What is the prognosis of back pain?

J.A. Hayden, DC, PhD, Assistant Professor a,b,* , K.M. Dunn, PhD, Senior Lecturer in Epidemiology c , D.A. van der Windt, PhD, Professor in Primary Care Epidemiology c , W.S. Shaw, PhD, Principal Research Scientist d

a Department of Community Health & Epidemiology, Dalhousie University, Halifax, Nova Scotia, Canada
b Research Services, Capital District Health Authority, Halifax, Nova Scotia, Canada
c Arthritis Research Campaign National Primary Care Centre, Primary Care Sciences, Keele University, Keele, Staffordshire, United Kingdom
d Center for Disability Research, Liberty Mutual Research Institute for Safety, Hopkinton, MA, USA

Understanding prognosis is important in managing low back pain. In this article, we discuss the available evidence on low back pain prognosis and describe how prognostic evidence can be used to inform clinical decision making. We describe three main types of related prognosis questions: 'What is the most likely course?' (Course studies); 'What factors are associated with, or determine, outcome?' (Prognostic factor or explanatory studies); and 'Can we identify risk groups who are likely to have different outcomes?' (Risk group or outcome prediction studies).

Most low back pain episodes are mild and rarely disabling, with only a small proportion of individuals seeking care. Among those presenting for care, there is variability in outcome according to patient characteristics. Most new episodes recover within a few weeks. However, recurrences are common and individuals with chronic, long-standing low back pain tend to show a more persistent course. Studies of mixed primary care populations indicate 60–80% of health-care consulters will continue to have pain after a year. Important low back pain prognostic factors are related to the back pain episode, the individual and psychological characteristics, as well as the work and social environment. Although numerous studies have developed prediction models in the field, most models/tools explain less than 50% of outcome variability and few have been
Importance of low back-pain prognosis

Prognosis is a description of the probable course or prediction of the outcome of a health condition over time. Important to prognosis is consideration and assessment of characteristics or factors that are associated with or determine the course of a condition. Health-care professionals may use prognostic information to educate or inform the management of their patients [1].

Several characteristics of low back pain make consideration of prognosis extremely important. Low back pain is common and costly, with most of the economic and social costs attributed to individuals who have prolonged disability. It has not been possible to identify a specific cause for most cases of low back pain, and interventions with strong evidence of effectiveness have not been identified [2]. Therefore, there has long been attention on prognosis research in the field.

There are three main types of related prognosis questions: ‘What is the most likely course?’, ‘What factors are associated with, or determine, outcome?’ and ‘Can we identify risk groups who are likely to have different outcomes?’ (Fig. 1). Understanding the likely course of low back pain provides a descriptive picture and is important for patient counselling, planning, management and monitoring. Identifying prognostic factors that are associated with worse or better disease outcome (explanatory studies) can help us to understand possible determinants and causal pathways for low back pain, which may lead to effective interventions. We can use prediction models or risk scores to identify groups of patients who are likely to have worse (or better) outcomes; this can assist in clinical decision making and to inform patients more specifically about their likely outcome (outcome prediction studies).

In this article, we discuss the state of the art on prognosis of low back pain, including course, important prognostic factors and identifying high- or low-risk groups. We discuss the current evidence in each of these areas of prognosis, how evidence is used in practice and some future directions in the field.

Evidence on low back pain prognosis

What we know about prognosis of low back pain comes from a large number of studies. Table 1 describes the three basic types of prognosis studies. Essentially, three components define prognosis studies: (1) a clearly defined cohort or population at a common and preferably early point in the course of their condition (e.g., a patient with a new episode of low back pain presenting for care), (2) definition of a future outcome (e.g., recovery from illness) and (3) measurement of the likelihood of this outcome and/or the strength of its determinants. With respect to probable outcomes and important determinants, different ‘phases of investigation’ in prognosis studies provide different strength of evidence: exploration, confirmation (validation) and impact (implementation) studies.

