Low back pain is not a self-limiting problem, but rather a recurrent and sometimes persistent disorder. To understand the course over time, detailed investigation, preferably using repeated measurements over extended periods of time, is needed.

New knowledge concerning short-term trajectories indicates that the low back pain ‘episode’ is short lived, at least in the primary care setting, with most patients improving. Nevertheless, in the long term, low back pain often runs a persistent course with around two-thirds of patients estimated to be in pain after 12 months. Some individuals never have low back pain, but most have it on and off or persistently. Thus, the low back pain ‘condition’ is usually a lifelong experience.

However, subgroups of patients with different back pain trajectories have been identified and linked to clinical parameters. Further investigation is warranted to understand causality, treatment effect and prognostic factors and to study the possible association of trajectories with pathologies.
Introduction

Until recently, low back pain (LBP) was believed to be a self-limiting condition, much like the common cold. The European guidelines for the management of acute LBP state that 90% of patients will recover within 6 weeks [1].

However, research in the past two decades has shown that the majority of back pain sufferers experience episodes of the problem; LBP is actually a recurrent condition [2]. Thus, LBP resembles a long-term condition such as asthma rather than a self-limiting condition such as the common cold. This means that we need to look at LBP (and perhaps all types of spinal pain) as a lifelong process, perhaps with different causes and modifying factors as life goes on, but always present as an underlying ‘trait’.

This shift of paradigm directs the focus of attention away from LBP seen as a single entity to the LBP condition regarded as a chain of LBP episodes [3], that is, with the focus on the course of LBP [4]. This new paradigm comes with a hope of being able to classify nonspecific LBP into clinically meaningful subgroups [5]. Such subgroups may offer new insights into causal mechanisms, prognostic factors and effective treatment strategies. In the past, most studies related to LBP as though it has an ‘end point’, measuring for example, pain intensity, return to work, or recovery at a rather arbitrarily chosen point in time with questionnaire surveys. Because patients with LBP experience ups and downs of varying intensity and duration, such end points are likely to capture LBP at different phases of the condition, making comparison between people and studies potentially meaningless. These outcomes should instead be viewed in the light of the long-term development of LBP (see also chapter 2 of this edition). However, little is known about the detailed course, and trajectory, of LBP.

Methods of data collection for LBP trajectories

In order to study a pain trajectory, frequent measurements of pain, disability or any other outcome over a fairly long time are needed, as measures may vary considerably with time in a fluctuating condition. Until recently, this was not really possible using postal surveys, as this would be both difficult and expensive. Instead, realistically, frequent data collection could be achieved only by using paper-based diaries, which have been shown to produce data of questionable validity [6]. With modern technology, it is now possible to use Web-based diary systems to facilitate repeated and frequent data collection. However, this requires the respondents to have Internet access and to be disciplined in using it also at frequent intervals. This is likely to result in biased study samples.

Frequent e-mail messages is another method that is cheap and capable of collecting ‘fresh’ momentary data much like electronic diaries, but – again – requires easy and frequent use of the Internet plus the discipline suiting the rhythm of questions. In other words, study participants must be able and ready to answer the questions as they are sent out, frequently in some cases but less frequently in others.

In some recent prospective studies, text messages and mobile phones have been used to collect frequent data. Questions are sent on scheduled days and times to the included respondents, who answer with a reply text message in a fully automated Web-based system, SMS Track® [7]. This system has the advantages of being cheap [8] and user-friendly [9], as most people in the modern world carry their phone with them at all times and thus can respond at any time. Further, it has been shown to be capable of yielding valid data [8]. However, the questions asked are restricted by the size of the text message, and must be short, requiring only a short answer. Examples of how such questions can be worded are provided in Table 1.

Answers are immediately recorded in a data file, accessible to the researcher online at any time. Depending on the question asked, the respondents may, for instance, record their pain on a scale from 0 to 10, as it is right now, the past 24 h, the past week and so on. The choice of measure and the frequency of data collection must of course be matched to minimise memory bias and decay. For example, the optimal recall period for pain would not be the same as that for sick leave.

However, one could be concerned that frequent and repeated measurements may tire respondents. Nevertheless, the response rates in these studies are high, so far between 63% [10] and 82% [9]. Moreover, in one study, patients from secondary care answering two text message questions weekly for
52 weeks said that they would not have minded a third question [8]. Another worry might be that the intense focus on the respondent’s conditions may actually influence the examined outcome and that the constant reminding may lead to mood problems. This was tested in a study of patients with rheumatic pain and found not to be the case [11].

