

LATERAL THINKING

Metacognition environment

Collaborative reasoning

research evidence

Clinical prediction rules

CLINICAL PATTERNS

critical fast and slow reasoning Human bias

thinking Abduction

DEDUCTION ethical reasoning

INDUCTION social Hypothesis testing

Physical PSYCHOLOGICAL

Activity and participation

Diagnostic procedural reasoning

reasoning Pain type

interactive reasoning BIOLOGICAL

Patient's Perspective

IMPAIRMENTS FUNCTION

OR STRUCTURE

education

Management

Clinical Reasoning in MUSCULOSKELETAL PRACTICE

Second Edition

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Foreword by Ann Moore, CBE

ELSEVIER

Clinical Reasoning in Musculoskeletal Practice

SECOND EDITION

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Foreword

This book, *Clinical Reasoning in Musculoskeletal Practice*, is the second edition of a book published in 2004 by Mark Jones and Darren Rivett. The title of the first version was *Clinical Reasoning for Manual Therapists*. It is very welcome to see the development of this title – recognizing the spread of approaches that musculoskeletal physiotherapists now take in addition to manual therapy which is still an important and fundamental approach. The book is of extreme relevance and importance to all practitioners dealing with musculoskeletal issues in clinical practice on a daily basis. The book is also highly relevant for clinical educators; academics focused on musculoskeletal science and practice in educational, as well as clinical settings; and, of course, for students, whether at undergraduate or postgraduate level.

It is exciting to see how clinical reasoning and decision-making theories have developed over the last 15 years or so, and this book captures these theoretical developments and also captures the clinical relevance and applications of these theories. Mark Jones and Darren Rivett have very successfully brought together 52 authors who are well known in the field of musculoskeletal physiotherapy. Importantly, the authors are based in 12 countries from across the world, which thus represents an international perspective on clinical reasoning.

The book contains three sections. Section 1 contains five chapters which focus on key theories which inform clinical reasoning in musculoskeletal practice. This section is a fundamental read before moving on into the next section: 'Clinical Reasoning in Action: Case Studies From Musculoskeletal Practitioners'. Section 2 consists of 25 chapters with each one focusing on a different musculoskeletal condition and demonstrating considerable complexities. Each case study includes a history of the patient's condition, examination findings, their treatment approaches, and their outcomes. In addition Mark Jones and Darren Rivett worked with the lead author of each of these chapters to explore their clinical reasoning throughout the case study, and finally, they provide a clinical reasoning commentary which links the clinician's reasoning to the five theoretical chapters in Section 1.

Finally, [Chapter 31](#) (Section 3) is a very useful chapter on strategies to facilitate clinical reasoning development, and readers will also find the two appendices very helpful in practice, as they contain a clinical reflection form and a clinical reasoning reflection worksheet.

This book is certainly a must-read for all those interested in musculoskeletal practice, and I would like to thank Mark and Darren for producing such a valuable contribution to the musculoskeletal field. I would also like to thank all the contributors to the book, who provide important insights and inspiration for us all.

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Preface

We published our first edition of *Clinical Reasoning for Manual Therapists*, focused on making expert clinical reasoning explicit through case studies, in 2004. Clearly there was a great need for such a resource, both in formal musculoskeletal educational programs and as a stimulus for informal professional development in clinical reasoning, as the book has been widely adopted internationally and has stood the test of time. Since then, however, there has been significant continued growth in the research evidence musculoskeletal clinicians are expected to know and use and an increase in the understanding of pain science. Associated with this growth in empirical research and understanding of pain has been a parallel increase in the emphasis on psychosocial assessment, pain education and cognitive-behavioural management. Of course, the clinical reasoning theory has also accordingly adapted and progressed in this time.

The political pressure for research- and evidence-based practice is greater than ever, increasingly in an attempt to justify cost-cutting measures in health care. This is despite the plethora of systematic reviews now available concluding, more often than not, that there is insufficient high-level research to judge what managements are best. Similarly, the relatively recent rise in musculoskeletal practice of clinical prediction rules – statistically derived clinical tools designed to assist in decision making – has generated much interest, particularly amongst less experienced clinicians and those not well versed in clinical reasoning. However, there is growing concern that clinical prediction rules are being adopted as a 'lazy man's' substitute for clinical reasoning and are being prematurely adopted by clinicians and required by funding bodies despite usually not having been fully validated and scientifically demonstrated to have a positive impact.

Conversely, pain science and chronic pain or disability research convincingly highlight the importance of musculoskeletal practitioners increasing their skills in psychosocial assessment and management. Although formal classroom education in these areas is increasing at the pre- and post-professional levels, it is still arguably less developed and often not well integrated into the clinical practice components of the curriculum. A key challenge to musculoskeletal education and clinical practice is to strengthen this important area without diminishing the knowledge and procedural skills essential to 'hands-on' physical assessment and treatment. Indeed, physiotherapy 'hands-on' procedural skills may be under threat from those who promote education (e.g. in pain management) as a *replacement* for established physical therapies, rather than something that needs to be *integrated* with those same therapies (Jull and Moore, 2012; Edwards and Jones, 2013). Arguably, skilled clinical reasoning is more important than ever because of the external pressures for greater efficiency and quality patient outcomes.

In this book, the theory underpinning clinical reasoning has been significantly expanded from the previous edition to include the following completely new chapters:

Chapter 1: Clinical reasoning: fast and slow thinking in musculoskeletal practice

Chapter 2: Understanding pain in order to treat patients in pain

Chapter 3: Influence of stress, coping and social factors on pain and disability in musculoskeletal practice

Chapter 4: Assessment, reasoning and management of psychological factors in musculoskeletal practice

Chapter 5: Clinical prediction rules: their benefits and limitations in clinical reasoning

Chapter 31: Strategies to facilitate clinical reasoning development

Aside from these six theory chapters, the bulk of the book is comprised of 25 new case study chapters of real patients, presented from their initial appointment through to discharge. In each case chapter, Mark and/or Darren worked with the clinical authors to explore their clinical reasoning throughout the case, then provided a Clinical Reasoning Commentary that links aspects of the clinical authors' reasoning to the theory chapters. The overarching

aim is to 'bring to life' the clinical reasoning theory and underpinning sciences in the context of a real-world clinical problem. Contributing clinical authors were invited on the basis of their world-renowned expertise in the case area, with representation of both spinal and peripheral musculoskeletal cases, multiple clinical approaches and authors from around the globe. Although the 'hypothesis categories' framework presented in [Chapter 1](#) was used as the basis for the majority of questions asked of clinical authors, they were not provided with this or any of the other theory chapters when writing their cases or answering the Reasoning Questions – that is, they were not prompted or required to conform to any of the theory presented in the first five chapters.

With such a diverse group of contributing clinical authors, there are, understandably, differences in the examination information obtained and forms of treatment used. However, despite this variability, there is considerable similarity across the cases with respect to their thoroughness in examination, scope of clinical reasoning and individually tailored management, informed by both research and experience-based evidence. Although the language used to report the cases and answer the Reasoning Questions also varies somewhat across the cases, consistent with the clinical reasoning promoted in the theory chapters, the reasoning presented throughout the cases is also holistic, biopsychosocial, collaborative and patient centred. Attention to both the physical and the psychosocial presentation is consistently evident, along with management that promotes patient understanding and self-efficacy.