Prognostic factor (explanatory) studies are one first type of prognosis study. The first phase of investigation of this study type, exploration, identifies associations of many potential prognostic factors and low back pain outcome (Fig. 1.2). This is the most common type of investigation in the low back pain literature. While these studies are necessary to identify new factors, they provide the least conclusive information regarding the independence of a variable as a valid prognostic factor. Multiple studies in this exploratory phase of investigation often have widely varying results, as spurious associations are common, and studies may overstate their conclusions [3]. Confirmation studies test the independence of the association between a prognostic factor and the outcome of interest. These studies aim to measure the independent effect of a prognostic factor while controlling for confounders.

In outcome prediction (risk group) studies, exploration (or development) phase studies aim to design prediction models by identifying the combination of prognostic factors that best predicts outcome (Fig. 1.3) [4]. Confirmation phase (or validation) studies evaluate the performance of a prediction model in new populations and settings (see Altman, 2000) [5]. Testing the impact of validated prediction models in clinical practice is necessary before widespread use of these tools can be considered [6–8].

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As we discuss later, a limitation of the low back pain field is that the majority of prognostic research is exploratory. This results in weak, often conflicting evidence in the field. Syntheses of these study findings, therefore, require cautious interpretation.

Course of low back pain

A key question when someone experiences low back pain is: ‘What is my likely course?’ As always, with questions of this type, the response is imprecise and dependent on a wide range of factors. Prognostic studies provide some guidance for answering.
General population studies have shown that most low back pain episodes are mild and rarely disabling [9], with only a small proportion seeking care [10]. Among patients presenting for care, however, the short answer is that approximately 62% will continue to have pain a year after consultation; approximately 16% initially off work will still be off at 6 months [11]. Importantly though, these figures mask substantial variability in outcome, according to patient characteristics. For example, among people with a new episode (acute low back pain), rapid improvements are common during the first month following a consultation [12].

In studies looking at the most ‘acute’ patients with the shortest time since low back pain onset, prognosis is favourable: 75–90% of patients recover in terms of pain and disability within weeks of seeking health care [13–16], and many people who were initially off work will rapidly return to work [16–19]. However, taking a longer-term perspective, many patients experience recurrences following an initial low back pain episode [11]. One-quarter to a third of people with initial acute symptoms report having symptoms 6–12 months after a consultation [19–21].

Studies looking at individuals with ‘chronic’ low back pain show a more persistent course. In two studies of incident chronic low back pain (identified from cohorts who were initially acute), approximately two-thirds of patients still had not fully recovered 1–2 years after the initial onset [22–23]. Among more prevalent chronic cases, the chances of recovery are even lower, with around 80% still having pain after a year [21]. Studies of more mixed primary-care populations indicate persistence rates more similar to the chronic populations, perhaps reflecting the high proportion of primary care populations with long-term problems [24]. Studies indicate that 60–80% of health-care consulters still have pain at 12-month follow-up [25–27].

Table 1
Summary of the three different prognosis study types, including brief description of the purpose, the key design features, presentation of results, and interpretation of findings from each.

<table>
<thead>
<tr>
<th>Type</th>
<th>Ultimate Purpose</th>
<th>Key design features</th>
<th>Presentation and interpretation of study results</th>
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</thead>
<tbody>
<tr>
<td>Studies of prognostic course</td>
<td>Describe likely outcome</td>
<td>- Clear description of population (or subgroup) at common, early point</td>
<td>- Cohort description provides information about generalizability</td>
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<tr>
<td>Prognostic factor studies (Explanatory)</td>
<td>Investigate causal determinants</td>
<td>- Conceptual framework guides study (with sufficient evidence from previous studies, patho-physiological plausibility, and relevance to our understanding or treatment of the disease)</td>
<td>- Studies recruiting people seeking care usually describe clinical course (rather than natural history)</td>
</tr>
<tr>
<td>Outcome prediction studies</td>
<td>Identify risk groups</td>
<td>- Prognostic factors used in model development can come from anywhere (causal determinants are good candidates, but no need to include them; confounding not important)</td>
<td>- Longer and multiple follow-up periods may give better picture of true course</td>
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These types of studies, with follow-up at a single time point (e.g., at 1 year) following health-care seeking, answer the question, ‘Will I get better?’ The issue of what happens in between the initial consultation and follow-up at a later time point is more complicated. Relapses are common in low back pain, and evidence shows that approximately 60% experience relapses of pain and 33% have repeated episodes of work absence [11]. Researchers are beginning to better understand change in pain over time, with new statistical techniques allowing identification of patterns of recovery [28,29]. Dunn et al. identified different recovery trajectories for low back pain patients including: (1) recovering, (2) persistent mild symptoms, (3) constantly fluctuating problems and (4) severe chronic levels of pain [29]. More studies are being carried out that will elucidate detailed patterns of change over time, giving researchers a better picture of the course of back pain; more work is needed to find out whether this information can be provided to back pain sufferers when they consult, to better answer their question of ‘What will happen to me?’

