Evidence suggests that psychosocial factors have an influence on the outcome of physical therapy treatment and that the extent of their influence differs considerably among patients. As a consequence, substantial research efforts are focused on developing new clinical tools designed to identify and highlight when psychosocial factors are present at a level relevant to decision making. The conceptual differences in the ways that psychosocial factors influence outcome are described, structured around 3 common research terms: (1) prognostic factors, (2) treatment effect modifiers or moderators, and (3) treatment mediators. Prognostic factors are those characteristics that help estimate a patient’s likely outcome irrespective of the chosen management. Treatment effect modifiers or moderators are factors measured at baseline that influence the relationship between a specific intervention and outcome. Treatment mediators are factors that have an intermediary role in the link between treatment and outcome. How these different influences on outcome can be translated into useful and complementary tools that aim to reduce treatment variability in clinical practice is described. One approach is to use prognostic factors to develop screening tools that identify an individual’s risk status, typically based on predictive psychosocial factors such as catastrophizing and depression. Another approach is to identify specific treatment effect modifiers to derive treatment decision aids or prediction rules to help match a patient’s characteristics to the interventions available. A third approach is to use treatment mediators (eg, self-efficacy) to develop monitoring tools to inform the clinician about which aspects of treatment to strengthen.
Although many patients who experience an acute episode of low back pain (LBP) will improve in the short term, some will proceed to chronic or recurrent problems, resulting in high medical costs, lost work productivity, and reduced quality of life.\textsuperscript{1,2} Although research has demonstrated that physical therapy for back pain can be effective, overall treatment effect sizes have tended to be small, regardless of the treatment modality used.\textsuperscript{3,4} It is argued that one explanation for the small effect sizes might be individual patient variability, both in terms of general prognosis and in terms of response to a specific intervention. The suggestion is that LBP is a heterogeneous condition that encompasses a number of distinct clinical subgroups. If this heterogeneity is not accounted for in research, overall treatment effects seen at the group level may mask the reality that some patients benefit substantially from certain interventions and others do not.

In response, research has focused on identifying how to better tailor available interventions for LBP to improve clinical outcomes.\textsuperscript{5} The aim is to characterize the most important influences on pain, disability, and response to treatment so that healthcare professionals can use this information in their decision making.\textsuperscript{6} Attempts to identify characteristics relevant to decision making for LBP have used 2 main approaches. The first approach has incorporated epidemiological evidence to identify factors related to general prognosis, with the goal of recognizing patients at high risk to proceed from an acute LBP episode to chronic disability. Many of the most important factors identified have been psychosocial, leading to the development of risk screening tools incorporating psychosocial prognostic variables.\textsuperscript{7,8} The second approach has sought to identify characteristics to help differentiate which specific intervention might be most effective for a patient.\textsuperscript{9,10} This approach historically has focused on factors from the physical examination, often combining factors into prediction rules or decision aids. Both approaches seek to identify subgroups to assist treatment consistency by steering clinical decision making.

Clinicians understand that many individual characteristics can influence a patient’s prognosis. The literature is replete with studies suggesting psychosocial factors are relevant to the course of an episode of back pain.\textsuperscript{6,11-12} As a consequence, LBP practice guidelines highlight the need for practitioners to consider these influences when examining patients.\textsuperscript{13,14} However, evidence suggests that clinicians tend to be inconsistent in applying assessment knowledge in their treatment approach\textsuperscript{15} and particularly struggle to know at what point to specifically seek to address psychosocial factors.\textsuperscript{16} Now that the role of psychosocial factors in influencing pain, disability, and response to treatment has been firmly established, research efforts are turning to the translation of this knowledge into useful clinical tools that increase consistency in clinical decision making and help to target treatments more effectively.

The purposes of this perspective article are: (1) to examine the influence of psychosocial factors on the outcomes of physical therapy treatments and (2) to explore how this information can be used to tailor patient management to improve outcomes.

**Psychosocial Influences**

The first step in examining the influence of psychosocial factors is to understand the ways research is seeking to describe how these factors might relate to clinical outcome. We, therefore, will explore 3 different terms that appear in the literature—prognostic factors, treatment effect modifiers or moderators, and treatment mediators—and discuss their implications for clinical practice. A visual representation of these terms is provided in the Figure.

