rates were 402 (66.0%) at 4 months and 450 (73.9%) at 12-months; 74.2·% (n=452) were clinically diagnosed as having sciatica. Figure 1 presents the study flowchart. Baseline characteristics of the study population are presented in Table 2. Forty seven percent, 41.5% and 11.5% of patients followed care pathways (a), (b) and (c), respectively. Fourteen patients reported that they underwent spinal surgery and 21 had spinal injections.

Participants who did not respond to the 12-month questionnaire were more often male, younger, and had higher baseline disability score compared to responders. (See Appendix A for details).

Prognosis of low back-related leg pain and sciatica

Overall, 55.0% of the cohort reported improvement at 12-months, both in the sciatica and referred leg pain subgroups. At baseline, mean disability was 12.6 (SD 5.7); this had decreased to means of 8.2 (6.7) and 7.8 (7.0) at 4 and 12-months respectively. Baseline mean back pain intensity was 5.6 (2.2); this decreased to 3.4 (2.6) and 3.3 (2.7) at 4 and 12-months

respectively. For leg pain, mean baseline pain intensity was 5.2 (2.4), falling to 2.8 (2.9) and 2.4 (2.7) at 4 and 12-months.

Prognostic factors associated with long-term changes in disability

Table 3 shows all univariable associations between baseline variables and disability. Multivariable analysis with sequential adjustment for other variables in the models, demographics and care pathways, identified factors significantly associated with outcome in each predefined domain/variable set (presented in Tables 4 and 5). Longer leg pain duration (OR 0.30, 95% CI 0.13-0.66), higher pain intensity (OR 0.84, CI 0.71-0.99), higher identity score (OR 0.68, CI 0.50-0.93) and patient's belief that the problem will last a long time (OR 0.29, CI 0.14-0.60) were negatively associated with improvement, whereas having myotomal weakness (OR 4.56, CI 1.69-12.33) was positively associated with improvement. With the exception of pain intensity, the same prognostic factors were significant in the sciatica subgroup.

Adjustment for demographics and care pathways did not have a large impact on associations for most variables for all domains (Tables 4 and 5).

Independent prognostic factors associated with long-term changes in disability

For the whole cohort, the combined multivariable model incorporating all variables from the 6 sets/domains, showed that longer leg pain duration (OR 0.41, CI 0.19-0.90), higher identity score (OR 0.70, CI 0.53-0.93) and patient's belief that the problem will last a long time (OR 0.27, CI 0.13-0.57) were the strongest independent prognostic factors negatively associated with improvement. These last two factors were similarly negatively associated with improvement in the sciatica subgroup (Table 6). The sensitivity analyses using multiple imputation and continuous RMDQ scores as the outcome, produced very similar results (data

not presented). The results from the sensitivity analysis using the subsample with sciatica and corroborative MRI findings, showed that 'identity' remained independently associated with outcome (see Appendix B).

Discussion

To our knowledge this is the first comprehensive study to describe prognosis and prognostic factors in patients seeking care in primary care for back-related leg pain, including sciatica, of any duration and severity. The prognosis of low back-related leg pain is similar in those with and without a clinical diagnosis of sciatica, with 55% meeting the study's criterion for improvement in disability. The improvements in disability from baseline in our cohort were similar, but mostly higher (mean change score; 4.8), compared to some LBP cohorts (UK) with or without leg pain, receiving primary care including physiotherapy interventions ((4.3) [23], (2.4) [24]). The percentage of patients with sciatica reporting improvement (55%) at 1 year is within the range of reports from secondary care populations, irrespective of outcome definition (range: 32% to 65%) [13,14,25].

In this study we set out to specifically investigate prognostic factors thought to be associated with long-term outcome in low back-related leg pain and in sciatica, and also examine their independent effect.

The factors associated with improvement in disability in this cohort were: shorter pain duration, lower leg pain intensity, fewer other symptoms associated with the back and leg pain (lower identity score), patient's belief that the problem will be short-lived, and initially having myotomal weakness. Symptom duration and pain levels are similarly reported to be associated with better outcomes in non-specific LBP [26,27].

For the sciatica subgroup, pain intensity was not statistically significant after adjustment for care pathways, which perhaps indicates that treatment modifies its effect (although the strength of association fell by only 0.03). This contrasts with current secondary care literature which points to leg pain severity in sciatica as likely associated with subsequent surgery (proxy of poor outcome with conservative management) [11]. More recently, Suri et al [16] also did not confirm leg pain intensity as being associated with disability in conservatively treated sciatica patients.

Depression was not found to be a significant factor when included with other psychological variables in the model. This is consistent with results from other studies, where factors of 'timeline' and 'identity' are independent and stronger prognostic factors in non-specific LBP when compared to depression [28]. In our cohort, the expectation of getting better soon was only relevant in the long-term, which may be indicative of the interplay between natural course and initial treatment effect. 'Identity' was a significant prognostic factor for the sciatica subgroup, across both time points, with decreased odds of improvement for each increase in score. The 'identity' score was the sum of symptoms including sleep disturbance, fatigue, unable to sit comfortably, all of which are often reported by patients with back and leg pain, and sciatica, and may be reasonably considered as an overall indication of severity or impact of symptoms. However, both these characteristics may well be influenced by patients' behaviour and psychological profile, such as a pessimistic outlook for example.