It should be apparent by now to the discerning reader why we have modified the title of the book from the original *Clinical Reasoning for Manual Therapists* to *Clinical Reasoning in Musculoskeletal Practice* in this edition. The breadth of clinical practice in the musculoskeletal field has clearly changed significantly since 2004, and the title change is an attempt to reflect just that while still embracing manual therapy as a core skill for the musculoskeletal practitioner.

Finally, we would like to express our sincere gratitude to the many contributing authors, both of the theoretical chapters and of the clinical reasoning cases. Although the gestation of this second edition has been rather more protracted than anticipated, they have uniformly demonstrated great patience and ongoing enthusiasm for this new edition of the book.

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Adelaide, Australia, 2019

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Transformative learning theory (Cranton, 2006; Mezirow 2009, 2012) refers to the process by which we use critical reflection to transform prior, taken-for-granted understandings to make them more inclusive, open, reflective and discriminating. For the focus in this book on improving your clinical reasoning skills, this requires an awareness of your current understanding of reasoning and a critical reflection on clinical reasoning in practice as a means of transforming your clinical understanding and potentially your clinical practice.

The initial new theory chapters on clinical reasoning; pain science; stress, coping and social factors; psychological factors; and clinical prediction rules provide important knowledge to underpin contemporary biopsychosocially based clinical reasoning in musculoskeletal practice. As discussed in [Chapters 1 and 5](#), human bias can undermine our judgements. To reduce bias and improve clinical reasoning, it is critical to first understand your own clinical reasoning, including the processes involved, different foci of reasoning attended to and factors influencing clinical reasoning proficiency. In addition to the theory chapters, the 25 new cases throughout this book should promote reflection and improve your understanding of your own clinical reasoning as you compare your reasoning as each case unfolds to that of the expert clinical authors, with accompanying reasoning commentary linking back to the theory chapters. This should facilitate an improved breadth, depth and accuracy of your clinical reasoning and clinical decisions, with the final chapter providing further strategies to develop your clinical reasoning skills in an ongoing manner. We see clinical reasoning as an essential professional competency and believe we need to study and practice clinical reasoning alongside our other professional competencies.

Practising clinical reasoning, by reading the cases and reasoning explored through the cases in this book (along with other strategies for facilitating clinical reasoning discussed in [Chapter 31](#)), will improve your underpinning understanding and hopefully your own clinical reasoning skills in actual clinical practice. To optimize that learning, the cases should not simply be read passively. As [Mezirow \(2012\)](#) highlights, transformative learning requires participation in constructive discourse to use the experience (and reasoning) of others to elicit reflection and awareness of your own reasoning and associated assumptions. Constructive discourse can occur by attempting to answer the Reasoning Questions posed throughout the cases prior to reading the expert clinicians' Answers to Reasoning Questions and by comparing and critiquing your reasoning with the reasoning put forward during the case. Even more stimulating and probably more beneficial is to engage in constructive discourse of a case and its associated reasoning in small groups of two or more practitioners or students.

Clinical reasoning in musculoskeletal practice is not an exact science with absolute correct and incorrect judgements. That is, it is not essential to agree with all the reasoning explained throughout the cases. What is important is that all cases present their assessment and management with explicit reasoning for what is done. When comparing your own reasoning to the case reasoning of the expert clinical authors, especially where differences exist, readers should consider assumptions being made (both in the case reasoning and your own) in assessments (e.g. information obtained versus not obtained), assessment analysis (e.g. hypothesis substantiation and alternative hypotheses), management (e.g.

clinical and research support provided, and alternative management options) and outcome re-assessment (e.g. breadth of self-report and physical measures informing treatment progression and success generally). Rather than simply attempting to pick holes in the clinical approach taken and the reasoning provided, readers are encouraged to suspend judgement and 'try on' the different points of view put forward. This sort of open-minded constructive discourse is important to both consolidating and varying your own perspectives. Practising clinical reasoning through the cases in this manner will assist your application of the theory covered in [Chapters 1–5](#) and [31](#), to your reasoning in clinical practice, improving both your integration of that theory and your clinical reasoning proficiency.

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SECTION 1

Key Theory Informing Clinical Reasoning in Musculoskeletal Practice

1

Clinical Reasoning: Fast and Slow Thinking in Musculoskeletal Practice

Mark A. Jones

Introduction

In this chapter clinical reasoning in musculoskeletal practice is presented as being multi-dimensional and involving fast, intuitive first impressions and slow, more analytical deliberations. It is hypothesis oriented, dialectic, collaborative and reflective. Skilled clinical reasoning contributes to clinicians' learning and to the transformation of existing perspectives. The scope of clinical reasoning is presented through discussion of three key frameworks: (1) biopsychosocial philosophy of practice, (2) clinical reasoning strategies and (3) hypothesis categories. Cognitive processes involved in clinical reasoning (e.g. deduction, induction, abduction) are explained, and key factors influencing skilled clinical reasoning and expertise are discussed, including critical thinking, metacognition, knowledge organization, data collection and procedural skills, and patient–therapist therapeutic alliance. Lateral thinking is proposed as important to the generation of new ideas.

Why do we need to study and practice clinical reasoning? Nobel Laureate Daniel Kahneman highlights the numerous biases of human judgment that occur due to quick judgments and a lack of analytical thinking. He describes two broad forms of thinking: fast (System 1) thinking characterized by automatic and effortless first impressions and intuition (as with tacit pattern recognition) and slow (System 2) thinking characterized by analytical deliberations requiring more attention, time and effort ([Kahneman, 2011](#)). Both of these fictitious¹ systems operate together, with System 1 running automatically and System 2 normally in a low-effort mode. Our System 1 quick impressions receive minimal scrutiny from our slower System 2 analysis, and if endorsed, those initial impressions and intuitions turn into beliefs that lead to actions. More simply, you accept your fast impressions as representing a prior belief without further scrutiny (note that this is true for patients as well as clinicians). However, when System 1 runs into difficulty, as when the representativeness of a finding (e.g. within a patient's story, physical assessment or outcome re-assessment) is unclear, contradictory or not what you expected, System 2 is called upon for more attentive processing.

A wide range of errors (e.g. poor, inaccurate judgments) can be attributed to quick first impressions and decisions based on insufficient information and lack of further deliberation. For example, consider the following puzzle ([Kahneman, 2011](#), p. 44) and your first impression/intuition (without formally trying to solve it):

*A bat and ball cost \$1.10.
The bat costs one dollar more than the ball.
How much does the ball cost?*

¹Kahneman highlights that his Systems 1 and 2 are fictitious in the sense that they are not systems in the convention of entities with interacting aspects that can be simply attributed to one part of the brain or another. He explains that the value of this distinction relates to the aptitude of our mind to better understand constructs presented as stories with active agents, in this case Systems 1 and 2.

The quick, intuitive and wrong answer is 10 cents² (50% of Harvard, MIT and Princeton students studied got this wrong; 80% of students from less prestigious universities) (Kahneman, 2011). Although heuristics, or shortcuts in thinking, work well in many circumstances, if they go unchecked by more deliberative thinking, as with this example, errors will occur.