Identifying important prognostic factors

Another important question about prognosis is: ‘What factors are associated with, or influence a patient’s outcome?’ Research studies have found many factors to be associated with poor outcome in low back pain, often with conflicting results. A recent review of 69 low back pain prognostic factor studies identified 221 distinct prognostic factors investigated [30]. An expert consensus process classified these factors into 36 different domains, highlighting the multidimensional nature of low back pain prognosis (Fig. 2).

Several broad systematic reviews are available that have attempted to synthesise evidence across all low back pain prognostic factors [31–36]. A recent ‘review of reviews’ found that several factors were consistently reported to be associated with poor outcome across these reviews, including factors related to the back pain episode, the individual and psychological characteristics as well as the work and social environment [37]. These factors are described in Table 2.

Focussed systematic reviews of low back pain prognostic factors have explored specific factor domains in more detail. Focussed reviews of psychological or psychosocial factors found similar relationships as the broad reviews with respect to the importance of general psychological stress and negative cognitive characteristics [38,39]. These reviews also reported, more specifically, that passive coping strategies [38–40], and somatisation [38] were associated with poor outcomes. Four of the focussed reviews also investigated social environment characteristics and found job dissatisfaction to be an important prognostic factor [39,40]. A focussed review on physical examination findings reported a general lack of association with back pain outcomes, similar to the conclusions of broad systematic reviews [41]. Contrary to the broad reviews, however, Hartvigsen et al. reported moderate evidence for no association between work-related social support or stress at work and outcomes [42], and Dionne et al. reported that low educational attainment was an important prognostic factor (or marker) for adverse consequences of back pain [43].

Identifying those at high risk of chronicity

Prognosis evidence can also help answer: ‘Can we identify risk groups who are likely to have different outcomes?’ These outcome prediction studies aim to develop models or tools that accurately predict low back pain outcome in individual patients, or that can be used to stratify patients according to their risk of a predefined outcome. Two recent systematic reviews have attempted to summarise the available evidence on outcome prediction models or tools for low back pain. Hilfiker et al. considered the predictive models applied 2–12 weeks after initial medical consultation for a new episode of non-specific low back pain [44]. This systematic review of 16 prognostic studies found that outcome prediction models were heterogeneous and have only ‘moderate’ ability to predict functional disability (at most, 51% of the variability was explained). Kent and Keating synthesised the evidence on outcome prediction models available for each of pain, activity limitation and participation restriction outcomes [45]. These review authors found 12 multivariable models predicting pain outcomes, 18 predicting activity limitation (e.g., functional disability) outcomes and 30 predicting participation restriction (e.g., return to work). Outcome prediction models reportedly explained a mean of 46% (from three studies
Fig. 2. Identified domains of low back pain prognostic factors, highlighting the multidimensional nature of the condition. ‘Baseline Factors’ are general characteristics of the individual and their environment; ‘Current LBP Episode’ include factors related to the current pain episode. (Modified from Hayden et al., submitted).
adequately reporting predictive strength), 43% (from seven studies) and 32% (from one study) of the outcome variance, respectively. Importantly, these review authors found few studies that tested validity of an outcome prediction model in an independent sample and few models had been developed into a user-friendly tool or prediction rule suitable for clinical use.