We found that having myotomal weakness at baseline was associated with improvement in disability at 12-months. All patients with myotomal weakness had additional neurological signs (i.e. reflex and/or sensory change). One recent study in secondary care [14] also reported that myotomal weakness was associated with improvement in one of their chosen outcome measures (leg pain), but other studies report on neurological deficits and their likely association with non-improvement [13,29]. The finding of initial myotomal weakness being

associated with improvement may reflect the fact that the most common reason for nerve root compression causing sciatic pain and neurological deficits, is a disc prolapse, which often improves spontaneously leading to improvement in pain and disability. Another possibility is that prognostic factors may be different in primary care cohorts, such as ours, compared to secondary care cohorts [13].

Strengths and limitations

As the majority of patients with back-related leg pain and sciatica are managed in primary care, one major strength of our study is the primary care setting, thereby providing important new evidence in a sample that is more representative of people with sciatica consulting health care than previously reported secondary care cohorts. The inclusion of consecutive eligible patients with any degree of pain severity and duration of symptoms further strengthens the generalisability of our findings, as these are applicable across the spectrum of patient presentations and not only for those populations with the most severe symptoms. The choice of potential prognostic factors was comprehensive, and underpinned by previous research and clinical experience. The sensitivity analysis using the RMDQ continuous scales produced similar results to the primary analysis using the dichotomous outcome increasing confidence in the results.

A potential limitation is the higher than expected attrition however, the multiple imputation sensitivity analysis showed similar estimates. Another limitation is that, due to small numbers in the referred leg pain subgroup, we were unable to do separate analyses as we did in the sciatica subgroup. We therefore cannot confirm that similar factors are associated with outcome in patients with referred leg pain.

Another issue is the potential confounding by treatment, where beneficial effects of treatment may influence the association between prognostic factors and outcome [30,31]. In order to

address this we estimated strength of association with and without adjustment for care pathways. As results remained broadly similar we are reassured that treatment did not have a significant impact on our findings. A further limitation in terms of treatment may be the use of analgesic medication. Patients were treated as per usual practice as regards analgesia, however we do not have data on this and therefore we are not able to adjust for or comment on the potential effect of analgesics use.

Lastly, it is important to consider the issue of uncertainty when diagnosing sciatica versus referred leg pain, and the potential for misclassification. In the absence of a 'gold standard' for the diagnosis of sciatica, diagnosis in this study was based on clinical opinion based on the clinical assessment findings, which reflects normal primary care practice. Extensive discussion of these points is presented elsewhere [18]. However, the baseline (clinical examination) characteristics of the subgroup clinically diagnosed with sciatica are clearly different to those of the subgroup diagnosed with referred leg pain, and in line with the symptoms and signs expected to be present in the clinical diagnosis of sciatica, although the possibility of misclassification still remains. Furthermore, the sensitivity analysis using the subsample with clinical diagnosis of sciatica and corroborative MRI findings of nerve root compression, found the same factor (identity) associated with outcome, which indicates that the influence of potential diagnostic misclassification on results, does not appear to be significant.

Suggestions for further research

Of the prognostic factors we investigated, independent predictors of improvement were similar in the whole sample and in the sciatica subgroup (which was the largest), with clinical characteristics more weakly associated with outcome and no longer significant in the combined model. This suggests that long-term outcome may be more strongly influenced by

factors indicative of overall impact of the condition as indicated by the 'identity' variable, therefore this should influence early management and treatment intensity. Although we included most factors currently considered potentially important, it is possible that there are still unknown characteristics especially relevant to sciatica that we are not capturing, and which may better guide choice of intensity and timing of different care pathways. More specific MRI findings (for example; size of disc herniation) were not included as prognostic variables, mainly because of the primary care setting which does not include routine MRI for this population. However, MRI characteristics can be investigated in further analysis to assess their contribution to the generic factors identified in this study.

We could not disentangle whether the prognostic factors mediate or moderate treatment effect. Further research investigating different models of care (for example, early and intensive interventions for patients with high overall impact of symptoms and a reduced expectation of a timely recovery versus current models of 'stepped' care), and incorporating the prognostic factors this study identified, may elucidate which factors are prognostic and which are predictive of treatment outcome.

Conclusion

At 1 year, 55.0% of primary care patients with low back-related leg pain and sciatica receiving current best care reported a 30% or more improvement in disability. In the long-term, patients' belief that they will get better soon, and not having many other complaints attributed to the back and leg pain, were independent prognostic factors associated with improvement. These prognostic factors can be used to inform and direct management decisions about timing and intensity of available therapeutic options for symptoms relief, especially in sciatica patients with corroborative MRI findings, for whom there are

potentially appropriate therapeutic interventions that are not applicable for patients with non-specific low back and leg symptoms. Exploration and appropriate handling of patient's expectations about their pain trajectory, both in referred leg pain and in sciatica cases, is considered relevant, similarly to most health problems presentations.

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Figure 1 Flow chart of study population.

