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Trajectories and predictors of the long-term course of low back pain: cohort study with 5-year follow-up

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Abstract

Low back pain (LBP) is a major health challenge globally. Research has identified common trajectories of pain over time. We aimed to investigate whether trajectories described in one primary care cohort can be confirmed in another, and to determine the prognostic value of factors collected 5 years prior to the identification of the trajectory. The study was carried out on 281 patients who had consulted primary care for LBP, at that point completed a baseline questionnaire, and then returned a questionnaire at 5-years follow-up plus at least 3 (of 6) subsequent monthly questionnaires. Baseline factors were measured using validated tools. Pain intensity scores from the 5-year follow-up and monthly questionnaires were used to assign participants into 4 previously derived pain trajectories (no or occasional mild, persistent mild, fluctuating, persistent severe), using latent class analysis. Posterior probabilities of belonging to each cluster were estimated for each participant. The posterior probabilities for the assigned clusters were very high (>0.90) for each cluster except for the smallest 'fluctuating' cluster (0.74). Lower social class and higher pain intensity were significantly associated with a more severe trajectory 5-years later, as were patients' perceptions of the greater consequences and longer

duration of pain, and greater passive behavioural coping. LBP trajectories identified previously appear generalizable. These allow better understanding of the long-term course of LBP and effective management tailored to individual trajectories needs to be identified.

Key words: Low back pain, latent class analysis, pain trajectory, prognostic factor.

Introduction

Low back pain (LBP) is common. It is the leading cause of years lived with disability worldwide [39]. It also has a major impact on health services, as 25-30% of people with back pain will consult their general practitioner (GP) about their pain each year [35]. The majority of consulters will not seek healthcare beyond the first 3 months, although up to 80% still have pain or disability a year later [8,22]. Many people with back pain experience pain over a number of years [13,22], but despite this, few studies include follow-up beyond a 1-year period [3,6,18].

In our previous work among primary care back pain patients, we identified, for the first time, 4 trajectories of change in back pain over time: persistent mild, recovering, severe and fluctuating [15]. In the long-term follow-up of that cohort, we have shown evidence that these trajectories persist over many years [11]. Other studies have since also described trajectories of back pain [26]. Despite some differences between studies, common trajectories have been identified across settings and countries. However, no research investigated if the patterns already described in one cohort can be confirmed in new cohorts [26]. We had the opportunity to replicate

methods we have previously used in one cohort (BaRNS Study) [11,15], within the follow-up of a separate cohort of primary care back pain patients (BeBack Study) [19], thereby facilitating examination of the generalisability of findings between samples, and allowing investigation of the potential for wider use and application of the findings.

Predictors of back pain outcome have been identified in a range of studies, but these studies have commonly used the presence or level of back pain at a single point as the outcome [30,40]. Studies have described associations with identified trajectories [2,7,9,10,11,15,27,29,37], but none, to date, have been able to determine predictors of trajectory membership at a time-point prior to the identification of the trajectory. This is important in order to establish a clear time sequence between the predictive factor and the outcome (in this case, a trajectory).

The aims of this study were to therefore investigate whether back pain trajectories found in one cohort of low back pain patients consulting in primary care are observed in a separate sample, and whether predictors of those trajectories can be identified.

Methods

Study design and setting

This was a prospective cohort study of patients seeking healthcare for low back pain in eight general practices within the North Staffordshire and Cheshire area, England (BeBack Study). Consecutive adults aged 18 to 60 years, who visited their GP about back pain between September 2004 and April 2006 were sent information about the study and invited to take part. Further details about recruitment are reported

elsewhere [19]. Ethical approval for all phases of the study was obtained from the North Staffordshire and North West Cheshire Research Ethics Committees.

1,591 participated in the cohort at the initial baseline [19]. The eligible subjects for this 5-year follow-up study was derived from 1,289 patients who responded to the initial baseline questionnaire and gave permission for further contact; 810 (63%) responded again after 6 months, and 696 of these (86%) were traced and contacted 5-years later. This eligible sample was sent a questionnaire at the 5-year follow-up stage, followed by 6 shorter monthly questionnaires. In total 488 responded at the 5-year follow-up stage (70%) and 281 (40%) completed the 5-year follow-up questionnaire and at least 3 subsequent monthly questionnaires. Participants in this analysis were those 281 patients.

Data collection

In all questionnaires, back pain intensity was derived from the mean of 3 self-reported 11-point numeric rating scales (NRS, 0 - 10) for the least and usual pain in last 2 weeks, and current pain [16]. Physical disability associated with back pain was measured using the Roland-Morris Disability Questionnaire (RMDQ, 24 items, score range 0 - 24) [36]. Pain duration was measured as time since the last pain-free month [13], and the presence of leg pain and distal leg pain was reported for the previous 2 weeks. These are classified as pain-related factors.