When you consider that every patient cue perceived (verbal, visual, kinaesthetic) undergoes some level of System 1 and/or System 2 processing, it is easy to appreciate the potential for analogous errors in musculoskeletal clinical reasoning. For example:

Acromioclavicular joint (ACJ) pain is provoked with shoulder movement into horizontal flexion.

Horizontal flexion provokes ACJ-area pain on active-movement testing.

The patient's pain is due to nociception in the ACJ.

The patient reports mid-thoracic pain consistently provoked after sitting to eat lunch.

The patient reports sitting in fully slouched position when eating lunch.

Mid-thoracic pain is due to nociception associated with slouched sitting at lunch.

Inappropriate pain beliefs and cognitions contribute to nociplastic pain sensitization.

A patient has inappropriate pain beliefs and cognitions.

The patient has nociplastic pain sensitization.

These examples illustrate errors of deduction. Nociception from other structures can be responsible for ACJ-area pain (e.g. subacromial tissues); other predisposing factors than slouched sitting can precipitate mid-thoracic pain (e.g. gallbladder nociception secondary to eating fatty foods); and inappropriate pain beliefs and cognitions can also exist with nociceptive dominant pain. Although you may believe your System 2 would not uncritically endorse these System 1 conclusions without obtaining further supporting information, it is a bit disheartening to contemplate the large number of biases evidenced in health-related and non-health-related human judgment that Kahneman and others (e.g. Croskerry, 2003; Hogarth, 2005; Kahneman et al., 1982; Lehrer, 2009; Schwartz and Elstein, 2008) report. Some examples easily recognizable in clinical practice include the following:

- The 'priming' influence of prior information (e.g. diagnosis provided in a referral, imaging findings, influence of a recent publication or course)
- 'Confirmation bias', or the tendency to attend to and collect data that confirm existing hypotheses
- 'Memory bias' of a spectacular successful outcome
- 'Overestimation of representativeness', as with the probability of a diagnosis given a finding being confused with the probability of a finding given a diagnosis
- 'Conservatism or stickiness', where initial impressions and hypotheses are not revised in the face of subsequent non-supporting information

The greater the coherence of our fast-thinking impressions, the more likely we are to jump to conclusions without further System 2 analysis. Unfortunately, humans are prone to find and accept coherence on the basis of limited information, so much so that Kahneman (2011, p. 86) has characterized this trait associated with many of our biases as 'What You See Is All There Is', that is, the assumption or acceptance that the information at hand is all that is available. You build a story (explanation) from the information you have, and if it is a good, coherent story, you believe it. Paradoxically, coherent stories are easier to construct when there is less information to make sense of.

Although fast thinking is the source of many of our errors, ironically, it is also the source of most of what we do right. When you break down the overall synthesis and analysis of a patient's presentation and consider the vast number of first-impression, fast-thinking judgments that lead up to and inform our understanding of patients and their

²If a ball is 10 cents and a bat is one dollar more (\$1.10), then together they would be \$1.20, not \$1.10. The ball is 5 cents.

problems (e.g. quick recognition of when a patient's telling of his or her story requires clarification; patient discomfort and emotions; observed postural, movement and control impairments; when additional physical testing is required for physical differentiation, etc.), the ubiquity of our fast thinking is obvious. With appropriate training and experience, we learn to effectively use our fast thinking to recognize potentially significant cues, interpret contextualized meanings, recognize when clarification and further testing are required to refine interpretations, and identify appropriate actions and solutions. The key is not to deny the use of initial impressions and fast thinking but to build our skill with this through quality practice and to be aware of the pitfalls and common errors of bias. One of the foremost researchers in problem solving, Herbert Simon (also a Nobel Laureate), perhaps best known for his seminal problem-solving research with chess masters, explains intuition as 'nothing more and nothing less than recognition' (Simon, 1992, p. 155). That is, accurate intuitions of experts are best explained by the effects of prolonged practice.

Although we articulate our judgments and make decisions through our analytical thinking, that is not to say this system is without error. Our slow analytical thinking will often simply endorse or rationalize ideas generated through our fast thinking (Kahneman, 2011). Research has demonstrated that experts function largely on pattern recognition (e.g. Boshuizen and Schmidt, 2008; Jensen et al., 2007; Kaufman et al. 2008; Schwartz and Elstein, 2008) and that overanalyzing also leads to errors in judgment (Lehrer, 2009; Schwartz and Elstein, 2008). However, although not flawless, our slow analytical thinking provides a backup, a check for our fast first impressions and pattern recognition that reduces error and as such needs to be understood and developed, especially in areas of uncertainty and complexity.

Kahneman concludes that humans need help to make more accurate judgments and better decisions. We need to study and practice clinical reasoning, alongside our other professional competencies, to improve the accuracy of both our fast and slow thinking.

Key Point

All thinking, including musculoskeletal clinical reasoning, involves a combination of fast System 1 first impressions, inductions or pattern recognition and slow System 2 deliberations, testing of hypotheses and deductions. Although errors occur in both fast and slow thinking, bias in human judgment necessitates the use of slow analytical thinking, particularly in areas of uncertainty and complexity, to minimize error. An understanding of clinical reasoning and practice doing clinical reasoning are needed to improve clinical reasoning proficiency and enhance the application of core musculoskeletal-associated theory to clinical practice.

The Scope of Clinical Reasoning

Clinical reasoning can be defined as a reflective process of inquiry and analysis carried out by a health professional in collaboration with the patient with the aim of understanding the patient, the patient's context and the patient's clinical problem(s) in order to guide evidence-based practice (Brooker, 2013, supplied by Mark Jones). Although more extensive definitions are available (see Christensen and Nordstrom, 2013; Higgs and Jones, 2008), this captures the broad essence of what we hope to promote in this book.

Musculoskeletal clinicians work with a multitude of problem presentations in a variety of clinical practice environments (e.g. outpatient clinics, private practices, hospital- or outpatient-based rehabilitation and pain unit teams, sports settings, home care and industrial work sites). The clinical presentations they encounter are, therefore, varied, ranging from discrete, well-defined problems amenable to technical solutions to complex, multifactorial problems with uniqueness to the individual that defy the technical rationality of simply applying a 'proven' protocol of management. Schön (1987, p. 3) characterizes this continuum of professional practice as existing between the 'high, hard ground of technical rationality' and 'the swampy lowland' where 'messy, confusing problems defy technical solution'. To practise at both ends of the continuum clinicians must have good propositional (scholarly, research based) and non-propositional (professional craft) knowledge as well as advanced technical skills to solve problems of a discrete, well-defined nature. However, to understand and manage successfully the 'swampy lowland' of complex patient problems requires a rich

blend of biopsychosocial knowledge and professional know-how, combined with personal awareness of your own philosophy of practice, potential biases and diagnostic, procedural and teaching skills. Contemporary musculoskeletal clinicians must have a high level of knowledge and skills across a comprehensive range of competencies, including assessment, management, communication (including teaching, negotiating, counselling), documentation and professional, legal and ethical comportment. Effective performance within and across these competencies requires a broad perspective of what constitutes health and disability and equally broad skills in both diagnostic and non-diagnostic clinical reasoning.