1 Table 1 List of the preselected sets of variables used in the analysis.

Variable Set	Domain	Measure
1	Duration of pain	Current episode of leg pain: Less than 6 weeks, Between 6 to 12 weeks, Over 3 months.
2	Pain intensity	Taking the highest of either back or leg pain using the mean of three 0 to 10 numerical rating scales for 'least', 'usual' and 'current' pain over the previous 2 weeks (Dunn et al 2010)
3	Neuropathic pain features	Using the Leeds Assessment Neuropathic Symptoms and Signs (S-LANSS); with a score of 12 or more indicating possible neuropathic pain (Bennett et al 2005)
4	Psychological perceptions	Pain self-efficacy: Measured with the Pain Self-Efficacy Questionnaire (PSEQ); with scores from 0 to 60; higher scores reflect stronger self-efficacy beliefs (Nicholas 2007) Identity; Symptom attribution to the condition (Moss-Morris et al 2002) from a list of 7 potential symptoms: back pain, leg pain, unable to sit comfortably, fatigue, stiff joints, sleep difficulties, loss of strength. The score is the sum of symptoms experienced. The list of the 7 potential symptoms was chosen by the research team. Timeline; illness/condition duration: ' My back and / or leg problem will last for a long time')[a] Personal control; How much influence a patient has over illness/condition; 'There is a lot which I can do to control my back and / or leg symptoms')[a] Depression; Measured using the Hospital Anxiety and Depression scale (HADs); with scores from 0 to 21, higher scores indicate higher levels of depressive symptoms (Zigmond and Snaith 1981)

5	Clinical examination	Pins and needles or numbness in leg(s) as reported by the patient. Leg pain increased by coughing/laughing/straining. Worse pain, either in low back or leg. Neurological examination variables; -Myotomal strength[b]; defined as normal (5 on Oxford scale)/abnormal (0,1,2,3, or 4 on Oxford scale) -Reflex (tendon); defined as normal, slightly reduced, significantly reduced/absent -Sensation[c]; (in leg(s)) defined as normal/abnormal -Neural tension test findings; defined as abnormal if any neural tension test is abnormal (i.e. straight leg raise, femoral stretch, slump)
6	Imaging (MRI) examination	MRI findings: Defined as normal when no evidence of nerve root compression correlating with clinical symptoms, or indicative of nerve root compression if there was evidence of clear or possible nerve root compression for any reason. All MRIs were scored by the same experienced Consultant Radiologist who had no knowledge of the specific patient presentation other than 'LBP with leg pain'

[a]Timeline and Personal control are measured on a Likert scale; Strongly disagree - Disagree - Neither agree or disagree - Agree - Strongly agree. For the purposes of the analysis it was dichotomised ((agree *(agree, strongly agree)* versus disagree *(strongly disagree, disagree, neither agree or disagree))*.

[b] Muscle strength tested according to the Oxford scale where; 0. No movement, 1. Flicker of movement, 2. Through full range actively with gravity counterbalanced, 3. Through full range actively against gravity, 4. Through full range actively against some resistance, 5. Through full range actively against strong resistance.

[c] Sensation was tested with a pin (neurotip).

Table 1 references.

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2. Bennett MI, Smith BH, Torrance N, Potter J. The S-LANSS score for identifying pain of predominantly neuropathic origin: validation for use in clinical and postal research. J Pain 2005; 6: 149-158

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4. Moss-Morris R, Weinman J, Petrie KJ, Horne R, Cameron LD, Buick D: The Revised Illness Perceptions Questionnaire (IPQ-R). Psychol Health 2002; 17: 1-16

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Table 2 Baseline characteristics of participants for the whole group and for the sciatica and referred leg pain subgroups.

All figures are frequencies and percentages (%) unless stated otherwise as mean and standard deviation (SD).

	All participants *n* = 609	**Sciatica subgroup *n* = 452**	**Referred leg pain *n* = 157**
Socio-demographics (Denominator*)			
Age (years) (609), mean (SD)	50.2 (13.9)	50.4 (14.0)	49.4 (13.7)
Gender (609), Female	381 (62.6)	276 (61.1)	105 (66.9)
BMI (609), mean (SD)	29.9 (7.0)	29.9 (6.3)	30.0 (8.7)
Current smoker (609)	194 (31.9)	151 (33.4)	43 (27.4)
Co-morbidities† (609)			
None	371 (60.9)	277 (61.3)	94 (59.9)
One other health problem	158 (25.9)	122 (27.0)	36 (22.9)
Two or more other health problems	80 (13.1)	53 (11.7)	27 (17.2)
Pain and function			
RMDQ disability score (0-23) (609), mean (SD)	12.7 (5.7)	12.9 (5.7)	12.0 (5.7)
Back pain intensity (mean of 3 NRS) (609), mean (SD)	5.6 (2.2)	5.6 (2.2)	5.4 (2.1)
Leg pain intensity (mean of 3 NRS) (608), mean (SD)	5.2 (2.4)	5.6 (2.3)	4.1 (2.3)
Duration of symptoms:			
Back pain (607)			
<6 weeks	218 (35.9)	174 (38.6)	44 (28.2)
6-12 weeks	126 (20.8)	96 (21.3)	30 (19.2)