**Prognostic Factors**

Prognostic factors are those characteristics that help to estimate a patient’s likely outcome irrespective of the chosen management. For example, the LBP epidemiological literature suggests that a strong prognostic factor for persistent symptoms is depression.\textsuperscript{17} This simply means that those who are more depressed are more likely to experience persistent back pain symptoms than those whose mood is not affected. Prognostic factors should be identified from longitudinal, single-group, cohort studies, which typically seek to eliminate treatment differences among individuals either by design or by statistical adjustment in analysis (Figure).

For a detailed review of LBP prognostic research, see Hayden et al\textsuperscript{6} or one of the in-depth systematic reviews that identify prognostic fac-
A wide array of physical and psychosocial characteristics have been evaluated as potentially relevant prognostic factors. For example, physical factors have included age, sex, pain intensity, body mass index, and neurological signs, and psychosocial factors have included severity of functional impairment, previous treatment, depression, somatization, fear-avoidance beliefs, self-efficacy, coping strategies, previous medical history or experiences of back pain, and job satisfaction. As numerous psychosocial variables have been identified as having some prognostic importance, it is suggested that the successful development of augmented treatment strategies to help physical therapists better prevent persistent pain-related disability will require a more narrow focus on a few key psychosocial factors that can be modified with treatment. In an effort to provide this focus, a recent large observational study of patients with LBP examined 20 potential psychosocial prognostic factors and highlighted that although all 20 factors were significantly predictive, there was a high degree of overlap among the variables. Only a few variables, including self-efficacy, perception of personal control, catastrophizing or expectations of outcome, and illness identity, were independent prognostic factors. That study highlighted the extent to which many psychosocial factors are correlated and thus the need to identify potential redundancy among constructs if the most efficient assessment of prognostic factors is to be achieved.

Treatment Effect Modifiers or Moderators
Treatment effect modifiers or moderators are characteristics measured at baseline that influence the relationship between a specific intervention and outcome. For example, spinal manipulation may have better outcomes among patients with less fear-avoidance behavior. In this example, fear-avoidance behavior measured at baseline has a modifying effect on manipulation outcome. Treatment modifiers are identified by...
demonstrating (using tests of interactions) that one intervention is significantly more effective than another (control or active) in patients with certain baseline characteristics. Identifying a specific treatment effect modifier, therefore, requires a study with at least 2 treatment arms, preferably with participants randomly assigned to treatment groups. This type of study is different from prognostic factor studies conducted with a single treatment arm that identify generic treatment predictors that are not necessarily unique to a particular intervention (Figure).

Many physical therapy decision-making paradigms traditionally have focused attention on factors from the initial physical examination in determining the most effective treatment strategy for a patient with LBP. For example, the decision-making paradigm described originally by McKenzie proposes physical examination findings, notably the centralization phenomenon, as a key treatment effect modifier. Whether a patient exhibits this finding at baseline is a key determinant of the specific intervention to be used.

Psychosocial factors are likely to have important roles as treatment effect modifiers, although more research is needed to confirm this. For example, Jellema and colleagues performed a randomized clinical trial comparing 2 different primary care management strategies in patients with subacute LBP: usual care and a minimal psychosocial intervention focused on education and discussion of psychosocial factors. The overall results showed little difference between the strategies; however, a secondary post hoc analysis suggested several psychosocial factors, including less-somatizing symptoms, more-solicitous responses by an important other, lower perceived risk for chronic LBP, and higher fear-avoidance beliefs, may have operated as treatment effect modifiers; the analysis suggested that targeting the intervention strategy based on a patient’s baseline scores for such factors is likely to provide improved clinical outcomes.

**Treatment Mediators**

Most treatments are designed to change specific factors. Treatment mediators represent intermediary steps in the link between an intervention and the desired outcome. For example, giving graded exercise (ie, treatment) may seek to improve function (ie, outcome). This outcome may be accomplished by reducing patients’ fear of movement or fear-avoidance behavior (treatment mediator), assuming there is a causal association among treatment, the potential mediator, and outcome. Mediation analysis is a statistical technique conducted to confirm whether an outcome (eg, function) following treatment (eg, graded exercise) is mediated by changes in a third variable (eg, fear of movement).