Clinical Reasoning in a Biopsychosocial Framework

The biopsychosocial framework was originally put forward by Engel (1977). As depicted in the World Health Organization (WHO) International Classification of Functioning, Disability and Health (ICF) model (WHO, 2001) (Fig. 1.1) the biopsychosocial perspective recognizes that disability is the result of the cumulative effects of the biological health condition (disease, illness, pathology, disorder), external environmental influences (e.g. physical, social, economic, political, etc.) and internal personal influences (e.g. age, gender, education, beliefs, culture, coping style, self-efficacy, etc.). This is in contrast to the reductionist biomedical model that previously dominated medicine and musculoskeletal practice where disease and illness were primarily attributed to pathogens, genetic or developmental abnormalities or injury. By understanding disability as also being socially constructed, the health professions, including musculoskeletal practice, expanded or made more explicit the need for clinicians to understand all potential biopsychosocial influences and integrate that understanding into their existing assessments, reasoning and management (e.g. Borrell-Carrió et al., 2004; Edwards and Jones, 2007a, 2007b; Epstein and Borrell-Carrió, 2005; Imrie, 2004; Jones et al., 2002; Jones and Edwards, 2008).

The contribution of psychosocial factors to the development, and particularly the maintenance, of patients' pain and disability and clinicians' assessments of their patients' psychosocial status is the focus of Chapters 3 and 4. For the purpose of this chapter, the biopsychosocial framework illustrated in Fig. 1.1 is used to highlight the scope of knowledge, skills and clinical reasoning required to fully understand our patients' problems and our patients themselves (i.e. the person behind the problem). The boxes across the middle of the diagram depict the patient's clinical presentation, incorporating physical impairments of body functions and structures, restrictions and capabilities in functional activities and restrictions and capabilities in the patient's ability to participate in life situations (e.g. work, family, sport, leisure) that collectively make up the patient's disability. Bidirectional arrows between the clinical presentation and the biomedical, environmental and personal influences

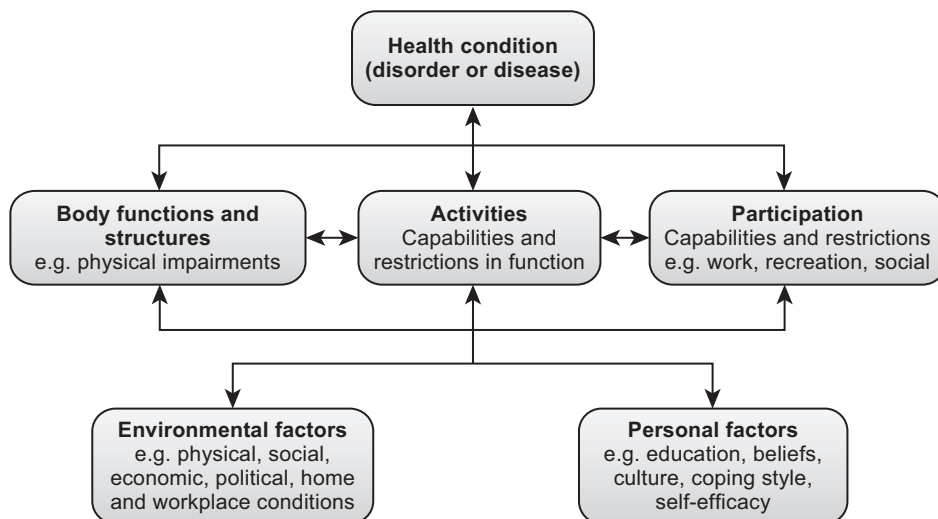


Fig. 1.1 Adaptation of World Health Organization (WHO) International Classification of Functioning, Disability and Health (ICF) framework. (Reproduced with permission [WHO, 2001, p. 18].)

reflect the reciprocal relationship whereby each has the potential to influence the other (Borrell-Carrió et al., 2004; Duncan, 2000; Pincus, 2004). For example, where traditionally functional restrictions, physical impairments and pain would have been conceptualized as the end result of a specific injury/pathology or syndrome, the reciprocal arrows highlight that these also can be associated with and even maintained by environmental and personal influences. A holistic understanding of a patient's clinical presentation therefore necessitates attention and analysis of the patient's physical health, environmental and personal factors. Although musculoskeletal clinicians are generally well educated to assess and manage the physical and many environmental dimensions of the patient's health condition, formal education and experience assessing, analysing and managing psychological and social factors contributing to both acute and chronic pain is often less developed and less structured (e.g. Barlow, 2012; Bishop and Foster, 2005; Foster and Delitto, 2011; Main and George, 2011; Overmeer et al., 2005; Sanders et al., 2013; Singla et al., 2014). The sociological dimension of psychosocial in particular is generally given less attention as a factor contributing to the pain experience (Blyth et al., 2007). A growing body of literature is now available informing musculoskeletal clinicians' psychosocial assessment and management (e.g. French and Sim, 2004; Hasenbring et al., 2012; Johnson and Moores, 2006; Jones and Edwards, 2008; Keefe et al., 2006; Main et al., 2008; Muncey, 2002; Schultz et al., 2002; also see Chapters 3 and 4) with literature also explicitly relating the WHO ICF to categorization of clinical problems, clinical reasoning and management (e.g. Allet et al., 2008; Childs et al., 2008; Cibulka et al., 2009; Edwards and Jones, 2007a; Escorpizo et al., 2010; Jette, 2006; McPoil et al., 2008; Steiner et al., 2002).

Being able to practice within a biopsychosocial framework requires different sets of knowledge and clinical skills to be able to understand both the biological problems and the environmental and personal factors that may predispose to the development or contribute to the maintenance of the patient's pain and disability experiences. As such, a distinction can be made between understanding and managing the biological problem to effect change versus understanding and interacting with the person to effect change. To assist clinicians' application of biopsychosocial practice, we have promoted our evolving use of two frameworks for guiding the focus of clinical reasoning required (clinical reasoning strategies) and the categories of decisions required (hypothesis categories) (Edwards et al., 2004a; Jones, 1987, 2014; Jones et al., 2008).

Key Point

Conceptualizing disability as the cumulative effects of the biological health condition (disease, illness, pathology, disorder), environmental influences (e.g. physical and social) and personal influences (e.g. beliefs, culture, socio-economic, education) highlights the scope of knowledge, skills and clinical reasoning required to practice in a biopsychosocial framework. Musculoskeletal clinicians are traditionally well educated in the assessment and management of physical and environmental factors contributing to patients' disabilities; however, formal education and experience assessing, analysing and managing psychological and social factors are often less developed and less structured. Psychosocial assessment and management feature in varying degrees within the case studies of this book. Attention to how psychosocial factors are screened, the reasoning used to determine their contribution to individual patients' clinical presentations and how they are addressed in management will assist clinicians in further developing this important component of their biopsychosocial practice.