Psychological factors were selected based on previous prognostic findings within the 2004 - 2006 dataset [4,5,19,20]. These were measured in the initial baseline questionnaire, using the Illness Perception Questionnaire-Revised (IPQ-R) [31]. The IPQ-R contains 5 subscales relating to the illness (in this case pain); consequences (the consequences related to pain, score range 6 - 30), emotional representation

(the emotional impact of pain, score range 6 - 30), personal control (how much perceived control the person has on the management of their pain, score range 6 – 30), treatment control (how much perceived control for the pain can be attributed to treatments, score range 5 - 25) and timeline (beliefs on how long the condition will last, score range 6 - 30). The Coping Strategies Questionnaire 24 was used to assess the level of catastrophising in relation to pain (CSQ24, catastrophizing subscale, 6 items, score range 0 - 36) [21], the Hospital Anxiety and Depression Scale was used to measure affect (HADS, 14 questions, score range 0 – 21 for anxiety and depression separately) [42], the Tampa Scale for Kinesiophobia was used to measure fear of movement (TSK,; 17 items, score range 17 - 68) [28], the Pain Self-efficacy Questionnaire was used to assess the ability of the person to cope and manage despite their current pain levels (PSEQ, 10 items, score range 0 - 60) [33]. Finally passive behavioural coping items were included measuring aspects such as withdrawal from activities, avoidance, and resting (6 items, score range 0 – 6) [41].

Baseline questionnaires also included the socio-demographic and occupational factors of age ~~(classified into age groups: <38, 38–45, 46–52, >52 years)~~, gender, educational level (education up to the age of 16 years vs. education beyond age 16), social class (higher: managerial, professional, intermediate, self-employed occupations vs. lower: supervisory, technical, semi-routine and routine occupations), and current working status (working as normal vs. reduced work or not working).

Statistical analysis

From the 5-year questionnaire and the subsequent 6 monthly questionnaires, pain intensity scores were trichotomized into no pain (a score < 1.0), mild-moderate pain

(a score ≥ 1.0 and < 5.0), and high pain (a score ≥ 5.0), analysed as an ordinal variable. This cut-off has been established in our previous studies [15,19], and is supported by evidence that individuals scoring less than the midpoint on a pain intensity scale were unlikely to suffer a significant level of disability [38]. Questionnaires were scored according to the systems suggested by the developers, where appropriate.

Baseline characteristics were grouped by domain; socio-demographic and occupational (age, gender, education, social class, employment status), pain-related (pain intensity, disability, pain duration, leg pain, distal pain), and psychological (illness perceptions, depressive and anxiety symptoms, fear of movement, catastrophising, coping, self-efficacy), similar to previous analyses [5].

Assignment of individuals to trajectories

The categorised pain intensity scores from the 5-year questionnaire and the following 6 monthly questionnaires were used to cluster participants into different courses of pain, using longitudinal latent class analysis (LLCA), as in the BaRNS study [15]. The assumption behind latent class analysis is that there exists a certain number of distinct pathways of low back pain, and participants can be grouped into a small number of clusters representing these pathways based on their profiles of pain over time, with each participant belonging to one cluster. The 4 trajectories ("no or occasional mild", "persistent mild", "persistent severe", "fluctuating between mild and severe pain") identified at 7 years follow-up from 112 participants in the BaRNS study [11] were used as the basis for this analysis, and each of the BeBack study participants were allocated to the predefined cluster best matching their pain profile. In order to do this, the 281 BeBack participants were merged into a single dataset

with the 112 participants from the BaRNS study who were pre-classified into their LLCA clusters. A 4-class restricted LLCA model was applied based on the 4 pre-established clusters. The posterior probabilities of belonging to each of the 4 clusters for the BeBack participants were then freely estimated within this model. Participants were allocated to the cluster for which they had the highest probability. The goodness of fit of the model was assessed by determining the mean posterior probabilities for the BeBack study participants allocated to each cluster, and subjective assessment of how well individual trajectories within a cluster followed the cluster-specific trajectory. Participants should be allocated to their assigned cluster with a high probability of belonging to that cluster, lower probabilities might suggest the model has difficulty discriminating between clusters and that participants may not match the trajectory described by their assigned cluster. Mean posterior probabilities above 0.70 are generally considered to show clear allocation of participants to clusters [32]. LatentGOLD 4.0 was used for this analysis.

An alternative approach to assess the generalizability of the previously derived trajectories is to assess whether we would identify the same number of clusters and trajectory patterns for this cohort using the same modelling method used in the previous study [11,15]. However there is no definitive method of identifying the best fitting model, and so both statistical goodness of fit indices (of which there are several) and interpretation of the resultant clusters are generally used. This means selection of the optimal model is somewhat subjective with potential for bias through our knowledge of the trajectories identified in our previous study. Therefore we carried this out purely as a sensitivity analysis by first using statistical goodness of fit indices to assess whether a four cluster model appeared optimal for this cohort. We then used the monthly cluster-specific probabilities of having each level of pain to

assess whether these four clusters yielded similar trajectories as in the previous study. See Supplementary File 1 for full details of the methods (available online at http://links.lww.com/PAIN/A499).