Understanding the influence of different treatment mediators may help clinicians know which treatment components to strengthen to improve desired outcomes and how treatment effects might be occurring. Treatment mediators, therefore, are factors that change during or as a consequence of treatment and correlate with a defined outcome (Figure). For this reason, they are not very useful in developing clinical decision-making tools about who gets which type of treatment, but instead inform us about the aspects or components of treatment that contributed the most to improvement. To conduct mediation analysis, data sets are required from patients who have received a specific intervention, with potential mediators included at baseline and follow-up so that changes in the mediator factor can be analyzed for their relationship with outcome. A randomized controlled trial provides the best opportunity to examine specific treatment mediators because the unique mediators of outcome from the active treatment can be delineated and controlled for by adjusting for general mediating effects in the control or comparison treatment using tests of interaction.

Considerably fewer studies have reported treatment mediators of LBP outcome than those reporting prognostic factors, but a key message in the research is the importance of psychosocial factors, alongside physical factors such as pain intensity. It also is worth noting that mediating factors can be different from prognostic factors within the same study. For example, Turner et al identified perceived control of pain and self-efficacy as mediators of outcome, whereas the prognostic factors were a higher level of depressive symptoms, nonspecific physical problems, rumination, catastrophizing, and stress at baseline. The difference was that prognostic factors predicted outcome depending on their baseline level, whereas mediators were factors that needed to change following treatment to influence outcome.

A study by Smeech and colleagues identified the importance of catastrophizing and perceived control over pain as mediators of outcome, and interestingly these factors were key mediators regardless of the treatment given in a trial of patients with chronic LBP. The study highlighted that treatment elements such as active physical therapy to improve aerobic fitness level and low back muscle strength (force-generating capacity) and endurance that did not deliberately target cognitive factors also can reduce pain catastrophizing. Before this study was published, it was tempting to presume that psychosocial mediators such as catastrophiz-
phizing would be mediated only by explicitly psychosocial interventions. The evidence from this study, however, suggests that it may not necessarily follow that a psychologist is better placed to improve treatment outcomes than a physical therapist, even when a goal of treatment is the mediation of a psychosocial factor such as pain catastrophizing. What is apparent is that such factors, which are broadly termed psychosocial factors, have a strong influence on the success of treatment for patients with back pain at a group level; therefore, we need to give our full attention to these factors.

Mediation analysis can inform us about which aspects of our treatment programs are crucial to achieving successful outcomes. Therefore, research is needed to explore ways to maximize change in identified treatment mediators to improve treatment outcomes. The evidence from the small number of studies to date that have examined mediators suggests the importance of 3 psychosocial constructs: (1) pain self-efficacy, which is a patient’s confidence to self-manage and get on with life despite his or her pain; (2) perceived control over pain, which is self-confidence to influence the level of pain; and (3) pain catastrophizing, which is an overly pessimistic and negative mental attitude toward pain consisting of 3 specific aspects—helplessness, rumination (dwelling again and again on the same issue), and magnification (exaggerating the perceived threat value of the pain). Much more research, however, is needed to inform physical therapists about how to elicit these constructs during assessments with patients and how best to augment their practice to target these factors during their management of LBP.

**Summary of the Psychosocial Influences**

It is possible for an individual psychosocial factor to be a prognostic factor, a treatment moderator, and a treatment mediator. For example, it could be hypothesized that depression is a prognostic factor for outcome regardless of treatment; that it modifies exercise therapy outcomes, with better outcomes in some patients (eg, those with low baseline levels of fear-avoidance behavior); and that it mediates treatment outcome in cognitive-behavioral therapy. However, it is important to consider the nature of the statistical methods and the underlying hypotheses regarding the role of a factor such as depression and possible causal relationships with outcome before classifying the factor into one of these categories. We cannot conclude that because a factor (eg, depression) is prognostic and potentially modifiable with treatment, it will necessarily be confirmed as a treatment effect modifier or treatment mediator. A good example from the back pain literature was the analysis of data from the UK BEAM trial. Secondary analysis revealed that prognostic factors for trial participants included age, work status, age upon leaving school, pain and disability, quality of life, and fear-avoidance beliefs and beliefs about one’s own back pain prognosis. However, the same factors did not help the researchers to predict response to any of the trial interventions (manipulation, exercise, or both), as these prognostic factors were associated with outcome regardless of treatment and were not identified as moderators of specific treatment effects.