Focus of Our Clinical Reasoning: Clinical Reasoning Strategies

When students first consider clinical reasoning in musculoskeletal practice, they typically only focus on diagnosis, with diagnosis itself often limited to categorizing the type of problem, injury or pathology. When all potential influences present in the biopsychosocial perspective (Fig. 1.1) are considered, as well as the reasoning required in the corresponding

management of identified influences, then clearly reasoning about diagnosis represents only a portion of the reasoning that actually occurs in clinical practice. Research and theoretical propositions across a range of health professions (e.g. physiotherapy, medicine, nursing, occupational therapy) have identified explicit foci of clinical reasoning, including diagnostic reasoning, narrative reasoning, procedural reasoning, interactive reasoning, collaborative reasoning, predictive reasoning, ethical reasoning and teaching as reasoning (Higgs and Jones, 2008). Edwards and colleagues (Edwards, 2000; Edwards et al., 2004a) investigated the clinical reasoning of expert physiotherapists in three different fields of physiotherapy (musculoskeletal, neurological and domiciliary/home health care) and found that these physiotherapists employed a range of 'clinical reasoning strategies' despite the differing emphases of their examinations and management. The following clinical reasoning strategies were each associated with a range of diverse clinical actions:

Diagnostic reasoning: Reasoning underpinning the formation of a musculoskeletal practice diagnosis related to functional limitation(s) and associated physical and movement impairments with consideration of pain type, tissue pathology and the broad scope of potential contributing factors.

Narrative reasoning: Reasoning associated with understanding patients' pain, illness and/or disability experiences. This incorporates their understanding (including personal meaning) of their problem(s) and effects on their lives; their expectations regarding management; associated cognitions and emotions; their ability to cope; and the effects these personal perspectives have on their clinical presentation, particularly whether they are facilitating or obstructing their recovery.

Reasoning about procedure: Reasoning underpinning the selection, implementation and progression of treatment procedures. Although clinical guidelines provide broad direction, typically focusing only on diagnostic categorization, practising clinicians need to adaptively reason how best to apply those guidelines to patients' individual presentations and goals. Progression of treatment is mostly then guided by judicious outcome re-assessment that attends to impairment and function-/disability-related outcomes.

Interactive reasoning: Reasoning guiding the purposeful establishment and ongoing management of clinician–patient rapport (discussed further under Factors Influencing Reasoning).

Collaborative reasoning: The shared decision-making between patient and clinician (and others) as a therapeutic alliance in the interpretation of examination findings, setting of goals and priorities, and implementation and progression of treatment (see Edwards et al. [2004b] and Trede and Higgs [2008] for further detail).

Reasoning about teaching: Reasoning associated with the planning, execution and evaluation of individualized and context sensitive strategies to facilitate change, including facilitating motivation for change, facilitating conceptual change in understanding and beliefs (e.g. regarding medical and musculoskeletal diagnosis and pain), facilitation of constructive coping strategies, and facilitation of improved physical performance, activity and participation capabilities (e.g. rehabilitative exercises, conditioning, sport technique, activity pacing and graded exposure).

Predictive reasoning: Reasoning utilized in judgments regarding effects of specific interventions and overall prognosis. Although prognostic judgments regarding whether musculoskeletal therapy can help and expected time frame are not precise, a thorough reasoning consideration of biological, environmental and personal factors that recognizes both facilitators and barriers (i.e. positives and negatives in a patient's presentation), as well as what is and isn't modifiable, will assist this reasoning strategy.

Ethical reasoning: Reasoning underpinning the recognition and resolution of ethical dilemmas which impinge upon patients' ability to make decisions concerning their health and upon the conduct of treatment and its desired goals (see Edwards et al. [2005] and Edwards and Delany [2019] for further detail).

Consideration of these diagnostic and non-diagnostic foci of reasoning assist by highlighting the broad scope of clinical reasoning we should be aware of, critique and strive to improve. The complexity of our reasoning is further evident in the finding that expert physiotherapists have been shown to dialectically move in their reasoning between contrasting biological and psychosocial poles in a fluid and seemingly effortless manner (Edwards, 2000; Edwards

et al., 2004a). For example, a diagnostic test may elicit a patient response reflecting fear of movement underpinned by inappropriate beliefs and cognitions regarding their diagnosis, pathology and/or pain. Sensitivity, specificity and likelihood ratios of the diagnostic test inform the likelihood of having that condition. At the same time, the expert clinician perceives the more qualitative patient expressions of fear, tempering their diagnostic analysis and dialectically shifting their reasoning from biological to psychosocial.

Attending to patients' psychosocial status alongside physical/diagnostic findings is essential. It is not possible to fully understand a patient's pain and disability experience without a comprehensive physical examination that reveals the extent of physical impairment and disability they have to cope with. Similarly, psychosocial assessment will not only inform diagnostic reasoning, but it also enables identification of unhelpful perspectives that need to be addressed in management for both acute and chronic presentations. Although the clinical reasoning strategies provide a framework to assist students and practicing clinicians recognize the different foci of reasoning required, it is also helpful to recognize the different categories of clinical decisions required within these different reasoning strategies.

Key Point

Diagnostic reasoning represents only one focus of clinical reasoning in musculoskeletal practice. Expert clinicians have been shown to employ a range of 'clinical reasoning strategies' incorporating different foci of reasoning including diagnostic reasoning, narrative reasoning, reasoning about procedure, interactive reasoning, collaborative reasoning, reasoning about teaching, predictive reasoning and ethical reasoning. Experts are able to dialectically move in their clinical reasoning between the biological and psychosocial poles of the biopsychosocial framework in accordance with emerging patient information. Awareness, critique and practice in all areas of clinical reasoning are important to developing expertise in clinical practice.

Categories of Clinical Decisions Required: Hypothesis Categories

It seems obvious that clinicians should know the purpose of every question they ask their patients and every physical assessment they conduct. That is, what do you want to find out, and what decision will that information inform? It is not necessary or even appropriate to stipulate a definitive list of decisions all clinicians must consider, as this would only stifle the independent and creative thinking important to the evolution of our professions. However, a minimum list of categories of decisions that can/should be considered is helpful to those learning and reflecting on their clinical reasoning because it provides them with initial guidance to understand the purpose of their questions and physical assessments, encourages breadth of reasoning beyond diagnosis and creates a framework in which clinical knowledge can be organized as it relates to decisions that must be made (i.e. diagnosing, understanding psychosocial influences, determining therapeutic interventions, establishing rapport/therapeutic alliance, collaborating, teaching, prognosis and managing ethical dilemmas). What follows is a list of 'hypothesis categories' initially proposed by Jones (1987) that has continued to evolve through professional discussion to this current format (Table 1.1). Research evidence regarding musculoskeletal clinicians' focus of clinical reasoning, including reasoning across and within these different categories, is available (e.g. Barlow, 2012; Doody and McAteer, 2002; Edwards et al., 2004a; Jensen, 2007; Rivett and Higgs, 1997; Smart and Doody, 2006). This, combined with reflective discourse from experienced clinicians and clinical educators, broadly supports the relevance and use of these particular hypothesis categories. Nevertheless, these specific hypothesis categories are not being recommended for uncritical use by all clinicians, and whatever categories of decisions are adopted should continually be reviewed to ensure they reflect contemporary health care and musculoskeletal practice.

TABLE 1.1**HYPOTHESIS CATEGORIES**

- Activity and participation capability and restriction
- Patients' perspectives on their experiences and social influences (psychosocial status)
- Pain type
- Sources of symptoms
- Pathology
- Impairments in body function or structure
- Contributing factors to the development and maintenance of the problem
- Precautions and contraindications to physical examination and treatment
- Management/treatment selection and progression
- Prognosis

Activity and Participation Capability and Restriction

Patients' activity capabilities and restrictions directly relate to the ICF framework of health and disability presented in [Fig. 1.1](#) and refer to the patient's functional abilities and restrictions (e.g. walking, lifting, sitting, etc.) that are volunteered and further screened for. To gain a complete picture, it is important the clinician identifies those activities the patient is capable of alongside those that are restricted.