In the near future, the use of tailor-made smart phone applications will most certainly combine the advantages of the diary with those of the mobile phone, as more sophisticated electronic equipment becomes common property within all social classes and as Internet access becomes increasingly available and affordable. Frequent data collection therefore offers many new research opportunities.

In addition, clinicians can make use of this method. The course of a condition can be illustrated on an individual level and used in the clinical decision making as well as to sensitise patients to the long-term condition. Some examples of some individual patterns are shown in Figs. 3–6 later in the paper.

The LBP condition versus the LBP episode

It is important to conceptualise LBP as representing two different aspects of a single disorder: the long-term condition of being prone to having LBP versus the acute episode, relapse or exacerbation, when the pain appears, reappears or worsens. If we, again, compare LBP to asthma, we can imagine that the individual LBP episodes may be prevented and treated just as the individual asthma attacks often can be handled. However, the true underlying cause of asthma is not the inhalation of pollen, and similarly one can assume that the causes of the LBP condition are not the same as those of the LBP episodes. The fact that this concept has not been clearly understood in the past may well explain our poor understanding of causality, treatment choice and prognostic factors. We therefore argue that these two concepts must be studied separately.

As discussed in the previous chapter by Dunn et al., LBP is a lifelong problem for most [3]. Ideally, to fully understand the LBP condition, lifelong studies should be undertaken, starting with the very first onset of pain to map out the development over time in terms of characteristics, frequency and duration. Clearly, this is not possible. We therefore have to make do with less lengthy observations to identify different particular patterns. It is also difficult to capture the very first onset of LBP in children and adolescents, for which reason we would have to make do with studying the course pattern in people who already have developed LBP.

Ideally, the study of LBP episodes should capture people who start a new episode after a period of being LBP free [12]; however, this may be difficult. The closest we might get to this is studies of people who consult for their problem, hoping that many of these have just started a new episode. Nevertheless, experience shows that patients often decide to consult later in the course of an episode and not at the very onset. In two observational studies [13,14] of patients consulting for LBP in the primary care setting, around 40% stated that their pain started within the previous week, around 15% stated that it was of 2 weeks’ duration and the remaining 45% had had pain for longer than a fortnight.

In order to obtain a detailed picture of the trajectories of LBP, frequent data collection points are necessary. Only then will the pattern of relapses and remissions be possible to ascertain.

Table 1: Examples of text-message (SMS) questions, outcome measures and frequencies.

<table>
<thead>
<tr>
<th>Question</th>
<th>Outcome measures</th>
<th>Type of answer</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>How many days in the past week has your low back been bothersome?</td>
<td>Number of days</td>
<td>A figure from 0 to 7</td>
<td>Weekly</td>
</tr>
<tr>
<td>How many times did you exercise?</td>
<td>Number of exercise sessions</td>
<td>A figure from 0 and up</td>
<td>Weekly</td>
</tr>
<tr>
<td>How many days during the past month have you been away from work?</td>
<td>Sickness absence (duration or absence yes/no)</td>
<td>A figure from 0 to 31</td>
<td>Monthly</td>
</tr>
<tr>
<td>Please answer how much your lower back hurts today?</td>
<td>Pain intensity</td>
<td>A figure from 0 to 2</td>
<td>Daily</td>
</tr>
</tbody>
</table>

0 = no pain / 1 = some pain / 2 = severe pain
Below follows a description of what is presently known about the long-term and short-term trajectories of LBP in adults.

**The overall course of LBP – the LBP condition**

In our opinion, ideally, the course of LBP should be measured at least monthly over a minimum period of 1 year. Lemeunier et al. conducted a systematic review of longitudinal studies of LBP in the general population [15] and set the requirements at a minimum of 100 patients followed up with a minimum of three surveys. They found eight original studies that were quite diverse with regard to the definition of LBP, populations under study, length of follow-up (between 1 and 28 years), number of follow-ups and outcomes. Unfortunately, only one study [16] fulfilled our criteria for frequent data collection. Despite these differences, a synthesis of the results revealed that people without LBP largely continue to be LBP free and those who have LBP continue to report LBP, indicating very clearly that LBP continues its course over time, with very little change. LBP is indeed a persistent condition. However, the different trajectories that people experience over their lifetime have not been mapped out nor is the clinical importance of various lifetime trajectories known.

