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Observational study

From acute to chronic back pain: Using linear mixed models to explore changes in pain intensity, disability, and depression

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HIGHLIGHTS

- Changes in pain intensity, disability, and depression since pain onset were investigated.
- Changes in pain intensity are found only over the first three months.
- Disability and depression slightly decrease following a linear trend.
- The results suggest that pain chronification is a continuous process.
- The utility of standard classifications of pain as acute or chronic is further discussed.

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ABSTRACT

Background/aims: This longitudinal study investigated the pattern of change in pain intensity, disability, and depression in 232 chronic pain patients who were followed up for 2 years since pain onset. Most studies that have investigated changes in these variables over time have used participants who had already been in pain for more than 3 months. Few studies have followed up individuals from the acute phase onward and such studies used traditional statistical methods that cannot identify transition points over time or measure inter-individual variability.
Methods: We followed up individuals with chronic pain from pain onset up to 18 months and we examined their pain intensity, disability and depression trajectories using a modelling approach that allows to account for between and within-individual variability. We compared three patterns of change based on theoretical criterions: a simple linear growth model; a spline model with a 3-month transition point; and a spline model with a 6-month transition point. Time with pain was selected as time metric to characterise the change in these variables in the transition from acute to chronic pain. Sex and age differences were also examined.
Results: The results showed that the pain intensity trajectory was best represented by the spline model with a 3-month transition point, whereas disability and depression were best explained by linear growth models. There were sex differences at intercept level in all the models. There were age differences at baseline for pain intensity. No sex or age differences were found for the slope.
Conclusions: Pain intensity decreased in the first 3 months but underwent no further change. Disability and depression slightly but constantly decreased over time. Although women and older individuals are more likely to report higher pain intensity or pain-related disability in the first three months with pain, no differences by sex or age appear to be associated with the changes in pain intensity, depression and disability through the process of chronification.
Implications: Our findings suggest that pain chronification could be considered a continuous process and contribute to the ongoing discussion on the utility of standard classifications of pain as acute or chronic from a clinical point of view. Clinical and intervention decisions based in these standard classifications should consider the differences in the trajectories of pain related variables over time. In addition, this article illustrates a statistical procedure that can be of utility to pain researchers.

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1. Introduction

Chronic pain is commonly defined as any pain lasting more than 3 months (IASP, 1994) and is one of the most disabling health problems [1]. A recent review suggested that pain decreases from the moment of pain onset [2]. However, these findings are not consistent across studies. Some authors found prevalence rates and pain intensity to be fairly stable over time [3,4], whereas others suggested that the course of pain can fluctuate [5]. Moreover, some studies have tried to group their participants according to reported changes in pain over time [6,7]. Elliot et al. [6] investigated changes in pain intensity over 4 years and found that 49% reported no change in pain intensity, whereas the rest only reported slight changes. Tamcan et al. [7] investigated pain intensity every week for 1 year and found that it remained fairly constant in those who reported mild and severe persistent pain intensity.

These studies mainly addressed pain and pain intensity prevalence rates, and only a few also investigated the course of adjustment variables, such as disability [6,8] or depression [9,10]. Regarding disability, Elliot et al. [6] investigated changes in chronic pain between baseline and 18-month follow-up and found significant changes in bodily pain and physical functioning over time. McGorry et al. [8] investigated daily self-reports of pain intensity and disability over a 6-month period. Their results suggested that chronic pain should not be considered a static phenomenon, and that intermittent increases in pain intensity might be associated with disability. Studies that have investigated depression trajectories have found inconsistent results. Mitchell and Adkins [9] found that levels of depression increased over time, whereas Saunders et al. [10] found that depression appeared to remain stable over a 5-year period.