Determination of prognostic factors

~~Given the small prevalence of the fluctuating trajectory in the BaRNS study [11], the 4 clusters were dichotomized into 2 cluster groups at 5-year follow-up: a no or mild (i.e. "no, or occasional mild" or "persistent mild") and a severe (i.e. "fluctuating" or "persistent severe") pain course for the purposes of determining prognostic factors. This division fits with our previous cut-off for high pain, as the mean pain scores for the no or mild cluster group were below 3 out of 10, and the mean pain scores for the severe or fluctuating cluster group were around 5 or above in the BaRNS study.~~

To determine factors predictive of pain course at 5-year follow-up, we used a stepped process based on an approach we have used previously [24,25]. Possible collinearity between potential prognostic factors was tested. Unadjusted relative risk ratios (RRRs) were calculated (with 95% confidence intervals (CIs)) to show the univariable association between each potential prognostic factor and the 5-year cluster group using univariable multinomial logistic regression models. Multivariable multinomial logistic regression modelling was then used within each domain (socio-demographic and occupational, pain-related, psychological) to assess the independent associations of the significant factors (statistical significance of any level of the ordinal variable) ~~or factors with ORs greater than 1.30 or less than 0.77~~ from the univariable analysis with pain course at 5-years. Then, all significant variables in the within-domain analyses were included in a final model, with all

variables entered simultaneously. The “no or occasional mild” group was set as the reference group. Given the small prevalence of the fluctuating trajectory in the BaRNS study [11] and the relative small cohort size of this study, the fluctuating group was combined with the “persistent severe” group.

We further determined whether the baseline prognostic factors had similar relationships with a single assessment (i.e. pain intensity score at 5-years) as identified for the patient clusters based on multiple assessments (i.e. the pain trajectories). Additional multinomial logistic regression models using the same stepped approach but using the trichotomized pain score at 5-years (< 1.0 as no pain, ≥ 1.0 & < 5.0 as mild-moderate pain, and ≥ 5.0 as high pain) as the dependent variable were carried out.

Analysis was performed using STATA 14 (StataCorp LLC, Texas, USA).

Results

Characteristics of the included sample from their initial baseline BeBack study questionnaires are presented in Table 1. Comparing these participants with patients who responded to the 5-year questionnaire but did not return enough subsequent monthly questionnaires (n = 207) showed only significant difference on age. Participants in this analysis were slightly (mean 48 vs. 46) older (see Supplementary File 2, available online at http://links.lww.com/PAIN/A499).

Trajectories analysis

The 281 participants in the current analysis were allocated to the four predefined clusters using LLCA. 79 (28%) were included in the “no or occasional mild” pain

cluster, 131 (47%) in the “persistent mild” cluster, 60 (21%) in the “persistent severe” cluster and 11 (4%) in the “fluctuating” cluster. The mean posterior probabilities for the assigned clusters was over 0.90 for each cluster except for the fluctuating cluster where it was 0.74. The probability of belonging to each non-assigned class was under 0.10 except for those allocated to the fluctuating cluster who had a mean probability of 0.22 of being allocated to the persistent mild cluster (see Table 2). This suggests the clusters were distinct and participants were clearly allocated to their assigned cluster.

The mean monthly pain intensity scores (trajectories) for each of the clusters has been plotted in Figure 1, and the clearly separate trajectories for the different clusters is apparent. Trajectories for the current analysis (BeBack study participants with 5-year follow-up) as well as the previous analysis (BaRNS study participants with 7-year follow-up) [11] are shown, and indicate very similar monthly cluster-specific mean scores in the two cohorts.

Comparison of the initial baseline characteristics of participants in the clusters at 5-year follow-up indicates that people in milder clusters were more highly educated and less likely to not work or have reduced their work than those in more severe clusters. Participants allocated to the milder clusters also reported shorter pain duration, less leg pain, and had lower scores on all of the measures of psychological factors (see Table 3).

Prognostic factors

~~For the analysis of prognostic factors, 210 patients were allocated into the no or mild pain course group (i.e. “no or occasional mild” pain or “persistent mild” pain), while~~

~~71 were grouped into the severe pain course (i.e. "fluctuating" or "severe chronic" pain).~~

All the selected baseline factors, except for age and gender, were found to be associated with 5-year cluster group in the univariable analyses (Table 4). After adjustment within each domain, social class and working status (from socio-demographic and occupational domain), pain intensity. physical disability, pain duration and distal pain (from pain-related domain), and perceived consequence, emotional representation, personal control, patient's perception that the pain will last a long time, anxiety~~, pain self-efficacy~~ and passive behavioural coping (from psychological domain) were still associated (Table 4).

In the final model, the baseline factors significantly associated with more severe 5-year pain course were: lower social class (RRR 5.4, 95% CI 1.8, 16.2; "persistent severe" and "fluctuating" to "no, occasional"), higher pain intensity (RRR 1.9 per unit increase, 95% CI 1.3, 2.6)~~, higher physical disability (OR 1.12 per unit increase; 95% CI 1.00, 1.26), pain duration of more than 3 years (OR 2.74; 95% CI 1.02, 7.31),~~ greater perception on serious consequence from pain (RRR 1.2 per unit increase, 95% CI 1.0, 1.4), lower emotional representation (RRR 0.8 per unit increase, 95% CI 0.7, 1.0), ~~and~~ greater perception that the pain will last a long time (RRR 1.2 per unit increase, 95% CI 1.1, 1.3), less beliefs in the personal controllability of pain (RRR 0.9 per unit increase, 95% CI 0.7, 1.0), and a higher passive behavioural coping score (RRR 1.9 per unit increase, 95% CI 1.2, 3.1) (Table 4).