**The short-term course of LBP**

*Studies over 1 year*

Itz et al. [17] conducted a systematic review of prospective studies of patients with LBP of <3 months’ duration from the primary care setting [17] and concluded that spontaneous recovery is unlikely, as 65% of patients still experience pain after 12 months. In their review, none of the included studies fulfilled our criteria for frequent data collection, and thus the conclusions were based on fewer measurements.

A summary of the findings from the literature in which the short-term, hence more detailed, course of LBP was studied is presented in Table 2, using information from the individual studies described in this chapter.

Tamcan et al. [16] collected weekly data in the general population using diaries for 1 year on pain intensity, medication use, health-care use and social and work limitations in people from the general population who had reported LBP at an earlier survey. They identified three different persistent courses and one fluctuating course.

Monthly surveys of pain intensity for a year were collected by Dunn et al. [5] in patients from the primary care setting, all of whom consulted for LBP, resulting in similar findings, two sub-trajectories of persistent pain and one of fluctuating pain. However, also a group of ‘recoverers’ was identified.

Contrary to the two studies above, a study by Jensen et al. [18] found LBP to be persistent over 1 year in patients who had consulted the secondary care setting (Fig. 1). In their study, weekly data were collected using SMS Track® on the number of pain days each week. A further analysis of these data by Leboeuf-Yde et al. showed that the vast majority (80%) never experienced a non-episode during this period of 1 year, a non-episode being defined as at least 4 weeks in a row without any LBP [19]. This is hardly surprising, as this group would be likely to consist of people with a more chronic condition than people in the general population or in the primary care setting.

Leboeuf-Yde et al., in another study, analysed data on 50-year olds from the general population [20] and showed that there are three distinct and equally common pain trajectories, namely those who during 1 year never have LBP, those who have it episodically and those who have persistent LBP. In addition, these data were collected with frequent text messaging and this study also included subjects without LBP at baseline.

*Studies over less than 1 year*

Menezes et al. conducted a review and meta-analysis of 33 clinical studies with follow-up times between 3 and 12 months [21], which concluded that among acute LBP sufferers, the majority had recovered by 12 weeks, whereas among patients with persistent LBP, less than half had recovered at
Table 2
A summary of studies that have sub-grouped LBP patients according to pain trajectory.

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Setting &amp; sample size</td>
<td>Primary care N = 342</td>
<td>Primary care N = 78</td>
<td>General population including people with LBP N = 305</td>
<td>Primary care N = 165</td>
<td>General population N = 261</td>
<td>Primary care N = 222</td>
</tr>
<tr>
<td>Frequency, type &amp; length of data collection</td>
<td>Monthly surveys for 12 months</td>
<td>Weekly text-messages for 12 weeks</td>
<td>Weekly diaries for 12 months</td>
<td>Weekly text-messages for 6 months</td>
<td>Fortnightly text-messages for 12 months More or less never 35%</td>
<td>Weekly text-messages for 6 months</td>
</tr>
<tr>
<td>Types of subgroups &amp; proportions</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>More or less never 35%</td>
<td>Persistent 18%</td>
</tr>
<tr>
<td>Severe chronic 21%</td>
<td>Worsened first, then fluctuating 5%</td>
<td>Severe persistent 10%</td>
<td>Moderate persistent 35%</td>
<td>More or less constant 35%</td>
<td>Episodic 30%</td>
<td>Episodic 83%</td>
</tr>
<tr>
<td>Mild persistent 36%</td>
<td>Unchanged first, then stays unchanged 3%</td>
<td>Improved &amp; unchanged first, fluctuates thereafter 24%</td>
<td>Mild persistent 20%</td>
<td>Stable (=Mild persistent) 26%</td>
<td>Slow improvers 16%</td>
<td></td>
</tr>
<tr>
<td>Fluctuating 13%</td>
<td>Improved first, then mainly recovered &amp; stays improved 54%</td>
<td>Fluctuating 35%</td>
<td>“Typical”/common improvers &amp; fast improvers 58%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recovering 30%</td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

NA = not applicable.

* This study contained other subgroups not included in this summary.

b These authors used data from the same study.
**Fig. 1.** Weekly data on the number of pain days (means and CIs) for two groups of LBP patients from the secondary care setting, prescribed rest and exercise, respectively. From Jensen RK, Leboeuf-Yde C, Wedderkopp N, Sorensen JS, Manniche C: Rest versus exercise as treatment for patients with low back pain and Modic changes. A randomised controlled clinical trial. BMC Med 2012, 10(1):22. Published with permission from the first author.