The Örebro Musculoskeletal Pain Screening Questionnaire (ÖMPSQ) [46] is one of the few outcome prediction tools that have been evaluated in several independent patient samples by multiple research groups. This questionnaire was developed to assist health-care providers assess psychosocial factors that may impede recovery (‘yellow flags’). The ÖMPSQ has overall moderate predictive ability to identify long-term poor outcome of back pain [47]. However, the area under the curve (AUC) in validation studies have shown varying results ranging from 0.68 to 0.83 [47]. (AUC is a measure of the tool’s ability to correctly predict outcome, where 0.5 is no better than chance and 1.0 is perfect prediction). Variable results across studies emphasise the variability of the performance of prediction models when applied in different settings, different populations or when using slightly different outcomes [48–51]. The STarTBack Tool [52] is a promising new instrument that has compared favourably with the ÖMPSQ in initial testing [53]. The STarTBack Tool includes nine items (referred leg pain, co-morbid pain, disability (two items), bothersomeness, catastrophising, fear, anxiety and depression), and has been shown to have good reliability, (external) validity and to be acceptable to patients and clinicians [52]. This outcome prediction tool classifies patients as low, medium or high risk, reflecting the complexity of their back pain problem.

Some new developments in the design of outcome prediction models for low back pain may lead to improvements in the performance of outcome prediction models. The use of repeated measures of back pain and disability rather than measuring outcome at a single point in time may better reflect the dynamic course of back pain over time (e.g., ref. [29, 51, 54]). Based on multiple measures of back pain intensity and dysfunction over a period of 5 years, Von Korff and Miglioretti empirically identified four pain severity classes: from no pain to severe limiting pain [55]. Patients were most likely to remain in the same pain severity class from one time point to the next. A risk score that combines information about pain severity, duration, breadth of pain and the impact of pain and depression predicts future pain status [54]. The Von Korff risk score has been externally validated in other US and UK samples [56,57]; studies are needed to test whether such an approach can be implemented in clinical practice.

Using prognostic information in clinical practice

Translating low back pain prognostic evidence into useful messages and testing the impact of using prognostic information to improve decision making has been a significant challenge. Barriers to translation include the inconsistencies of findings across studies, difficulties of implementing new innovations in clinical care and lack of consensus regarding effective management strategies for high-risk patients. We discuss some ways by which information about a patient’s likely course, and presence (or absence) of good or poor prognostic factors could inform decision making (A separate discussion of how prognostic information can be used for treatment-matched classification is included in the next article by Kamper and colleagues).
Information about prognostic factors may be used to tailor treatments or develop new treatment strategies. One of the earliest attempts to tailor treatment based on prognostic factors was the ‘yellow flags’ concept described by Kendall et al. (1997), encouraging clinicians to assess psychosocial factors along with their usual physical examination and medical history. The yellow flags assessment method, which was first adopted as part of clinical guidelines prepared for the New Zealand Accident Compensation Corporation, included administration and scoring of the ÖMPSQ [58] for all patients with pain persisting beyond 2–4 weeks, followed by a more detailed interview of those patients endorsing multiple psychosocial factors. From ÖMPSQ results, patients are categorised as low, medium or high risk. For high-risk patients, suggested methods for clinicians to counter yellow flags include establishing positive and realistic expectations for recovery, focussing on functional recovery rather than pain reduction, reinforcing activity, social participation and return to work, maintaining communication and co-ordination among stakeholders, promoting self-management and self-responsibility and acknowledging difficulties, setbacks and emotional distress.

This ‘flags’ system has been refined recognising multiple components and origins of low back pain prognostic factors [59]: psychological factors, as well as workplace organisational or environmental factors (‘black flags’) and individual perceptions and attitudes about the workplace (‘blue flags’) [60]. The ‘flags’ concepts are helpful to translate a large body of epidemiological evidence into simple clinical assessment methods; however, further development and testing is needed.

Some studies of low back pain prognosis have sought to explain specific mechanisms or pathways by which acute low back pain might develop into a chronic problem. Prognosis studies such as these may inform development of new interventions. For example, the fear-avoidance beliefs model has provided a framework for understanding why beliefs about activity avoidance might ultimately lead to further disability [61,62]. However, other prognostic factors have been more difficult to integrate into causal models and even more difficult to match to appropriate interventions. Shaw and colleagues found substantial gaps between the epidemiological and intervention research in a comparison of modifiable risk factors and intervention strategies for low back pain [63]. Their review concluded strong risk factor concordance for workplace technical or organisational interventions, graded activity exposure and cognitive therapies focussed on pain beliefs, but poor concordance for exercise, back education and return-to-work co-ordination. Given the relative strength of psychosocial factors in low back pain prognosis, interventions that incorporate psychological methods or use social supports may have the greatest efficacy. Development of future intervention strategies for low back pain should make greater use of prognostic data to support the theoretical rationale for interventions and to identify those patients most likely to benefit.