Patients' participation capabilities and restrictions refer to the patient's abilities and restrictions to participate in life situations (e.g. work, recreation/sport, family, etc.). Again, determining participation capabilities, including modified participation (e.g. modified work duties), is important because this will contribute to other decisions such as prognosis and management. Note that identifying patients' activity and participation restrictions and capabilities, either through interview or through questionnaire, does not really qualify as formulating 'hypotheses' in the sense that these are not clinicians' judgments or deductions; rather, they are simply essential information to obtain in order to understand the extent of the patient's disability and quality of life. They are included in the hypothesis categories framework simply to facilitate attention to these critical aspects of the patient's pain/disability experience. Later, when making judgments about pain type, the proportionality of activity and participation restrictions and the physical impairments/pathology identified through examination will need to be considered. When activity and participation restrictions are out of proportion to identified physical impairments and pathology, then it may reflect a nociplastic pain type ([IASP Taxonomy 2017](#); [Nijs et al., 2015](#); [Smart et al., 2012c](#); [Woolf, 2011](#)), and it is likely the patient's psychosocial status will be negatively contributing to the patient's disability.

Patient Perspectives on Their Experiences and Social Influences (Psychosocial Status)

Patients' perspectives on their experiences and social influences relate to the patient's psychosocial status, which the clinician needs to assess and understand. Musculoskeletal clinicians' psychosocial assessment is discussed in more detail in [Chapters 3](#) and [4](#). But briefly, psychosocial assessment incorporates such things as:

- What are the patient's perspectives of their pain/disability experience?
 - Understanding / beliefs regarding their problem, its diagnosis, about pain (for example, with respect to: seriousness, changeability and controllability) AND what is the basis of those beliefs (i.e. why do they think that)?
- What are their expectations and beliefs about management and their role in management? What are their specific goals?
- How they are coping, emotionally (e.g., anger, depressive symptoms, feelings of vulnerability, etc.) and behaviorally? Do they have any specific coping strategies (e.g. medication, rest, alcohol, exercise, avoidance), and if so, are they effective?

- What are the patient's social circumstances (e.g. education / health literacy, culture, living, work, friends, etc.) and what is their perception of support:
 - How does the patient think they are perceived by their partner, workmates and employer, and how does this affect their self-concept, self-efficacy and pain/disability experience?
- Is change important to the patient? What is their self-efficacy to positively contribute to change? What tasks do they currently believe they can perform? What tasks do they believe they will be able to return to following management?

In the clinical reasoning strategies framework presented earlier, hypotheses regarding psychosocial status fit within narrative reasoning focused on understanding patients' pain, illness and/or disability experiences. When assessing understanding of their problem (e.g. diagnosis, pain), this is not simply their superficial understanding (e.g. what the doctor told them or what they have read); rather, it refers to what meaning they attach to that understanding (e.g. likely recovery, fear of further damage, etc.).

Pain Type

Understanding pain, including types of pain, differences between acute and chronic pain, referred pain and the associated neurophysiology, is essential knowledge to musculoskeletal clinicians. For this knowledge to be useful in clinical practice, it then must be linked to clinical reasoning, for example, clinical patterns of different pain types and the implications to precautions in assessment and management, management strategies and prognosis. [Chapter 2](#) provides an overview of contemporary pain science understanding linked to clinical reasoning. For the purposes of this chapter, pain type is discussed as a hypothesis category because of its overarching importance to these other reasoning decisions, especially management.

The three main types of pain musculoskeletal clinicians need to be able to assess for and recognize include nociceptive pain (with and without inflammation), neuropathic pain and nociplastic pain³ (e.g. [Gifford et al., 2006](#); [IASP Taxonomy 2017](#); [Nijs et al., 2014b](#); [Woolf, 2011, 2014](#)). Nociceptive pain is protective and refers to pain that is associated with actual or threatened damage to non-neural tissue and involves activation of peripheral nociceptors ([IASP Taxonomy 2017](#)). Nociceptive inflammatory pain occurs with tissue damage, and/or immune cell activation in the case of systemic inflammation, facilitating repair by causing pain hypersensitivity until healing occurs ([Woolf, 2010](#)). Neuropathic pain refers to pain arising as a direct consequence of a lesion or disease affecting the somatosensory system and can be further differentiated into peripheral or central neuropathic pain depending on the anatomic location of the lesion ([IASP Taxonomy 2017](#); [Jensen et al., 2011](#); [Treede et al., 2008](#)). Nociplastic pain is dysfunctional pain associated with altered nociceptive processing in the central nervous system in the absence of overt peripheral drivers such as tissue injury or neuropathy. Nociplastic pain has been demonstrated in a wide range of conditions commonly treated by musculoskeletal clinicians, including non-specific chronic back pain, complex regional pain syndrome, chronic fatigue syndrome, fibromyalgia, post-surgical pain, and visceral pain hypersensitivity syndromes ([Ashina et al., 2005](#); [Clauw 2015](#); [Coombes et al., 2012](#); [Fernandez-Carnero et al., 2009](#); [Lluch Gírbés et al., 2013](#); [Meeus et al., 2012](#); [Nijs et al., 2012a](#); [Perrotta et al., 2010](#); [Price et al., 2002](#); [Roussel et al., 2013](#); [Woolf, 2011](#)). The hypersensitivity manifests as increased responsiveness to a variety of stimuli, including mechanical pressure, chemical substances, light, sound, cold, heat, stress and electrical, with links to a range of CNS dysfunctions, as discussed in [Chapter 2](#).

Although both subjective and physical clinical features of pain types have been reported ([Bielefeldt and Gebhart, 2006](#); [Mayer et al., 2012](#); [Nijs et al., 2010](#); [Nijs et al. 2015](#); [Schaible, 2006](#); [Smart et al., 2012a, 2012b, 2012c](#); [Treede et al., 2008](#); [Woolf, 2011](#)), diagnostic criteria and biomarkers of nociplastic pain are still not definitive ([Kosek et al.,](#)

³Through most of the writing of this book this third pain type was called "maladaptive central nervous system sensitization". This was changed to "nociplastic" in the final stages of writing to be consistent with the IASP change in terminology. However, it is acknowledged the new term is controversial and may change again in the future.