3-6 months	92 (15.2)	75 (16.6)	17 (10.9)
Over 6 months	171 (28.2)	106 (23.5)	65 (41.7)
Leg pain (583)			
<6 weeks	251 (43.1)	192 (44.2)	59 (39.6)
6-12 weeks	120 (20.6)	94 (21.7)	26 (17.5)
3-6 months	84(14.4)	62 (14.3)	22 (14.8)
Over 6 months	128 (22.0)	86 (19.8)	42 (28.0)
Leg pain is worse (609)	280 (46.0)	252 (55.8)	28 (17.8)
S-LANSS (possible neuropathic pain) (607)	332 (54.8)	232(51.6)	61 (39.0)
Psychological measures and perceptions			
HADs depression subscale (continuous score) (609), mean (SD)	6.4 (4.0)	6.3 (4.0)	6.4 (4.0)
HADs depression subscale: categorised (609)			
Normal (0-7)	392 (64.4)	295 (65.3)	97 (61.8)
Possible case (8-10)	119 (19.5)	82 (18.1)	37 (23.4)
Probable case (≥ 11)	98 (16.1)	75 (16.6)	23 (14.7)
Pain self-efficacy score[‡] (593), mean (SD)	34.1 (14.6)	33.3 (14.7)	36.6 (13.9)
Illness perception:			
-Identity score[§] (609), mean (SD)	5.9 (1.3)	5.9 (1.3)	5.9 (1.2)
-Timeline ('back/leg pain will last forever' (agree/strongly agree)) (609)	345 (56.7)	249 (55.1)	96 (61.2)
-Personal control ('what I do can determine whether back/leg pain gets better/worse' (agree/strongly agree)) (605)	367 (60.7)	277 (61.8)	90 (57.3)
Clinical assessment			
Pins and needles and/or numbness (patient reports having these symptoms) (609)	382 (62.7)	316 (69.9)	66 (42.0)

Cough, sneeze or strain (patient reports increased leg pain with cough/sneeze/strain) (609)	129 (21.2)	120 (26.6)	9 (5.7)
Leg pain is worse than back pain (patient report) (609)	280 (46.0)	252 (55.8)	28 (17.8)
Myotomal change (as per Oxford scale) (608)			
5/5 (None)	503 (82.7)	347 (76.8)	156 (100)
4/5	92 (15.1)	92 (20.4)	0 (0.0)
0/5 or 1/5 or 2/5 or 3/5	13 (2.1)	13 (2.9)	0 (0.0)
Reflex change (at ankle or patella) (609)			
None	490 (80.5)	341 (75.4)	149 (94.9)
Slightly reduced	30 (4.9)	30 (6.6)	0 (0.0)
Significantly reduced	22 (3.6)	19 (4.2)	3 (1.9)
Absent	67 (11.0)	62 (13.7)	5 (3.2)
Sensory change (as examined using a pin) (609)			
None	356 (58.5)	226 (50.0)	130 (82.8)
Reduced pin/prick	201 (33.0)	175 (38.7)	26 (16.6)
Loss to pin/prick	52 (8.5)	51 (11.3)	1 (0.6)
Neural tension test positive (any) (609)	335 (55.0)	324 (71.7)	11 (7.0)
MRI (554)			
Findings of nerve root compression	297 (53.6)	252 (60.7)	45 (32.4)

***The number of participants for each variable is shown in parentheses** – the denominator varies for some participants due to missing data and/or not applicable case**.** [†]The health problems included chest problems, heart problems, raised blood pressure, diabetes, and circulation problems in the leg. [‡]10 item scale, score range=0-60 – higher scores reflect stronger self-efficacy beliefs; [§]sum of scores on 7 symptoms – higher scores represent strongly held beliefs about number of symptoms attributed to the illness**.**

Table 3 Univariable associations between baseline variables and improvement in the RMDQ at 4 and 12 months for the whole group and sciatica subgroup based on mixed-effect logistic regression model (statistically significant values in bold).