**Key points:**

- The influence of numerous overlapping psychosocial prognostic indicators on LBP-related disability is established, and current efforts are seeking to develop tailored interventions to augment physical therapist practice based on key independent prognostic constructs such as fear-avoidance beliefs.
- There are limited data to suggest that psychosocial variables are likely to be treatment effect modifiers that may prove useful for selecting patients who are likely to benefit from treatment augmented by specific psychosocial approaches.
- There is early evidence for the importance of psychosocial factors such as self-efficacy, personal control, and pain catastrophizing as mediators for treatment outcome. More research is needed to inform physical therapists about how to augment practice to ensure these factors improve with treatment.

**Translating This Knowledge Into Clinical Tools to Tailor Treatments**

As well as patient heterogeneity, research suggests that there is substantial treatment heterogeneity in clinical practice, with the same individual likely to be given different interventions depending on which clinician he or she consults. In clinical medicine, it is generally agreed that a goal of evidence-based practice is to reduce unwarranted treatment variability, which typically leads to better patient outcomes. Decreasing unwarranted variation in treatment may be facilitated by identifying important patient subgroups, clarifying the optimal treatment strategies for each subgroup, and developing strategies to translate this knowledge into clinical practice to standardize decision making. The growing body of research on the influence of psychosocial factors on outcomes of treatment for LBP makes it clear that these factors will play an important role in standardizing decision making and, ultimately, in improving clinical outcomes of...
care. Having considered the research on the different influences of psychosocial factors, it may be useful to reflect on the 2 main approaches that currently are being used to translate information on psychosocial prognostic factors and treatment effect moderators into the development of clinical tools that can be used to better target treatment strategies, often augmented to address particular psychosocial concerns. While conceptually different, these 2 approaches are complementary, and each is likely to contribute substantially to physical therapist practice in the future. The first approach is to use screening tools to identify prognostic factors, clarifying an individual patient’s risk status for a poor outcome. The second approach is to use specific treatment effect modifiers to derive treatment decision aids or prediction rules. We, therefore, will explore these 2 approaches, provide existing examples of each, and discuss their strengths and weaknesses for research and clinical practice. A third consideration we will explore is the potential value of utilizing factors identified as treatment mediators in developing monitoring tools. Details of the methodological processes needed to develop classification tools to identify subgroups of patients with LBP are described elsewhere.36

Clinical Application of Prognostic Variables—Screening Tools

Screening, usually referred to as primary prevention screening, is defined as “the testing of a symptomless population in order to detect cases of a disease at an early stage.”37 However, in the context of secondary prevention of persistent disability following an episode of back pain, screening tools are intended to detect among patients with a recent onset of back pain, those who are likely to have a negative future outcome (eg, chronic disabling pain, extended time off work). A useful and valid screening tool, therefore, should accurately predict the likelihood of these negative outcomes, which then could be used to influence clinical decision making regarding the priority for and intensity of subsequent treatment provided. Screening tool developers typically use statistical methods such as regression-based nomograms, artificial neural networks, classification and regression tree analysis, cluster analysis, and risk-group stratification models. Without the aid of screening tools, clinicians do not appear to be able to accurately identify a patient’s prognosis38 or agree with other clinicians on a patient’s risk status, making a strong case for the introduction of formal screening tools15 instead of relying on intuition and experience of the clinician. The main criticism of the provision of back pain screening tools is that primary care clinicians do not have the time, equipment, or specialist skills to apply subgroup testing procedures,39 indicating the need to balance pragmatic concerns related to the length and ease of screening tools and their accuracy for identifying the likelihood of a particular outcome.