**Fig. 2.** The mean number of weekly reported days with pain after consulting in primary care for LBP. From: Kongsted A, Leboeuf-Yde C: The Nordic back pain subpopulation program – individual patterns of low back pain established by means of text messaging: a longitudinal pilot study. Chiropractic & Osteopathy 2009, 17:11. Published with permission from the first author.
None of the included studies used frequent data collection and were therefore not able to illustrate the detailed course over time.

In a study by Eklund et al. using weekly text message data over 6 months in patients with LBP from primary care [22], the subgroups detected in the general population described above [20] were replicated, although the proportions were somewhat different. As this was a study of patients consulting for LBP, no pain-free individuals were found. However, as expected, the clinical population from the primary care setting contains more people with persistent pain than the general population and fewer than secondary care [19].

As in the review by Menezes [21], early improvement was noted also by Kongsted and Leboeuf-Yde [10], who collected 18 weekly text messages from patients in the primary care setting. This study revealed a quick reduction in LBP reporting, which slowed down towards the end of the study (Fig. 2). This initial favourable development was also confirmed by Axén et al. in a 6-month study from primary care using weekly text message data [23]. On a group level, improvement from the LBP episode was seen mainly in the early course. LBP in this study was reported as number of days each week with bothersome LBP. Although improvement was the common development, four subgroups with different after-treatment trajectories were identified. Group 1 was the ‘typical’ trajectory: definite improvement was noted in the first 5–6 weeks (Fig. 3). Groups 2 and 3 responded faster and slower, respectively (Figs. 4 and 5). Finally, Group 4 showed a rather stable trajectory (Fig. 6) with mild, persistent pain. Figs. 3–6 below show some individual examples of each of these types of trajectories (Fig. 6).

In addition, Kongsted and Leboeuf-Yde [10] noted a number of sub-trajectories in relation to early course and later course over the duration of the study of patients in primary care, which lasted for 18 weeks. More than 50% of the subjects could be categorised as experiencing early improvement
followed by full recovery or staying somewhat improved. An additional 30% could be classified as ‘fluctuating’.

**Trajectories of the LBP episode**

None of the studies reported above included obvious inception cohorts in terms of new episodes of LBP. Jensen et al. [18] had an inclusion criterion of at least 2 months and Tamcan et al. [16] studied patients who previously reported LBP in a cross-sectional survey. Leboeuf-Yde et al. [20] studied people from the general population (with or without LBP at baseline) and in the studies by Dunn et al. [5] Kongsted et al. [10] and Axén et al./Eklund et al. [22,23] (who used data from the same study sample), all the included subjects had consulted for LBP. Probably, in some of these primary care populations, patients experiencing their first LBP episode may be present, but it is much more likely that the bulk of these patients had experienced LBP previously. However, no such distinction was made in any of the studies. Therefore, presently there seems to be no information available on the trajectories of first-time LBP episodes.

**Summary of trajectories of LBP**

Studies of trajectories of LBP using frequent data collection methods have identified various subgroups. As can be seen in Table 2, several methods of classification were used, and LBP was studied both in the clinical and in the general population. Still, the identified subgroups have similar features,
persistent and episodic patterns being identified by all research groups. The sizes of these subgroups vary, as would be expected in different populations.

**Pain trajectories related to clinical findings**

It is all very well to detect and describe how LBP runs a different course in different groups of people. However, trajectories will only become clinically relevant when they can be used to investigate the cause and prognosis of a condition. Does it matter to which subgroup people belong? Do different trajectories have different aetiologies? Should they be treated differently? Can the prognosis be altered? A first step would be to see if different trajectories have specific clinical characteristics. To date, only four studies appear to have coupled LBP trajectories with clinical data [5,10,16,23] and one study investigated whether periods of LBP were correlated with amount of leisure-time physical activity [24].

Dunn et al. [5] subgrouped patients on the basis of pain intensity and found that changes in disability showed similar patterns to changes in pain. They also noted some differences between groups on psychological variables such as depression. The patients in the 'persistent mild' category showed large reductions in depressive symptoms following primary care consultation, compared to the 'severe chronic' patients who had high depression scores with no improvement. In addition, patients belonging to the 'fluctuating' pain group failed to show improvements in depression scores. However, it was not possible to discern the cause and the effect between the psychological findings and the pain trajectory.