Improved vs· not improved: reference category in parenthesis	All participants		Sciatica subgroup	
	4 Months (n=402)	12 Months (n=450)	4 Months (n=308)	12 Months (n=338)
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Pain variables (Sets 1, 2, 3)				
Duration of leg pain (<6 weeks)				
6-12 weeks	0.73 (0.28 to 1.93)	1.02 (0.39 to 2.61)	0.55 (0.17 to 1.79)	1.10 (0.35 to 3.46)
Over 3 months	**0.16 (0.07 to 0.38)**	**0.23 (0.10 to 0.52)**	**0.09 (0.03 to 0.29)**	**0.19 (0.07 to 0.56)**
Pain intensity (cont)	**0.66 (0.55 to 0.79)**	**0.74 (0.63 to 0.89)**	**0.62 (0.49 to 0.79)**	**0.73 (0.58 to 0.91)**
S-LANSS: possible neuropathic pain (No)	**0.31 (0.14 to 0.65)**	**0.46 (0.23 to 0.93)**	**0.26 (0.10 to 0.66)**	**0.37 (0.15 to 0.92)**
Psychological measures and perceptions (Set 4)				
Pain self-efficacy	**1.05 (1.02 to 1.08)**	**1.04 (1.01 to 1.06)**	**1.04 (1.01 to 1.08)**	**1.04 (1.01 to 1.08)**
Illness perception:				
-Identity*	**0.54 (0.40 to 0.73)**	**0.52 (0.38 to 0.69)**	**0.48 (0.33 to 0.69)**	**0.48 (0.33 to 0.70)**
-Timeline**	**0.33 (0.16 to 0.69)**	**0.20 (0.09 to 0.41)**	**0.29 (0.11 to 0.73)**	**0.12 (0.05 to 0.33)**
-Personal control**	1.40 (0.66 to 2.96)	1.55 (0.76 to 3.18)	1.37 (0.54 to 3.51)	1.61 (0.65 to 4.00)
HADs depression (cont)	**0.82 (0.75 to 0.91)**	**0.86 (0.78 to 0.94)**	**0.82 (0.73 to 0.93)**	**0.82 (0.73 to 0.93)**
Clinical assessment and imaging (Set 5, 6)				
Reporting pins and needles and/or numbness (No)	0.47 (0.22 to 1.02)	0.86 (0.42 to 1.76)	0.76 (0.30 to 1.93)	1.45 (0.59 to 3.58)
Increased leg pain with cough/sneeze/strain (No)	0.74 (0.29 to 1.87)	0.82 (0.34 to 1.94)	0.94 (0.32 to 2.79)	0.89 (0.32 to 2.47)
What is worse (Back pain)	1.58 (0·76 to 3.27)	1.13 (0.56 to 2.27)	3.15 (1.22 to 8.10)	1.95 (0.79 to 4.78)
Myotomes (No weakness (normal))	1.66 (0.64 to 4.29)	**2.62 (1.02 to 6.69)**	2.08 (0.70 to 6.16)	**3.22 (1.10 to 9.46)**
Reflex (Normal)				
Slightly reduced	0.19 (0.03 to 1.17)	0.72 (0.13 to 3.91)	0.18 (0.02 to 1.32)	0.69 (0.12 to 4.59)
Absent or significantly reduced	0.58 (0.20 to 1.68)	0.46 (0.17 to 1.30)	0.67 (0.19 to 2.32)	0.43 (0.13 to 1.44)
Sensation (Normal)	0.54 (0.25 to 1.13)	0.57 (0.28 to 1.17)	0.61 (0.24 to 1.53)	0.46 (0.19 to 1.12)
Neural tension test (Normal)	1.04 (0.50 to 2.16)	0.92 (0.46 to 1.85)	1.58 (0.59 to 4.23)	1.02 (0.39 to 2.68)
MRI finding: Nerve root compression (No)	1.07 (0.50 to 2.29)	1.06 (0.51 to 2.18)	1.00 (0.37 to 2.68)	1.08 (0.41 to 2.82)

*Symptoms that the patient sees as part of the illness (0-7)

Timeline and Personal control are measured on a Likert scale; Strongly disagree - Disagree - Neither agree or disagree - Agree - Strongly agree. For the purposes of the analysis it was dichotomised ((agree *(agree, strongly agree)* versus disagree *(strongly disagree, disagree, neither agree or disagree)*). **The reference for the analysis is: 'Strongly disagree/disagree/neither'.

Table 4 Association of six preselected set of variables (models 1 to 6) with improvement in RMDQ at 4 and 12 months based on mixed-effect logistic regression model for the whole group.