Statistically significant predictors of a worse 5-year outcome when based on a single assessment (i.e. pain intensity score at 5-year) were higher baseline pain intensity, longer pain duration, greater perception that the pain will last a long time and a

higher passive behavioural coping score (Supplementary File 3, available online at http://links.lww.com/PAIN/A499).

Sensitivity analysis

The sensitivity analysis deriving latent classes for this cohort using the same approach as in the original study showed that a 4-cluster model fitted this cohort's data well. The derived clusters were similar in their patterns of pain as the original clusters. The mean posterior probabilities for the assigned clusters were over 0.95 for each cluster except for the "fluctuating" cluster where it was 0.88. The probability of belonging to each non-assigned cluster was low (< 0.12). Comparison of the assignment of participants to the clusters to their cluster assignments based on the previously identified clusters used in the main analysis showed that 259/281 (92%) participants were assigned to the same clusters (see Supplementary File 1, available online at http://links.lww.com/PAIN/A499).

Discussion

This study shows that low back pain trajectories identified within one primary care consultation cohort are generalizable to another. Predictors of those trajectories, apparent 5 years before the identification of the trajectories, have also been identified. It is the first time that the external validity of identified trajectories has been assessed using comparable methods within a new sample of low back pain patients, and the analysis shows that the previous findings of 4 trajectories [15] of low back pain have good external validity. For the first time, prognostic factors for trajectory membership have been described using data from a time point before the

trajectories were derived. Findings indicate that socio-economic status, pain intensity ~~and duration, physical disability,~~ and several dimensions of patients' illness perceptions (including consequences, emotional response, timeline, personal control and passive behavioural coping) are key predictors of pain trajectory 5-years later.

A strength of this study is the prospective design, meaning that the measurement of prognostic factors associated with 5-year trajectory clusters clearly preceded the data collection period used to derive the trajectories. The use of pain trajectories as the outcome in the analysis of prognostic factors is also a strength, as studies have shown that trajectories are more accurate measures of pain status than single or scattered follow-up points [1], and this type of analysis has been recommended [26]. Our analyses using the single pain score at 5-years as the outcome generated fewer associations with the baseline prognostic factors. Trajectories of pain in this group of back pain patients were relatively stable over time. However this may not be the case in other groups of pain patients, for example patients with new episodes of back pain, pain in other body sites, or different age groups. For example, common trajectories of pain in knee osteoarthritis included both improvement and deterioration [34], as did pain across several sites in adolescents [17]. These trajectories can only be captured by repeated measurements. Although repeated monthly pain assessments involve increased measurement burden for patients, it better reflects patterns of pain over time and reduces recall bias [1]. New data collection methods such as web-based questionnaires, mobile devices and the visual trajectories questionnaire for pain [12] may be helpful to reduce the measurement burden. There were missing monthly pain scores within the sample used in our analysis, however analysis of just those with no missing data did not affect the prevalence of each cluster and slightly increased the mean posterior probabilities for

the assigned cluster. The long-term follow-up and use of validated questionnaires are also strengths. However, the sample size for the analysis of predictors was limited due to loss to follow-up at 5-years, and the small size of some of the trajectories. ~~This meant that it was not possible to identify predictors of individual trajectory membership, but of trajectory cluster groups.~~ Comparison with study participants not included in the full analyses or the whole cohort subjects [19] showed few differences other than included participants were slightly older. Ideally we would have kept the fluctuating cluster as a separate group when exploring cluster predictors, however given the small number of participants in this cluster this was not possible. Our study shows the trajectories identified in another sample of back pain consulters appear generalizable but further work should assess the generalisability of the identified predictors for these trajectories, in particular whether a fluctuating pattern of pain has different predictors to a persistent severe pattern.

We allocated participants to the 4 trajectories of low back pain derived in a previous study [15] and assessed how well these participants fitted their allocated trajectory. An alternative approach to assess the generalizability of the previously derived trajectories would have been to derive the trajectories for this cohort using the same modelling method used in the previous study. However deciding on the optimal number of clusters may have then been influenced by knowledge of these prior trajectories, given there is no definitive method using statistical goodness of fit measures of determining the optimal number of clusters [26]. Hence we performed this as a sensitivity analysis which again indicated good generalisability of the clusters. The approach we have taken utilises a strength of latent class analysis of using information on people with established and validated clusters to identify the most likely cluster membership of a new group of people. This approach has shown

that a distinct group of low back pain patients could be clearly allocated to the same trajectories identified previously. Our study suggests these trajectories can now be applied more widely in research for classifying back pain consulters.