2016; Vardeh, Mannion & Woolf, 2016; Woolf, 2011, 2014). As such, when clinical features of different pain types co-exist, differentiation is challenging. This is particularly true for initial appointments where the full picture of the patient's presentation (subjective, imaging, physical findings) is still emerging. For example, the full pain experience, including initial screening for adverse psychosocial factors by interview and/or questionnaire, often is not fully revealed at the first appointment. As clinician-patient rapport develops and time allows for questionnaire responses to be explored and clarified, a fuller picture will usually become available. Both physical and psychosocial stress can contribute to neuroimmune system dysregulation and thus contribute to pain hypersensitization. Clarification of apparent overlap in pain mechanisms (e.g. nociception with and without sensitization) may be assisted through outcome re-assessments of targeted treatment interventions over a defined period of time. That is, nociplastic pain occurs in response to both internal and external inputs, including cognitive and emotional modulation (e.g. thoughts, beliefs, fears, anxiety) and can be triggered, but not maintained, by nociception from pathological, inflamed or overloaded tissues if present, enabling increased sensitivity (or decreased load tolerance) to co-exist with somatic and visceral nociception. While pain type informs management, the mechanisms and contributors that underpin pain type can differ and change over time. As such, hypotheses about the dominant pain type may change as further information comes to light. Short-term treatments and re-assessments to potentially relevant physical impairments may assist in establishing how much an apparent sensitization is being driven by the symptomatic physical impairments or other co-existing cognitions, emotions and life stressors. Although interventions directed at musculoskeletal tissues have central modulatory influences (e.g. Cagnie et al., 2013; Nijs et al., 2011a, 2012a; Schmid et al., 2008; Smith et al., 2013, 2014; Vincenzino et al., 2007b; Zusman, 2008), they are unlikely to be sufficient on their own to resolve persistent nociplastic pain. However, when physical impairments and associated disability underpin psychological stress and negative cognitions, skilled physical and environmental management would be expected to improve if not resolve negative psyche and disability. When both physical and cognitive/affective factors appear to contribute to maintained pain and disability, management would logically address both. In contrast, successful management for dominant nociplastic pain and persistent pain memories maintained by psychosocial factors will likely require combinations of pharmacotherapy and cognitive-behavioural strategies through pain neuroscience education, facilitation of active coping strategies, graded activity and exercise (Louw et al., 2011; Moseley, 2004; Moseley & Butler, 2017; Nijs et al., 2011a, 2011b, 2012b, 2014a; Turk and Flor, 2006; Zusman, 2008) and is unlikely to be helped by traditional tissue-based approaches. The importance of recognizing clinical features of nociplastic pain is also evident when hypothesizing about potential nociceptive tissue pathology or sources based on joint, muscle and soft tissue assessments. Nociplastic pain can create local false-positive provocation of symptoms suggestive of tissue pathology (Gifford, 1998; Nijs et al., 2010) illustrating the influence of one hypothesis category (e.g. pain type) on another (e.g. source of symptoms) and the complexity of clinical reasoning required.

Source of Symptoms

Although the majority of patients with musculoskeletal problems present with pain as a symptom, they also present with other symptoms such as hyper-/hypoesthesias, paraesthesias, dyseesthesias, vascular associated symptoms, stiffness, weakness, joint sensations (e.g. instability, clicking, locking) and urinary urgency and incontinence, among others. Patients in other areas of clinical practice (e.g. neurological, cardiorespiratory) present with additional symptoms characteristic of disorders of those systems. Consequently, as discussed under General Health Screening, it is important thorough screening occurs for other symptoms beyond the patient's main complaint to ensure that relevant symptoms not spontaneously volunteered and that relevant health comorbidities are not missed.

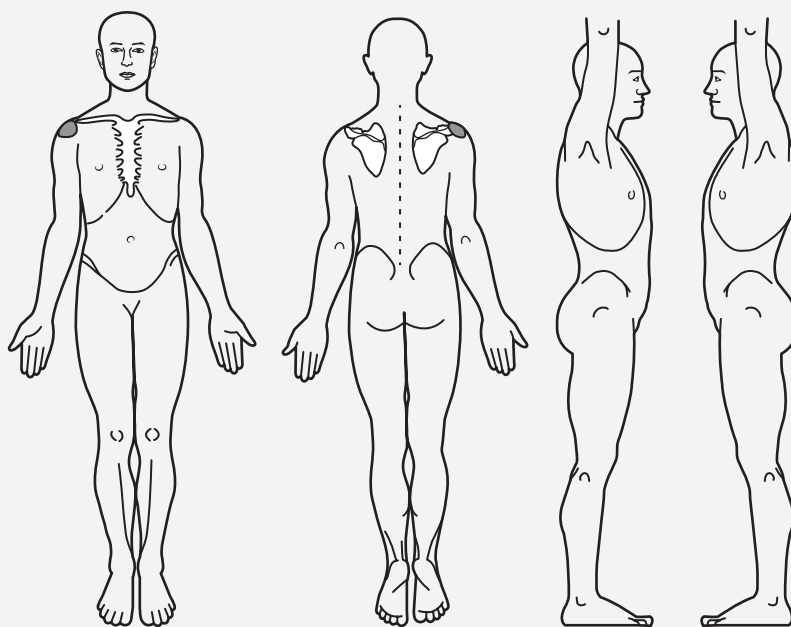
When patients do present with pain, and when a nociceptive 'pain type' is hypothesized, then it is appropriate to reason further regarding potential sources of nociception. Although validation of the source of nociception on the basis of a clinical examination alone is often limited, biological and clinical knowledge of pain distribution, patterns of provocation and relief and common mechanisms of onset enables clinicians to hypothesize about the

likely sources of nociception. The accuracy of this aspect of diagnosis is significantly better with some types of problems (e.g. muscle and ligament injuries) than others (e.g. low back pain). However, even when a specific tissue cannot be confirmed, broader hypotheses about body regions (e.g. spine versus shoulder or hip) are still helpful in differential questioning and testing through the subjective and physical examination.

As an example of generating hypotheses regarding possible sources of nociception for a patient's symptoms based on the area of symptoms, consider the body chart in [Table 1.2](#) depicting a common area of shoulder pain and the potential nociceptive, neuropathic and visceral sources of nociception that should be considered.

TABLE 1.2

BODY CHART DEPICTING AN EXAMPLE OF SYMPTOM LOCATION AND THE POTENTIAL NOCICEPTIVE, NEUROPATHIC AND VISCERAL SOURCES THAT SHOULD BE CONSIDERED FOR THAT SYMPTOM AREA



Potential Local Nociceptive Sources	Potential Neuropathic Sources	Potential Nociceptive Sources of Somatic Referral	Potential Nociceptive Sources of Visceral Referral
- Glenohumeral periarticular (rotator interval structures, capsule and ligaments) - Glenohumeral intra-articular (glenoid labrum, biceps attachment, joint surface) - Subacromial space (rotator cuff, biceps, bursa, coraco-acromial ligament, acromion) - Acromioclavicular joint	- Axillary nerve - Suprascapular nerve - C3–C7 nerve roots	- Any C5/C6 motion segment structures (muscle, posterior intervertebral joint) - Any somatic structure sharing the C5–C6 innervation	- Visceral structures with common innervation to shoulder (e.g. phrenic nerve C3–C5 innervates diaphragm, pericardium, gallbladder, pancreas) - Visceral structures capable of irritating diaphragm (heart, spleen [L], kidneys, pancreas, gallbladder [R], liver [R])

Considering potential structures involved within the suggested columns assists a thorough generation of hypotheses that can then be 'tested' with further questioning through the behaviour of symptoms (aggravating and easing factors), history, general health screening and physical examination–treatment–re-assessment. As alluded to earlier, hypotheses about specific tissue sources of nociception for the patient's symptoms must be made with consideration of the dominant pain type hypothesized. Although clinical examination cannot always confirm the actual nociceptive source of a patient's nociceptive-dominant symptoms, clues from the area and behaviour of symptoms, history, physical examination and treatments/re-assessments, combined with knowledge of common clinical patterns, will enable the clinician to hypothesize the likely structures at fault and possibly their pathology.