	4 months (n=402)			12 months (n=450)		
Variables in the model (Reference category)	**Adjusted for all the variables in the model**	**Adjusted for the variables in the model and demographics***	**Adjusted for all the variables in the model, demographics & care pathways**	**Adjusted for only variables in the model**	**Adjusted for the variables in the model and demographics***	**Adjusted for all the variables in the model, demographics & care pathways**
	OR (95% CI)	**OR (95% CI)**	**OR (95% CI)**	**OR (95% CI)**	**OR (95% CI)**	**OR (95% CI)**
Model 1						
Duration of leg pain (<6 weeks)						
6-12 weeks	0.73 (0.28 to 1.93)	0.67 (0.26 to 1.73)	0.81 (0.31 to 2.12)	1.02 (0.39 to 2.61)	0.87 (0.35 to 2.19)	0.92 (0.3 to 2.31)
Over 3 months	**0.16 (0.07 to 0.38)**	**0.22 (0.09 to 0.51)**	**0.26 (0.11 to 0.61)**	**0.23 (0.10 to 0.52)**	**0.29 (0.13 to 0.63)**	**0.30 (0.13 to 0.66)**
Model 2						
Pain intensity (cont)	**0.66 (0.55 to 0.79)**	**0.71 (0.60 to 0.86)**	**0.76 (0.63 to 0.91)**	**0.75 (0.63 to 0.89)**	**0.82 (0.69 to 0.97)**	**0.84 (0.71 to 0.99)**
Model 3						
S-LANSS: possible neuropathic origin (No)	**0.31 (0.14 to 0.65)**	**0.37 (0.18 to 0.77)**	**0.44 (0.21 to 0.91)**	**0.46 (0.23 to 0.93)**	0.60 (0.30 to 1.19)	0.65 (0.33 to 1.29)
Model 4						
Pain self-efficacy	1.03 (0.99 to 1.06)	1.02 (0.99 to 1.06)	1.02 (0.99 to 1.05)	1.00 (0.97 to 1.03)	0.99 (0.96 to 1.02)	0.99 (0.96 to 1.03)
Illness perception:						
-Identity	**0.64 (0.46 to 0.88)**	0.74 (0.54 to 1.00)	0.77 (0.56 to 1.05)	**0.58 (0.42 to 0.80)**	**0.67 (0.49 to 0.91)**	**0.68 (0.50 to 0.93)**
-Timeline	0.52 (0.25 to 1.11)	0.49 (0.23 to 1.01)	0.55 (0.26 to 1.16)	**0.31 (0.15 to 0.65)**	**0.28 (0.13 to 0.59)**	**0.29 (0.14 to 0.60)**
-Personal control	1.49 (0.69 to 3.19)	1.57 (0.75 to 3.27)	1.48 (0.70 to 3.13)	1.52 (0.73 to 3.17)	1.61 (0.79 to 3.30)	1.60 (0.78 to 3.29)
HADs depression (cont)	0.95 (0.84 to 1.08)	0.96 (0.84 to 1.08)	0.96 (0.84 to 1.09)	0.96 (0.85 to 1.08)	0.96 (0.85 to 1.08)	0.96 (0.85 to 1.09)
Model 5						
Reporting pins and needles and/or numbness (No)	0.57 (0.26 to 1.26)	0.61 (0.28 to 1.33)	0.66 (0.30 to 1.44)	1.02 (0.48 to 2.17)	1.23 (0.59 to 2.57)	1.32 (0.63 to 2.76)
Increased leg pain with cough/sneeze/strain (No)	0.78 (0.29 to 2.11)	0.62 (0.24 to 1.64)	0.82 (0.30 to 2.19)	0.83 (0.33 to 2.09)	0.71 (0.29 to 1.74)	0.77 (0.31 to 1.88)
What is worse (Back pain)	1.65 (0.74 to 3.68)	1.74 (0.80 to 3.78)	1.72 (0.79 to 3.74)	1.18 (0.55 to 2.53)	1.24 (0.60 to 2.59)	1.28 (0.61 to 2.66)
Myotomes (No weakness (normal))	2.61 (0.92 to 7.41)	2.69 (0.98 to 7.40)	**3.47 (1.22 to 9.82)**	**3.92 (1.42 to10.83)**	**4.10 (1.53 to 11.00)**	**4.56 (1.69 to 12.33)**
Reflex (Normal)						
Slightly reduced	**0.14 (0.02 to 0.91)**	0.16 (0.03 to 1.00)	0.16 (0.03 to 1.01)	0.52 (0.09 to 2.95)	0.57 (0.10 to 3.07)	0.58 (0.11 to 3.11)
Absent or significantly reduced	0.53 (0.18 to 1.58)	0.47 (0.16 to 1.35)	0.53 (0.18 to 1.54)	0.41 (0.15 to 1.17)	0.35 (0.13 to 0.98)	0.38 (0.14 to 1.05)
Sensation (Normal)	0.53 (0.24 to 1.16)	0.66 (0.31 to 1.42)	0.74 (0.34 to 1.59)	0.49 (0.23 to 1.05)	0.65 (0.31 to 1.36)	0.67 (0.33 to 1.40)

Neural tension test (Normal)	1.04 (0.46 to 2.36)	0.95 (0.43 to 2.09)	1.01 (0.45 to 2.25)	0.88 (0.40 to 1.96)	0.75 (0.35 to 1.63)	0.80 (0.37 to 1.73)
Model 6						
MRI finding: Nerve root compression (No)	1.07 (0.50 to 2.29)	0.95 (0.45 to 2.00)	1.30 (0.60 to 2.80)	1.06 (0.51 to 2.18)	0.95 (0.47 to1.93)	1.05 (0.51 to 2.15)

*Adjusted for age, gender, BMI, smoking, and co-morbidities

Table 5 Association of six preselected set of variables (models 1 to 6) with improvement in RMDQ at 4 and 12 months based on mixed-effect logistic regression model for the sciatica subgroup