Outcome prediction models may be used in clinical practice to guide management decisions, leading to better patient outcomes and/or more efficient care. However, in the field of low back pain, there have been few studies to investigate the impact of prediction models in clinical practice. An important step in evaluating impact is to determine whether a prediction model adds prognostic information to the clinician’s estimate of prognosis. Jellema et al. compared the predictive performance of a prognostic estimation by the general practitioner (GP) during the first consultation for a new episode of low back pain to the performance of several prediction models including the ÖMPSQ [51]. Predictive values showed that GPs were more successful in identifying patients with a high risk of an unfavourable course of low back pain than identifying those with a low risk. This may indicate that primary care practitioners are able to identify patients in need for referral or more extensive treatment early in the course of a back pain episode, without the use of a prediction model. Calibration and discrimination of the GP estimate did not differ substantially from existing prediction models, but GP estimation performed less well than a newly developed prediction model. Adding the information from the prediction model to risk estimation by the GP resulted in a significant improvement of predictive performance [51]. Another study, currently underway, will evaluate the clinical- and cost-effectiveness of applying the StarTBack tool, described earlier, to low back pain patients in primary care [64].

Low back pain patients are commonly defined as having an acute or chronic condition based on the duration of their symptoms, implicitly referring to course. This reflects distinctions that are used in clinical practice and clinical practice guidelines, such as the European Guidelines for treatment of acute
or chronic [66] low back pain. There is some evidence that this division is appropriate, as acute patients are likely to have a better outcome than chronic patients [19,23]. However, there is also evidence that this is a rather simplistic approach, as there is a trend for poorer prognosis across a spectrum of patients with different episode durations [24]. Alternatively, using additional prognostic information to define patient groups in clinical practice, such as important psychosocial prognostic factors or the Von Korff risk score [55–57] will better reflect the biopsychosocial model and may result in more acceptable labels for patients [67].

Future directions in low back pain prognosis

Several areas have been identified to advance the field of low back pain prognosis. First, standardisation of measurement of prognostic concepts will facilitate syntheses. Attempts have been made to standardise elements of prognostic study design. These include consensus on the definitions of low back pain [43], guidance on definition of low back pain episodes [68], recommendations for outcome measures that should be included [69] and attempts to produce international cohort studies with core sets of prognostic indicators [70]. These are all excellent ways to begin standardisation, but researchers need to put these into practice, and fill gaps where information is not standardised.

Course of low back pain

We also need to look wider and consider novel and innovative approaches to understanding low back pain. Further research looking beyond a two-point model of research studies, which tend to measure prognostic factors at a baseline point and outcome at a later time point, is needed. A recent new direction for research on low back pain has been to identify clusters of patients with different trajectories of pain over time [29]. Methods for identifying these trajectories have come from other conditions such as incontinence and alcohol abuse [71,72]. When low back pain trajectories are considered more closely, people with milder and recovering trajectories of pain have shorter duration of symptoms than people with more severe chronic symptoms [29]. This indicates that such trajectories might actually represent phases in the long-term course of low back pain, perhaps fitting into a model of pain stages such as that proposed by Raspe et al [73]. Studying low back pain over a longer time period such as using methods from life-course epidemiology may be useful [74,75].

Important prognostic factors

To better understand low back pain prognosis, we need to more fully consider other domains associated with and/or contributing to low back pain outcome. Considering the biopsychosocial model of low back pain, we have amassed evidence on the ‘bio’ part of this, and the past few years have seen many studies incorporating the ‘psycho’ part, but the social part has been somewhat neglected, with the notable exception of work-related factors [76]. It is possible that ‘social’ factors are often seen as out of the control of the patient or researcher, and put on the ‘too-difficult’ pile, but perhaps investigating factors such as societal beliefs, social support, benefits systems, family influences and availability of health care might be fruitful avenues for investigation.