Our findings on the predictors of cluster membership have similarities with other studies of associations with back pain trajectories. For example Macedo et al [29] ~~also~~ reported that disability and self-efficacy were associated with trajectories, and Axén et al [2] ~~also~~ reported that pain intensity and duration were associated with trajectories, although in neither of these studies did the measurement of predictors clearly precede the derivation of trajectories. Other prognostic factors such as social class status and patients' perceptions about back pain have not been identified in previous trajectory studies. The latter finding supports the idea that people develop personal beliefs about their low back pain and these influence subsequent reactions and behavior, which then may affect their long-term outcomes. Identification of these factors has potential clinical impact as these perceptions are modifiable factors and could be revised, for example, through education or cognitive restructuring.

The findings from this analysis that low back pain trajectories have good external validity, combined with findings from previous studies showing the clearly different characteristics of patients in these trajectories [15], and their long-term persistence, have key implications. Knowledge of these long-term trajectories should enable better understanding of the long-term course of low back pain. If the trajectory that an individual is likely to belong to can be identified, the challenge is then to identify effective management tailored to individual trajectories. This may mean more intensive treatment for those on a more severe trajectory, but for those likely to be in the milder trajectories this may mean avoiding unnecessary investigations or over-treating. However, the finding that pain intensity at baseline predicts pain trajectory

5-years later, along with previous findings that trajectory membership [11] and presence of low back pain [23] have long-term stability, indicates the challenge of shifting patients from more severe trajectories, and helping people better manage and cope with their symptoms may be the best current alternative. Improved understanding of how people get into these stable pain trajectories in the first place is required. Given the evidence of relatively trajectory stability in adult back pain populations, one potential direction would be a focus on children or young adult populations as a way of developing preventative interventions [14].

Our results provide clear evidence of the generalizability of low back pain trajectories in patients consulting in primary care, and provide direction for future research and clinical practice.

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Contributors: NEF conceived the BeBack study, and KMD conceived the current analysis. KMD and YC drafted the manuscript. PC, KMD and NF coordinated the data collection. YC, VYS and KPJ analysed the data. ~~KMD and~~ YC had full access to all the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis. All authors contributed to the interpretation of the data and approved the final version of the manuscript submitted for publication.

Data sharing arrangement: The Arthritis Research UK Primary Care Centre has established data sharing arrangements to support joint publications and other research collaborations. Applications for access to anonymised data from our research databases are reviewed by the Centre's Data Custodian and Academic Proposal (DCAP) Committee, and a decision regarding access to the data is made subject to the NRES ethical approval first provided for the study and to new analysis being proposed. Further information on our data sharing procedures can be found on the Centre's website (http://www.keele.ac.uk/pchs/publications/datasharingresources/) or by emailing the Centre's data manager (primarycare.datasharing@keele.ac.uk).

Conflicts of interest: None.

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Figure 1. Mean monthly back pain intensity scores of current study participants (BeBack, 5-year follow-up) and the comparison study (BaRNS, 7-year follow-up)

Table 1. Characteristics of participants at initial baseline (n=281)

	Initial baseline	
Characteristics	Number (%)	Mean (SD)
Socio-demographic		
Age (years)	-	48.1 (8.8)
Gender (female)	176 (62.6)	-
Education (<16 years)	106 (37.7)	-
Social class (low)	104 (37.0)	-
Working status (restricted/not working)	110 (39.2)	-
Pain-related		
Pain intensity	-	4.0 (2.3)
Disability grade	-	8.8 (5.9)
Pain duration (≥ 3 years)	67 (23.8)	-
Leg pain (yes)	177 (63.0)	-
Distal pain (yes)	175 (62.3)	-
Psychological		
IPQR, consequences score	-	17.3 (5.5)
IPQR, emotional representation score	-	16.4 (5.4)
IPQR, personal control score	-	20.9 (3.6)
IPQR, treatment control score	-	17.1 (3.3)
IPQR, timeline acute-chronic score	-	20.2 (5.8)
CSQ, catastrophizing score	-	9.5 (7.9)
HADS, anxiety symptoms score	-	8.1 (4.5)
HADS, depression symptoms score	-	6.2 (4.2)
TSK, fear of movement score	-	38.7 (7.1)
Pain self-efficacy score	-	39.2 (14.1)
Passive behavioural coping score	-	2.3 (1.4)

IPQR, the Illness Perception Questionnaire-Revised; CSQ, the Coping Strategies Questionnaire; HADS, the Hospital Anxiety and Depression Scale; TSK, the Tampa Scale for Kinesiophobia; SD, standard deviation.