Tamcan et al. [16] identified their subgroups according to pain characteristics, medication use, health-care use and social and work limitations and noted that they coincided with different trajectories. In addition, differences between these groups on the basis of self-rated health and demographic

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**Fig. 5.** Individual LBP trajectories in patients from the primary care setting belonging to the cluster of "slow improvers". These patients improved at a slower rate than most. Data published with permission from the first author, I Axén.
characteristics were assessed. A logical pattern was found: older patients and those with poorer quality of life were most commonly found in the ‘severe persistent’ and ‘moderate persistent’ groups compared to the ‘fluctuating’ and ‘mild persistent’ groups.

Kongsted and Leboeuf-Yde linked validated diagnostic subgroups using pain trajectories in patients with LBP in the primary care setting [25]. In this study, patients with disc pain had more days with pain and very rarely (only 5%) belonged to the ‘recovered’ pain course. Patients with pain of a muscular origin, on the other hand, reported fewest days with pain and a third of these patients belonged to the ‘recovered’ trajectory.

Axén et al. [23], after having identified pain trajectories, tested whether these were statistically associated with some clinical background variables. Although only few variables were available, it was possible to identify significant and meaningful differences between the four trajectory subgroups and these clinical characteristics. For example, those with the quickest recovery started off being in the worst shape. Those with the slowest recovery were also the oldest with the most persistent pain at baseline.

Finally, Jespersen et al. [24] coupled the pain pattern over 1 year with leisure-time physical activity in a cohort of employed subjects with or without LBP at baseline. No correlation between the two was detected, indicating that leisure-time physical activity is not protective of LBP, contrary to common belief.

In summary, the results from these five studies clearly indicate that this research area deserves further exploration. In other words, different types of trajectories seem to identify clinically meaningful subpopulations. Finally, perhaps it will be possible to add a vital piece to the puzzle of LBP!
Summary

Despite differences in the LBP patient populations, outcomes, data collection methods and frequency of measurement, researchers who have synthesised the recent research results have presented a congruent picture of the LBP trajectory. It is no more to be considered a benign and self-limiting condition but one of longer duration. Therefore, it is relevant to study both its natural and clinical course.

In the general population, when observed over 1 year with frequent data collection, there are three large groups in relation to troublesome LBP: those without LBP, those who experience it on and off and those who have it most of the time. The bottom line is that people with LBP are likely to experience either a persistent or an episodic trajectory. Definite recovery with no recurrences does not appear to be a common outcome, although it is not known how these patterns develop over a lifetime.

People with LBP will not necessarily seek care, but a person who consults a primary care clinician for an episode of LBP is likely to feel better fairly quickly. However, the post-treatment trajectories can vary, as there are several subgroups. Clinical findings have been coupled with distinct trajectories in a meaningful way, indicating that these trajectories can be used to determine clinically relevant subgroups.

However, when patients with LBP have come as far as consulting in secondary care, they are likely to be persistently troubled over the ensuing 12 months.

Research agenda

We suggest that in clinical studies, the trajectory should be used as an outcome more often. Thus, rather than just using a single end point at a single point in time, change in the LBP trajectory, measured with repeated measurements, seems a more relevant measure of effect in a disorder that does not, in fact, have a clinical end point.

The exploration of clinically relevant subgroups based on trajectories needs further attention, also using frequent data collection methods. As suggested in recent studies, these subgroups may represent different diagnoses and psychological profiles. Therefore, they may provide a key to the selection of different treatments.

Finally, the identification of the persistent and episodic nature of the LBP condition invites the idea of secondary and tertiary prevention. Research should be directed towards effective measures to minimise the occurrence, length and intensity of episodes, as well as to identify suitable methods to lessen the impacts of a persistent problem rather than attempting to cure the condition.

Practice points

Information about LBP trajectories may inform clinical practice: The LBP condition should not be viewed as curable. We therefore suggest that clinicians should view and communicate information about episodes within the context of a longer-term pain trajectory, to provide patients with a realistic view of the problem. Thus, issues such as effective short-term treatment strategies, pain management and activity maintenance as well as secondary and tertiary prevention should be high on the clinical agenda. ‘Management rather than cure’ might be a helpful catch phrase, similar to the well-known recommendation of ‘don’t worry – keep active’.

References