	4 months (n=308)			12 months (338)		
Variables in the model (Reference category)	**Adjusted for all the variables in the model** OR (95% CI)	**Adjusted for the variables in the model and demographics*** OR (95% CI)	**Adjusted for all the variables in the model, demographics & care pathways** OR (95% CI)	**Adjusted for only variables in the model** OR (95% CI)	**Adjusted for the variables in the model and demographics*** OR (95% CI)	**Adjusted for all the variables in the model, demographics & care pathways** OR (95% CI)
Model 1						
Duration of leg pain (<6 weeks)						
6-12 weeks	0.55 (0·17 to 1·79)	0.50 (0.16 to 1.60)	0.65 (0.19 to 2.19)	1.10 (0.35 to 3.46)	0.96 (0.31 to 2.92)	1.01 (0.31 to 3.22)
Over 3 months	**0.09 (0.03 to 0.28)**	**0.14 (0.05 to 0.41)**	**0.16 (0.05 to 0.50)**	**0.19 (0.07 to 0.56)**	**0.26 (0.09 to 0.73)**	**0.23 (0.08 to 0.69)**
Model 2						
Pain intensity (cont)	**0.62 (0.49 to 0.79)**	**0.69 (0·54 to 0.87)**	**0.75 (0.59 to 0.95)**	**0.73 (0.58 to 0.91)**	**0.78 (0.63 to 0.98)**	0.81 (0.64 to 1.01)
Model 3						
S-LANSS: possible neuropathic pain (No)	**0.26 (0.10 to 0.66)**	**0.32 (0.13 to 0.81)**	**0.37 (0.14 to 0.96)**	**0.37 (0.15 to 0.92)**	0.50 (0.21 to 1.19)	0.52 (0.21 to 1.26)
Model 4						
Pain self-efficacy	1.01 (0.97 to 1.04)	1.01 (0.97 to 1.05)	1.00 (0.9 to 1.04)	0.99 (0.96 to 1.04)	0.99 (0.96 to 1.04)	0.99 (0.95 to 1.03)
Illness perception:						
-Identity	**0.54 (0.36 to 0.80)**	**0.63 (0.43 to 0.91)**	**0.65 (0.44 to 0.96)**	**0.56 (0.38 to 0.83)**	**0.64 (0.44 to 0.94)**	**0.64 (0.43 to 0.95)**
-Timeline	0.48 (0.19 to 1.22)	0.49 (0.20 to 1.21)	0.58 (0.22 to 1.51)	**0.20 (0.08 to 0.53)**	**0.22 (0.08 to 0.55)**	**0.21 (0.08 to 0.54)**
-Personal control	1.53 (0.59 to 3.92)	1.62 (0.65 to 4.02)	1.46 (0.56 to 3.82)	1.43 (0.57 to 3.62)	1.50 (0.62 to 3.63)	1.51 (0.60 to 3.81)
HADs depression (cont)	0.94 (0.80 to 1.10)	0.94 (0.80 to 1.10)	0.94 (0.80 to 1.11)	0.93 (0.80 to 1.08)	0.93 (0.81 to 1.08)	0.93 (0.78 to 1.09)
Model 5						
Reporting pins and needles and/or numbness (No)	0.47 (0.16 to 1.34)	0.57 (0.20 to 1.60)	0.62 (0.21 to 1.84)	0.93 (0.43 to 2.54)	1.20 (0.45 to 3.19)	1.37 (0.50 to 3.74)
Increased leg pain with cough/sneeze/strain (No)	0.87 (0.28 to 2.77)	0.56 (0.18 to 1.74)	0.74 (0.23 to 2.45)	0.83 (0.29 to 2.43)	0.66 (0.23 to 1.91)	0.68 (0.23 to 2.00)
What is worse (Back pain)	**3.00 (1.09 to 8.25)**	**3.07 (1.15 to 8.21)**	**3.10 (1.12 to 8.62)**	2.01 (0.77 to 5.26)	1.98 (0.78 to 5.00)	2.12 (0.85 to 5.73)
Myotomes (No weakness (normal))	2.75 (0.86 to 8.77)	2.92 (0.94 to 9.09)	**4.31 (1.27 to 14.63)**	**4.57 (1.45 to 14.40)**	**4.57 (1.51 to 13.82)**	**5.62 (1.76 to 17.92)**
Reflex (Normal)						
Slightly reduced	**0.11 (0.01 to 0.92)**	0.12 (0.01 to 0.99)	0.12 (0.01 to 1.07)	0.46 (0.07 to 3.19)	0.51 (0.08 to 3.34)	0.56 (0.08 to 3.79)
Absent or significantly reduced	0.56(0.16 to 2.01)	0.45 (0.13 to 1.58)	0.48 (0.13 to1.83)	0.35 (0.10 to 1.21)	0.30 (0.09 to 1.02)	0.35 (0.10 to 1.20)
Sensation (Normal)	0.63 (0.24 to 1.65)	0.82 (0.32 to 2.07)	1.03 (0.39 to 2.72)	0.40 (0.16 to 1.03)	0.53 (0.22 to 1.30)	0.56 (0.23 to 1.41)

Neural tension test (Normal (negative)	1.22 (0.43 to 3.46)	1.13 (0.41 to 3.12)	1.28 (0.44 to 3.74)	0.84 (0.30 to 2.35)	0.68 (0.25 to 1.87)	0.81 (0.29 to 2.27)
Model 6						
MRI finding: Nerve root compression (No)	1.00 (0.37 to 2.68)	0.71 (0.27 to 1.88)	1.08 (0.38 to 3.05)	1.08 (0.42 to 2.82)	0.82 (0.32 to 2.09)	0.89 (0.33 to 2.39)