Table 2. Posterior probability of membership of clusters (n=281)

	Mean posterior probability for each cluster (95% CI)			
Assigned cluster, n	No, occasional mild	Persistent mild	Fluctuating	Persistent severe
No, occasional mild, *n*=79	0.97 (0.95, 0.99)	0.03 (0.01, 0.05)	0.0 (0.0, 0.0)	0.0 (0.0, 0.0)
Persistent mild, *n*=131	0.02 (0.01, 0.03)	0.93 (0.91, 0.95)	0.05 (0.03, 0.07)	0.00 (0.0, 0.01)
Fluctuating, *n*= 11	0.0 (0.0, 0.0)	0.22 (0.10, 0.35)	0.74 (0.59, 0.88)	0.04 (0.0, 0.08)
Persistent severe, *n*=60	0.0 (0.0, 0.0)	0.02 (0.0, 0.03)	0.05 (0.03, 0.07)	0.94 (0.90, 0.97)

Table 3. Initial baseline characteristics of 281 low back pain patients stratified by trajectory clusters at 5-year

	5-year cluster								
	No, occasional mild, n=79		Persistent mild, n=131		Fluctuating, n=11		Persistent severe, n=60		p^c
Initial baseline characteristics	Number (%)	Mean (SD)	Number (%)	Mean (SD)	Number (%)	Mean (SD)	Number (%)	Mean (SD)	
Socio-demographic and occupational factors									
Age (years)	-	47.7 (8.8)	-	47.9 (8.8)	-	49.9 (8.5)	-	48.6 (9.1)	0.41
Gender (female)	47 (59.5)	-	83 (63.4)	-	8 (72.7)	-	38 (63.3)	-	0.61
Education (<16 years)	19 (24.1)	-	50 (38.2)	-	4 (36.4)	-	33 (55.0)	-	< 0.001
Social class (low)	20 (25.3)	-	51 (38.9)	-	4 (36.4)	-	29 (48.3)	-	0.008
Working status (restricted/not working)	18 (22.8)	-	40 (30.5)	-	8 (72.7)	-	44 (73.3)	-	< 0.001
Pain-related factors									
Pain intensity[b]	-	2.8 (2.1)	-	3.6 (1.8)	-	4.4 (1.2)	-	6.5 (1.8)	< 0.001
Disability[b]	-	6.3 (4.8)	-	7.3 (4.9)	-	12.5 (3.5)	-	14.8 (5.4)	< 0.001
Pain duration (≥ 3 years)	12 (15.2)	-	25 (19.1)	-	6 (54.6)	-	24 (40.0)	-	< 0.001
Leg pain (yes)	42 (53.2)	-	78 (59.5)	-	7 (63.6)	-	50 (83.3)	-	< 0.001
Distal pain (yes)	34 (43.0)	-	87 (66.4)	-	9 (81.8)	-	45 (75.0)	-	< 0.001
Psychological factors									
IPQR, consequences score[b]	-	14.3 (4.7)	-	17.0 (4.9)	-	20.3 (4.8)	-	21.6 (5.0)	< 0.001
IPQR, emotional representation score[b]	-	14.3 (5.0)	-	16.3 (4.7)	-	16.1 (3.5)	-	19.8 (6.0)	< 0.001
IPQR, personal control score[a]	-	22.5 (3.1)	-	21.1 (3.7)	-	21.5 (2.9)	-	18.3 (2.7)	< 0.001
IPQR, treatment control score[a]	-	18.5 (3.1)	-	17.0 (3.0)	-	17.2 (2.8)	-	15.2 (3.5)	< 0.001
IPQR, timeline acute-chronic score[b]	-	16.7 (5.6)	-	20.3 (5.4)	-	24.5 (1.9)	-	23.9 (4.5)	< 0.001
CSQ, catastrophizing score[b]	-	6.5 (5.7)	-	8.4 (6.7)	-	10.7 (6.2)	-	15.7 (9.6)	< 0.001
HADS, anxiety symptoms score[b]	-	6.0 (3.7)	-	7.8 (4.2)	-	8.9 (2.8)	-	11.1 (4.6)	< 0.001
HADS, depression symptoms score[b]	-	4.2 (2.9)	-	5.9 (3.9)	-	8.0 (3.1)	-	9.2 (4.7)	< 0.001
TSK, fear of movement score[b]	-	35.7 (5.9)	-	38.3 (6.8)	-	39.0 (2.3)	-	43.2 (7.6)	< 0.001
Pain self-efficacy score[a]	-	45.0 (11.9)	-	41.4 (12.3)	-	33.5 (9.8)	-	28.0 (15.0)	< 0.001
Passive behavioural coping score[b]	-	1.8 (1.3)		2.2 (1.3)		2.8 (1.2)		3.0 (1.4)	< 0.001