Research evaluating screening tools has demonstrated that individual prognostic factors explain only a modest part of the variance in future outcomes, but that when combinations of predictors are used together, the ability to identify patients at risk of chronic disabling back pain increases substantially.40,41 There are several examples of back pain screening tools that use combinations of psychosocial factors.7,36,42–47 One LBP instrument recently developed for primary care decision making is the STarT (Subgrouping for Targeted Treatment) Back Screening Tool,8 and another is the Örebro Musculoskeletal Pain Screening Questionnaire (ÖMPSQ).7 The ÖMPSQ has demonstrated reproducibility in at least a dozen international settings.48–50 Clinicians wanting to assess prognostic indicators for chronicity using a brief and practical tool, therefore, need research that clarifies the merits of different available tools to help choose the best one to use in their own practice.60

To develop such screening tools, the first step is to identify prognostic factors for persistent disabling back pain among patients early in their back pain episode using regression analysis of LBP cohort studies. The most prognostic individual items to accurately detect a chosen outcome then are combined into an index scale with cutoff threshold values determined to best discriminate patients into risk-defined groups (eg, low, medium, and high). Targeted pathways of care (of increasing treatment intensity) then can be developed to match the clinical profiles of patients in specific risk groups based on literature evidence and using clinical experts. These targeted pathways may indicate whether there is a need for additional treatment or the optimal timing or intensity of additional treatment, but are limited because they are not designed to identify treatment effect modifiers to conclusively match an individual patient to a specific treatment. For example, a patient identified based on a screening tool as having an increased risk of experiencing prolonged disability and work absence may be appropriate for early referral for physical therapy; however, the optimal physical therapy treatment approach may not be evident from the screening tool alone. Once screening tools are described, clinical trials can be conducted to compare outcomes of risk-group stratification and linked targeted pathways with a control intervention.61

Although most screening tools described in the literature encom-
pass several psychosocial constructs, an alternative approach is to use single-construct screening tools to identify patients with LBP who might need a specific treatment approach or different services. For example, there is a validated musculoskeletal depression screening tool,62 and a clinical trial that is testing the use of depression screening and targeted treatment among patients with musculoskeletal conditions is in progress (C. Mallen, Arthritis Research UK Primary Care Centre, Keele, United Kingdom; personal communication; 2010).

Clinical Application of Moderator Variables—Clinical Decision Aids

Several studies have attempted to identify treatment effect modifiers, either as individual variables or as multivariate clinical prediction rules specific to various interventions for back pain.63 The goal of these attempts is to develop decision aids to assist in the determination of the specific treatments most likely to benefit an individual patient. For example, Childs et al.64 examined a prediction rule from data of patients who had been randomly assigned to receive spinal manipulation or an exercise-only treatment and identified a combination of 5 variables that were associated with better early response to spinal manipulation: symptom duration, symptom location, fear-avoidance beliefs, lumbar mobility, and hip rotation range of motion. Replication and validation of proposed treatment effect modifiers are needed before using these factors as decision-making aids in clinical practice.23,64

Despite the fact that numerable psychosocial factors have been identified as prognostic factors for patients with back pain, relatively little research has been conducted to determine which psychosocial factors are treatment effect modifiers.65 There may be a presumption that treatments incorporating cognitive or behavioral principles would be particularly effective for patients found to have high levels of various prognostic factors such as depression, fear-avoidance beliefs, pain catastrophizing, and so on, but this hypothesis remains relatively untested.66 George and colleagues67 performed a randomized trial comparing standardized physical therapy with or without the inclusion of graded exercise principles designed to reduce pain-related fear. A significant interaction between elevated fear-avoidance beliefs and treatment outcome was reported, suggesting the baseline level of fear-avoidance beliefs was a treatment effect modifier for physical therapy incorporating graded exercise principles.66 A recent follow-up randomized trial68 failed to replicate this interaction effect, questioning whether a patient’s initial level of fear-avoidance beliefs can be used as a decision-making aid to determine if he or she is likely to benefit from the incorporation of behavioral principles into physical therapy care. It is clear that more research is needed to identify relevant psychosocial baseline findings that can assist clinicians in directing the choice of treatment strategies to improve clinical outcomes.