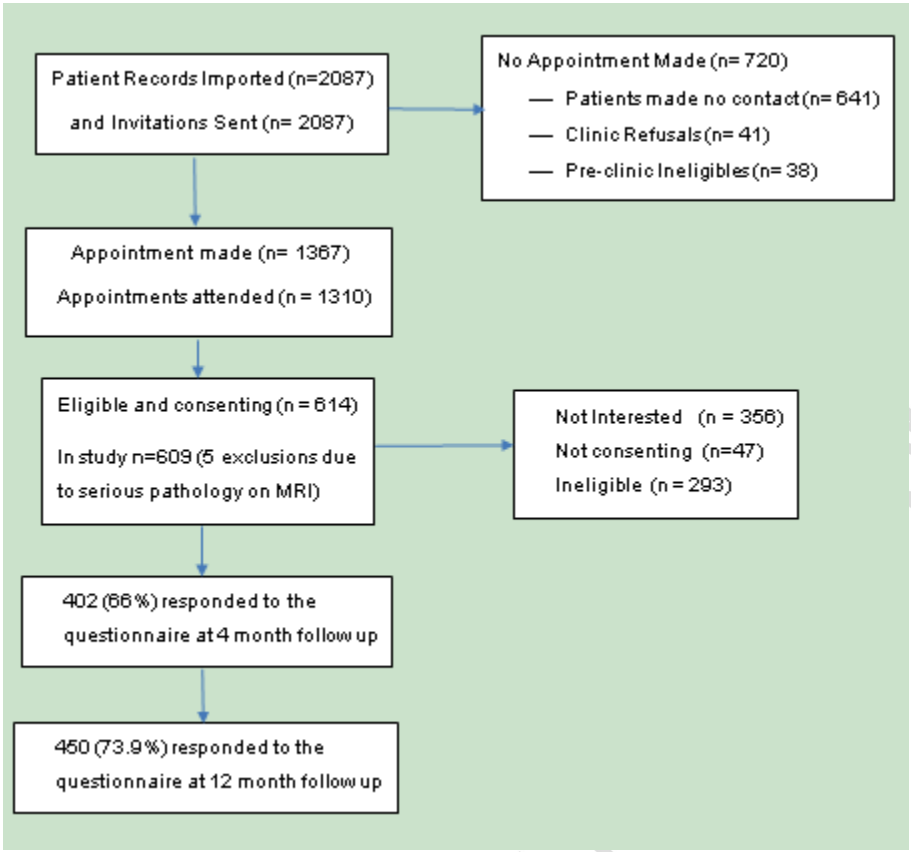
*Adjusted for age, gender, BMI, smoking, and co-morbidities

Table 6 Multivariable associations between baseline characteristics and improvement in the RMDQ for the whole group and the sciatica group, combining all the six preselected set of variables

	4 months			12 months		
Variables in the final model (Reference category)	**Adjusted for all the variables in the final model**	**Adjusted for the variables in the model and demographics***	**Adjusted for all the variables in the model, demographics & care pathways**	**Adjusted for all the variables in the final model**	**Adjusted for the variables in the model and demographics***	**Adjusted for all the variables in the model, demographics & care pathways**
	OR (95% CI)	**OR (95% CI)**	**OR (95% CI)**	**OR (95% CI)**	**OR (95% CI)**	**OR (95% CI)**
Whole group						
Duration of leg pain (>6 weeks)						
6-12 weeks	0.79 (0.30 to 2.10)	0.75 (0.29 to 1.94)	0.85 (0.32 to 2.24)	1.11 (0.43 to 2.84)	1.03 (0.41 to 2.56)	1.04 (0.41 to 2.62)
Over 3 months	0.23 (0.10 to 0.55)	0.28 (0.12 to 0.64)	0.31 (0.13 to 0.72)	0.36 (0.16 to 0.79)	0.42 (0.19 to 0.92)	0.41 (0.19 to 0.90)
-Timeline	-	-	-	0.31 (0.15 to 0.64)	0.27 (0.13 to 0.56)	0.27 (0.13 to 0.57)
Pain intensity (cont)	0.75 (0.63 to 0.91)	0.80 (0.67 to 0.96)	0.81 (0.67 to 0.97)	-	-	-
-Identity	0.66 (0.49 to 0.89)	0.73 (0.54 to 0.97)	0.74 (0.54 to 0.99)	0.59 (0.44 to 0.79)	0.69 (0.52 to 0.91)	0.70 (0.53 to 0.93)
Sciatica subgroup						
Duration of leg pain (>6 weeks)						
6-12 weeks	0.58 (0.18 to 1.86)	0.56 (0.18 to 1.76)	0.66 (0.20 to 2.20)	1.30 (0.41 to 4.10)	1.27 (0.41 to 3.82)	1.29 (0.40 to 4.19)
Over 3 months	0.15 (0.05 to 0.46)	0.19 (0.07 to 0.57)	0.20 (0.06 to 0.63)	0.31 (0.11 to 0.88)	0.41 (0.15 to 1.11)	0.34 (0.11 to 1.01)
-Timeline	-	-	-	0.21 (0.08 to 0.55)	0.22 (0.09 to 0.56)	0.21 (0.08 to 0.56)
Pain intensity (cont)	0.70 (0.54 to 0.89)	0.75 (0.59 to 0.96)	0.79 (0.62 to 1.02)	-	-	-
-Identity	0.63 (0.43 to 0.90)	0.69 (0.49 to 0.99)	0.74 (0.51 to 1.07)	0.57 (0.39 to 0.81)	0.64 (0.45 to 0.91)	0.65 (0.45 to 0.94)
What is worse (Back pain)	3.47 (1.32 to 9.11)	3.15 (1.22 to 8.12)	3.37 (1.25 to 9.08)	-	-	-

Only the variables that were statistically significant in the final combined model are presented; *Adjusted for age, gender, BMI, smoking, and co-morbidities

1 Figure 1.



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