In addition, we expect future low back pain prognosis studies to use novel designs. Both exploratory and simple confirmatory studies are based on the often unrealistic assumption that the effect of the prognostic factor on the outcome is direct and isolated (i.e., it is not mediated). This may be inadequate to describe complex relationships in low back pain (i.e., multifactorial, and where the impact of factors may change over time). A new area for prognosis research is to more explicitly define and test the real complexity of low back pain prognostic pathways or processes (e.g., using structural equation modelling). These studies may apply knowledge from confirmatory independent associations and incorporate other knowledge from the field to better understand causal relationships. These studies start with an explicit theoretical framework that includes the prognostic construct of interest, variables that are thought to influence or modify the effect of that factor, variables that are thought to be intermediate or a mediator in the pathway towards the outcome, potential confounding variables and the outcome of interest.
Outcome prediction models

New directions for outcome prediction studies may concern each of the different phases: development studies, validation studies and impact studies. The development of outcome prediction models could gain from more insight into the methodology of developing prediction models, and especially into the consequences of using different methods of deriving prediction models. For example, it is not clear if the use of different statistical approaches or of different methods for selecting variables lead to differences in the composition of prediction models or to differences in predictive performance. Similarly, empirical studies are needed to demonstrate if different methods for dealing with missing values or for modelling continuous predictors lead to differences in model performance. Furthermore, more advanced statistical techniques could perhaps explore the possibilities of incorporating repeated measures of time-dependent predictors (e.g., psychosocial variables or work conditions) in prediction models, as well as repeated measures of outcomes better reflecting the dynamic nature of low back pain.

In outcome prediction studies, given the shortage of validation studies, resources may be more effectively targeted towards testing the external validity of existing models in different settings and populations, rather than in developing new prediction models. Better methods may be employed to present the predictive performance of models, in such a way that it is helpful to clinicians. For example, the C-index or area under the ROC curve may give a general estimation of the discriminative ability of a prediction model, but is not meaningful for clinical purposes. It may be more informative to present the predictive values for different risk groups, and to present the added value of the prediction model above estimation by clinicians based on experience and expertise. The definition of cutoff values to identify high- or low-risk groups should receive careful consideration, based on the consequences of missing patients with a high or low risk of developing persistent pain and disability.

Impact analyses are still in their infancy in the field of low back pain, but several studies are underway. Although scarce, there are a few good examples from other medical fields where more experience has been gained in evaluating the impact of applying prognostic information in clinical practice (e.g., ref. [77–79]). These examples may help to design randomised controlled trials to evaluate the effects and costs of implementing prognostic models in clinical practice, or to develop decision modelling studies to investigate the consequences of implementing prognostic information on treatment decisions and patient outcomes.

What is known:

- There are three main types of prognosis studies: (1) course, (2) prognostic factor, or explanatory, and (3) risk group, or outcome prediction.
- Prognosis of most low back pain is good and a minority seek care. Among those presenting for care, most new episodes recover within a few weeks. However, recurrences are common and individuals with chronic, long-standing low back pain tend to show a more persistent course. Studies of mixed primary care populations indicate that 60–80% of health-care consulters will continue to have pain after a year.
- Important prognostic factors are related to the back pain episode, the individual and psychological characteristics, as well as the work and social environment.
- The ‘flags’ system may be useful to remind clinicians of the multiple components and origins of low back pain prognostic factors including: psychological (yellow), workplace organizational and environment (black), and attitudes and perceptions of the workplace (blue).
- The Örebro Musculoskeletal Pain Screening Questionnaire is an outcome prediction tool that has shown moderate predictive ability and has been tested in multiple settings; the STarT-Back Tool is a promising new instrument.
Future research directions:

- Advanced phases of investigation are needed to progress the low back pain prognosis field, including confirmation studies for prognostic factors, and validation and impact studies for prediction models.
- Studying prognosis using more frequent and longer follow-up will help us understand patterns of recovery and change over time.
- Future studies should include investigation of social environment characteristics as potentially important prognostic factors.
- Future intervention strategies for low back pain should make greater use of prognostic data to support the theoretical rationale for interventions and to identify those patients most likely to benefit.

References