Clinical Application of Mediator Variables—Treatment Monitoring Tools

Earlier in this article we explored how psychosocial factors can influence outcome by mediating treatment effects. Translating our understanding of key mediators into useful clinical tools to help target treatment has not received much back pain research attention. Although mediators cannot help to identify patient subgroups, they can inform us about which aspects of treatment to strengthen and, therefore, are likely to be important in monitoring treatment progress over the course of treatment.

Research in the field of mental health highlights the importance of good clinical reasoning at not only the outset of treatment but throughout the course of treatment provided. It appears that clinicians are too often tempted to change the direction of treatment, based not on actual patient progress but on their prediction of treatment failure and their own mood. Clinicians’ moods and prediction of failure are influenced primarily by their perception of their therapeutic alliance with the patient.69 Patient monitoring tools using established treatment mediators may have a role in facilitating more empirically based clinical reasoning about modifying treatment plans.70 Research has demonstrated that greater benefits on outcome are observed when treatment progress feedback is given not only to clinicians but also to patients.71 It is thought that these benefits relate to a strengthening of the alliance between clinicians and patients, prompting discussions that empower patients and more objectively guide therapists about when to modify treatment options. Physical therapists traditionally have monitored patients’ pain ratings and range of movement.72 However, a number of other outcomes that are not routinely monitored are likely to be key mediators of treatment outcome, such as patients’ level of understanding about their condition, perceptions of symptom legitimization, confidence to self-manage, and personal control of their symptoms. One interesting new avenue of research is to test whether systematic monitoring tools using key mediators serve to improve therapeutic alliance and thus clinical outcomes. However, at present, very little research has explored the development of simple clinical tools to enable physical therapists to do this in practice. In addition, there are a number of potential psychosocial treatment mediators that have yet to be adequately
Key points:
• Screening tools are being tested using information about psychosocial prognostic factors to guide clinical decision making.
• A few studies have tested the benefit of using treatment effect modifiers to direct treatment and have shown initial positive results, although most did not fully utilize psychosocial factors. Further validation is needed before existing decision-making aids are ready for adoption into clinical practice.
• Research is beginning to explore which psychosocial factors are key aspects of treatment that need to be monitored to achieve optimal clinical outcomes.

Conclusions
It is increasingly recognized that to improve clinical reasoning and reduce treatment variability, a number of complementary approaches are needed that characterize the different ways in which psychosocial factors influence response to treatment. These approaches include the further development and refining of screening tools that help to identify patients with high scores on prognostic factors, treatment decision aids that identify subgroups based on known treatment effect modifiers, and progress-monitoring tools that help clinicians to quantitatively evaluate treatment progress on key mediators of outcome. Some of the limitations of decision aids—such as their inability to classify all patients to treatment and the fact that individual LBP treatments are rarely used in isolation but more typically are combined into packages of care—are strengths for screening tools. Screening approaches tend to classify all patients into a risk group and are able to discriminate distinct groups for which new multicomponent treatments can be developed. Screening tools also have strengths in early decision making and in determining the need for additional care or the overall type of care indicated, but are limited in that, unlike decision aids, they are unable to determine the most effective specific interventions to apply to an individual patient.

As these complementary methods become clearer, it is recommended that research focuses on using the combined knowledge of predictors, mediators, and modifiers to provide clinically useful tools. People with back pain are a heterogeneous patient population, and it is likely that research to limit this heterogeneity through the identification of subgroups will vastly reduce treatment variability. Readers should be aware that screening tools are useful only in identifying risk status and not in matching patients to specific treatments. Risk status is useful in clinical reasoning about prioritization of patients and in referral decisions for additional care. Prediction rules are helpful in determining which specific interventions to apply to the individual at the outset, and treatment mediators may prove helpful in determining which patient monitoring tools to use over the course of treatment and in knowing which aspects of treatment to strengthen. In this way, knowledge of psychosocial influences on treatment response will not only remain academic but also can be translated into practical clinical tools that help reduce treatment variability and provide evidence-based care.

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