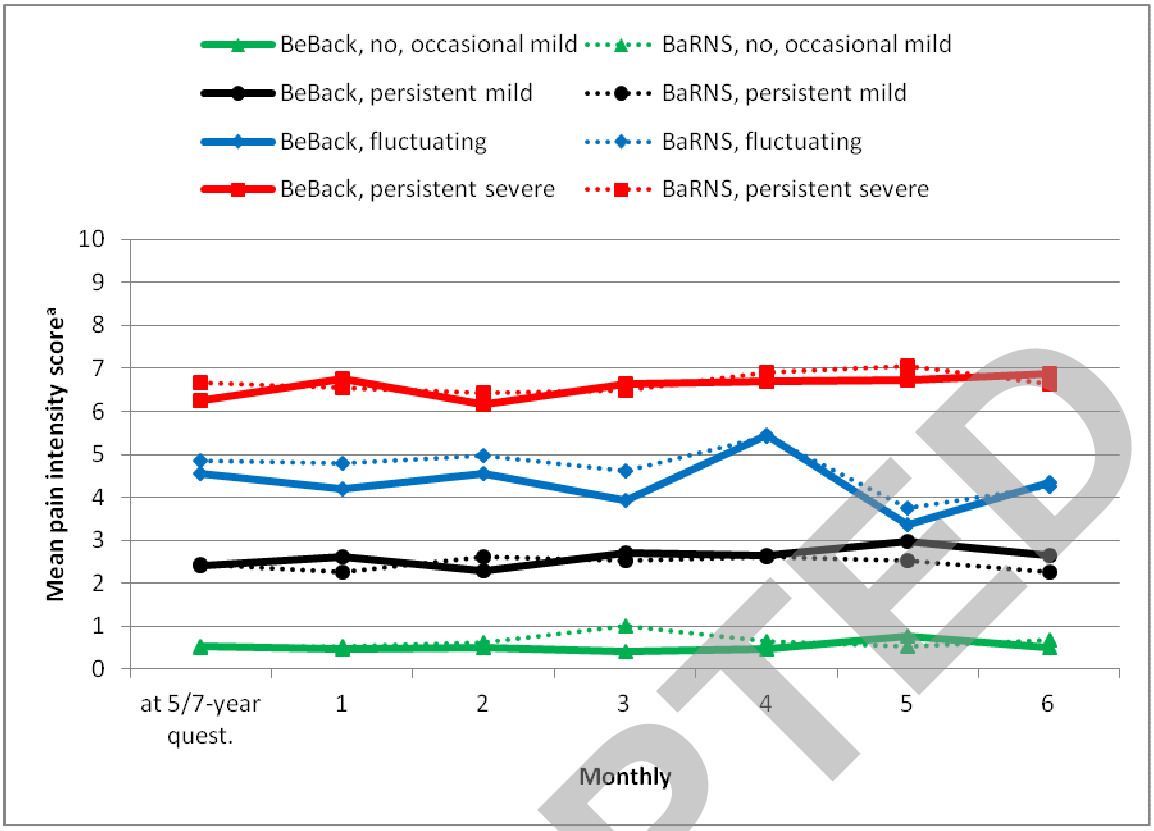
[a] high score associated with better outcome; [b] low score associated with better outcome; [c] *p* value for trend.

Table 4. Multinomial logistic regression models for the relationship between potential prognostic indicators at initial baseline and membership of pain trajectories clusters at 5-years

Prognostic indicators	RRR (95% CI), unadjusted	RRR (95% CI), domain adjustment	RRR (95% CI), final model
Socio-demographic and occupational			
Age, years			
No, occasional	1.0 (referent)	-	-
Persistent mild	1.00 (0.97, 1.03)	-	-
Fluctuating and persistent severe	1.01 (0.98, 1.05)	-	-
Female			
No, occasional	1.0 (referent)	-	-
Persistent mild	1.18 (0.66, 2.09)	-	-
Fluctuating and persistent severe	1.25 (0.65, 2.43)	-	-
Less education			
No, occasional	1.0 (referent)	1.0 (referent)	-
Persistent mild	2.05 (1.10, 3.84)	1.79 (0.92, 3.48)	-
Fluctuating and persistent severe	3.77 (1.87, 7.61)	2.01 (0.88, 4.61)	-
Low social class[a]			
No, occasional	1.0 (referent)	1.0 (referent)	1.0 (referent)
Persistent mild	2.08 (1.12, 3.88)	1.87 (0.98, 3.55)	2.23 (1.05, 4.74)
Fluctuating and persistent severe	4.79 (2.25, 10.16)	4.17 (1.84, 9.44)	5.39 (1.80, 16.19)
Restricted or not working			
No, occasional	1.0 (referent)	1.0 (referent)	1.0 (referent)
Persistent mild	1.51 (0.79, 2.87)	1.26 (0.63, 2.50)	0.94 (0.40, 2.21)
Fluctuating and persistent severe	9.27 (4.41, 19.50)	5.98 (2.64, 13.56)	1.66 (0.51, 5.48)
Pain-related			
Pain intensity score[a]			
No, occasional	1.0 (referent)	1.0 (referent)	1.0 (referent)
Persistent mild	1.26 (1.07, 1.48)	1.34 (1.09, 1.65)	1.18 (0.94, 1.48)
Fluctuating and persistent severe	2.40 (1.91, 3.02)	2.08 (1.57, 2.74)	1.87 (1.33, 2.64)
RMDQ Disability score			
No, occasional	1.0 (referent)	1.0 (referent)	1.0 (referent)
Fluctuating	1.04 (0.98, 1.11)	0.97 (0.90, 1.05)	0.95 (0.86, 1.05)
Fluctuating and persistent severe	1.34 (1.24, 1.45)	1.14 (1.03, 1.26)	1.06 (0.92, 1.22)
Pain duration >=3 years			
No, occasional	1.0 (referent)	1.0 (referent)	1.0 (referent)
Persistent mild	1.32 (0.62, 2.81)	1.09 (0.49, 2.43)	0.76 (0.30, 1.90)
Fluctuating and persistent severe	4.34 (1.99, 9.47)	3.21 (1.19, 8.64)	1.91 (0.53, 6.90)
Leg pain			
No, occasional	1.0 (referent)	1.0 (referent)	-
Persistent mild	1.26 (0.72, 2.22)	1.00 (0.53, 1.90)	-
Fluctuating and persistent severe	3.76 (1.78, 7.95)	1.01 (0.38, 2.71)	-
Distal pain			
No, occasional	1.0 (referent)	1.0 (referent)	1.0 (referent)
Persistent mild	2.62 (1.47, 4.65)	2.82 (1.53, 5.18)	2.27 (1.12, 4.58)
Fluctuating and persistent severe	4.47 (2.19, 9.12)	2.86 (1.10, 7.42)	1.60 (0.48, 5.27)
Psychological			
IPQR, consequences score[a]			
No, occasional	1.0 (referent)	1.0 (referent)	1.0 (referent)
Persistent mild	1.13 (1.06, 1.20)	1.07 (0.97, 1.18)	1.10 (1.00, 1.21)
Fluctuating and persistent severe	1.34 (1.24, 1.46)	1.17 (1.02, 1.34)	1.17 (1.01, 1.36)
IPQR, emotional representation score[a]			
No, occasional	1.0 (referent)	1.0 (referent)	1.0 (referent)