Most of these studies included individuals with pain of more than 3-months duration, but none measured these three variables in chronic pain patients since the time of pain onset (i.e., when pain was acute). Although many studies have measured variables at pain onset to predict adjustment when pain becomes chronic, few have investigated their course from acute to chronic pain [11,12]. Casey et al. [11] evaluated pain intensity and disability at pain onset and at 3 months. They found that acute disability, but not acute pain intensity, predicted disability at 3 months. Philips and Grant [12] investigated participants with acute back pain at 3 and 6 months. Their results suggested that: pain intensity appeared to decrease slightly over time; depression mainly changed during the first 3 months, followed by stabilisation; and disability sharply decreased during the first 3 months followed by an increase at 6 months. To the best of our knowledge, these studies were the first to investigate changes from pain onset to its chronic phase in samples of chronic pain patients. However, they mainly used traditional analytical strategies (i.e., multiple regressions, traditional repeated measures analysis), which provide limited information about the pain trajectories, and did not address inter-individual variability. More recent studies have acknowledged this variability and classified chronic pain patients by their pain intensity trajectories [13–15]. For example, Dunn et al. [13,14] classified back pain patients attending primary care services into 4–5 groups by their monthly pain levels over 6 months, being these similar seven years later. Kongsted et al. [15] followed a similar approach and described pain intensity trajectories based on weekly measurements over a year. They identified 5–12 sub-groups in a sample with a recent episode of low back pain via latent class models. These studies [13–15] not only highlight the great inter-individual variability in pain intensity trajectories but the complexity of characterising the course of low back pain [13–15]. It should be noted that the majority of the individuals considered in these studies had pain for more than three months or had previous episodes of back pain.

Within this context, research studies aiming to characterise the course of pain should consider statistical techniques that can measure the pattern of change taking into account inter-individual variability (e.g., linear mixed models) so as individuals who have suffered pain for less than three months at baseline. Our study investigates the pattern of change in pain intensity, depression, and disability from pain onset up to 2 years of chronic pain, using linear mixed models. We propose a specific modelling approach to explore change not only in pain intensity but in relevant adjustment variables.

2. Methods

2.1. Participants

A total of 254 patients with an acute back pain episode were recruited by general practitioners in five Primary Care Units in Málaga (Spain). Exclusion criteria were: pain lasting more than 3 months; being treated for a malignancy, terminal illness, or psychiatric disorder; the presence of back pain that was related with or secondary to a specific medical condition (e.g. tumours, trauma, infection, fractures, and inflammatory disorders), presence of specific back pain; operation in the lumbar area; pregnancy; and not being able to understand Spanish.

The participants were assessed on five occasions, the first when pain duration was less than 3 months. Subsequently, they were assessed four times at 6-month intervals. After screening for eligibility, the overall response rate was 91% of the initial sample. The overall attrition rate was of 36% from wave 1 to wave 2, 12% from wave 2 to wave 3, 6% from wave 3 to wave 4, and 3% from wave 4 to wave 5. Reasons for attrition were as follows: 36% of the missing participants did not reply to the phone calls; 36% stated they "had no time" for the assessment session; 14% expressly refused participation; 10% had made four appointments but did not attend; 3% moved away; and 0.8% died.

2.2. Instruments

Pain intensity. Patients were asked to rate their highest, average, and lowest level of pain over the past 2 weeks, as well as their current pain, on a 0–10 scale, with 0 indicating no pain and 10 pain as intense as the individual could imagine. A composite score was calculated for each individual by averaging the highest, average, lowest, and current level of pain intensity. Jensen et al. [16] showed that composites of 0–10 ratings are reliable measures of pain intensity in chronic pain patients.

Depression. The 7-item Hospital Anxiety and Depression Scale [17] subscale for depression was administered. Higher scores indicate higher levels of depression. The Spanish version of the scale shows appropriate reliability and validity [18]. The internal consistency of the HADS is high ($\alpha = .86$). In the present study the depression subscale showed an adequate internal consistency ($\alpha = .81$).

Disability. The Roland–Morris Questionnaire [19] was used. It consists of 24 items, which reflect limitation in different daily activities attributed by the patient to low back pain. The patient marks each item that applies to his or her current status. The Spanish version showed adequate internal consistency (between $\alpha = .83$ and $\alpha = .94$). In the present study, these showed high internal consistency ($\alpha = .89$)

2.3. Procedure

To guarantee the standardisation of the recruitment process across the five centres, and prior to data collection, the researchers