Persistent mild	1.09 (1.03, 1.16)	0.98 (0.89, 1.09)	0.97 (0.87, 1.07)
Fluctuating and persistent severe	1.21 (1.13, 1.30)	0.87 (0.76, 0.99)	0.83 (0.71, 0.97)
IPQR, personal control score[a]			
No, occasional	1.0 (referent)	1.0 (referent)	1.0 (referent)
Persistent mild	0.88 (0.80, 0.96)	0.87 (0.78, 0.98)	0.90 (0.81, 1.00)
Fluctuating and persistent severe	0.72 (0.65, 0.81)	0.76 (0.65, 0.89)	0.85 (0.72, 1.00)
IPQR, treatment control score			
No, occasional	1.0 (referent)	1.0 (referent)	-
Persistent mild	0.84 (0.75, 0.93)	0.98 (0.85, 1.14)	-
Fluctuating and persistent severe	0.73 (0.65, 0.82)	1.03 (0.85, 1.25)	-
IPQR, timeline acute-chronic score[a]			
No, occasional	1.0 (referent)	1.0 (referent)	1.0 (referent)
Persistent mild	1.13 (1.07, 1.19)	1.11 (1.02, 1.20)	1.09 (1.01, 1.17)
Fluctuating and persistent severe	1.31 (1.21, 1.41)	1.22 (1.09, 1.37)	1.19 (1.06, 1.34)
CSQ, catastrophizing score			
No, occasional	1.0 (referent)	1.0 (referent)	-
Persistent mild	1.05 (1.00, 1.10)	0.94 (0.87, 1.01)	-
Fluctuating and persistent severe	1.16 (1.10, 1.23)	0.97 (0.89, 1.05)	-
HADS, anxiety symptoms score			
No, occasional	1.0 (referent)	1.0 (referent)	1.0 (referent)
Persistent mild	1.12 (1.04, 1.21)	1.08 (0.96, 1.22)	1.03 (0.93, 1.15)
Fluctuating and persistent severe	1.32 (1.20, 1.44)	1.24 (1.06, 1.45)	1.08 (0.92, 1.27)
HADS, depression symptoms score			
No, occasional	1.0 (referent)	1.0 (referent)	-
Persistent mild	1.16 (1.06, 1.26)	1.07 (0.92, 1.24)	-
Fluctuating and persistent severe	1.37 (1.24, 1.52)	1.01 (0.85, 1.21)	-
TSK, fear of movement score			
No, occasional	1.0 (referent)	1.0 (referent)	-
Persistent mild	1.06 (1.02, 1.11)	1.02 (0.96, 1.08)	-
Fluctuating and persistent severe	1.17 (1.11, 1.24)	0.99 (0.91, 1.08)	-
Pain self-efficacy score			
No, occasional	1.0 (referent)	1.0 (referent)	-
Persistent mild	0.97 (0.95, 1.00)	1.02 (0.98, 1.05)	-
Fluctuating and persistent severe	0.91 (0.89, 0.94)	0.97 (0.93, 1.02)	-
Passive behavioural coping score[a]			
No, occasional	1.0 (referent)	1.0 (referent)	1.0 (referent)
Persistent mild	1.27 (1.01, 1.58)	1.30 (1.00, 1.69)	1.35 (1.02, 1.78)
Fluctuating and persistent severe	2.02 (1.54, 2.64)	1.78 (1.24, 2.55)	1.90 (1.17, 3.08)

[a]Prognostic factors significantly associated with a more severe trajectory in the final model; IPQR, the Illness Perception Questionnaire-Revised; CSQ, the Coping Strategies Questionnaire; HADS, the Hospital Anxiety and Depression Scale; TSK, the Tampa Scale for Kinesiophobia; RRR, relative risk ratio; CI, confidence interval.



[a]Original score on an 11-point scale (0 - 10).