Pathology

Pathology is defined as the structural and functional changes in the body caused by disease or trauma (Goodman and Fuller, 2009). Although it is often not possible for musculoskeletal clinicians to confirm pathology clinically, similar to the limitation of clinically confirming the source of nociception, it is still important to hypothesize about pathology for consideration of implications to other hypothesis categories, particularly precautions to physical examination and treatment, management and prognosis. Some suspected pathologies require further investigation and possibly medical or surgical management (e.g. fracture, dislocation, compartment syndrome, cauda equine, visceral referred symptoms), whereas others simply require more caution in physical examination and treatment (e.g. neuropathic pain, seronegative spondyloarthropathies). Research regarding management for different pathologies informs broad management strategies, and understanding of known or suspected pathology also enables better estimation of prognosis (e.g. post-traumatic sprained wrist versus painful wrist associated with rheumatoid arthritis).

Pathology should be considered with respect to characteristic morphological changes of the structures and tissues involved and with respect to the associated pathogenesis or pathophysiological processes underpinning those changes. Symptom presentation alone can be insufficient to guide safe and effective examination and treatment. For example, hypotheses regarding suspected acute muscle or ligament injury and knowledge of the associated inflammatory healing process significantly guide the stages of management based on pathophysiology. However, although pathology can be a source of nociception and can correlate with activity and participation restrictions as well as physical impairments found on examination, pathology also can be asymptomatic, similar pathology can present quite differently in different patients and patients can present with tissue nociception without detectable pathology. Even when pathology is symptomatic, it may not correlate with activity and participation restrictions, physical impairment or improvement in symptoms. As such, pathology is not a good outcome measure, and over-focus on pathology can lead to errors of reasoning. Skilled clinical reasoning necessitates that the clinician must avoid simply administering prescribed pathology-focussed treatments. Practice guidelines and research- and theory-supported literature on management for different disorders and pathologies (e.g. tendinopathy – Cook and Purdam [2009]; intervertebral disc – Adams et al. [2010]; exercise for tissue repair – Khan and Scott [2009]; lateral epicondylalgia – Coombes et al. [2009]; see also Goodman and Fuller [2009]) provide excellent resources so long as application of their recommendations and principles are tailored to each patient's presentation (see Chapter 5). Hypotheses regarding pathology are particularly critical for identifying possible sinister and non-musculoskeletal conditions that require further investigation (discussed further under Precautions and Contraindications). A balance in reasoning between sources of symptoms (e.g. nociception), pathology and impairment is important. Known sources of symptoms and pathology must be seriously considered and unknown sources and pathology cautiously hypothesized. Adverse psychosocial influences and physical impairments should all be considered for their contribution to the development and maintenance of the patient's pain and disability. Although physiological effects of manual therapy and exercise can positively affect tissue healing (e.g. Khan and Scott, 2009) and pain neuromodulation (Nijs et al., 2012b, 2014a; Schmid et al., 2008; Vicenzino et al., 2007b; Voogt et al., 2015; Zusman, 2008), pathology is usually an ineffective or inefficient

outcome measure to monitor on its own, and hence treatment interventions are best directed to negative psychosocial influences, function and associated physical impairments with due consideration of the pathology and pain type categories.

Impairments in Body Function or Structure

Impairment in the context of a patient's health condition is a loss or abnormality of body structure or of a physiological or psychological function (WHO, 2001). In musculoskeletal practice, psychological impairments typically manifest as elevated and functionally maladaptive psychological reactions to symptoms (i.e. 'yellow flags') and are explicitly targeted within the hypothesis category of patients' perspectives on their experience and social influences. Physiological impairments can exist in any body system (e.g. musculoskeletal, neurologic, psychologic, cardiovascular, respiratory, hematologic, gastrointestinal, genitourinary, gynaecologic, immunologic, endocrine), which may be closely associated with presenting musculoskeletal symptoms and impairments, may masquerade as 'musculoskeletal' and may have comorbid implications to musculoskeletal management such as exercise and fitness prescription. Although musculoskeletal clinicians are not qualified to diagnose outside their area of training, thorough screening of symptoms and general health, as discussed further in this section, is essential to identify previously diagnosed and potential undiagnosed non-musculoskeletal problems within different body systems for consideration of relevance to the patient's 'musculoskeletal' presentation and possible referral and further investigation (Goodman, Heick & Lazaro, 2017).

Common musculoskeletal-associated physical impairments hypothesized from the subjective examination and confirmed in the physical examination include impairments in posture, active and passive movement, soft tissue, neurodynamics and motor function (e.g. cognitive and proprioceptive awareness, control, balance and coordination, strength, etc.). Like pathology, physical impairments may be symptomatic and directly associated with the nociceptive source of the patient's symptoms or asymptomatic but still contributing by altering stress/load elsewhere causing other structures to be symptomatic (e.g. tight scalene muscles compromising neurovascular structures). Asymptomatic physical impairments must be analyzed with regard to the structures and processes responsible (e.g. restricted passive hip extension due to hip joint hypomobility, hip flexor tightness/tone and/or anterior neural irritation; or lower extremity weakness and trophic changes secondary to vascular claudication and peripheral vascular disease). Judging whether an impairment is contributing to other structures being symptomatic can sometimes be done through assessment of the effect of kinematic correction on symptom provocation (e.g. Mobilizations With Movement, scapular correction/assistance during movement, lumbopelvic postural correction during movement) but still must be critically evaluated through ongoing management and re-assessment.

Symptomatic physical impairments in a nociceptive-dominant presentation also have to be analyzed as to the structures, pathology and processes involved. Qualitative and quantitative description of symptomatic impairments with respect to pain (e.g. Visual Analogue Scale), mobility (e.g. active and passive range of movement and relationship to symptoms) and dynamic control (e.g. patterns of activation and kinematics) assist in the selection and progression of treatment, as well as the sensitivity of re-assessments.

Contributing Factors

Hypotheses regarding potential contributing factors represent the predisposing or associated factors involved in the development or maintenance of the patient's problem. Both intrinsic and extrinsic factors should be considered, including environmental, psychosocial, behavioural, physical/biomechanical and hereditary.

The potential physical contributing factors that can create excessive strain causing another structure to be symptomatic are quite varied. Examples here include hip extension stiffness causing increased lumbar spine strain during walking and weakness of the scapular upward rotators causing increase subacromial strain during shoulder elevation. Just as physical impairments commonly exist without becoming symptomatic, physical impairments can also cause increased strain without those tissues becoming symptomatic. Although

these impairments still represent risk factors for musculoskeletal symptoms later (analogous to dietary risk factors for heart disease), establishing their relevance in a patient's current pain presentation requires systematic intervention to alter the impairment and re-assessment of the effect. Often this can be established relatively quickly with procedures that immediately address the impairment (e.g. manual assistance or taping of the scapula) or brief trial treatments to assess their benefit.

Even with the same pathology, different patients can have different physical, environmental and psychosocial contributing factors necessitating quite different management. For example, three patients can present with similar subacromial bursitis pathology causing subacromial nociception but quite different predisposing contributing factors necessitating quite different management. Patient one, for example, may present with a tight posterior glenohumeral joint capsule causing increased antero-superior humeral head translation during overhead activities that result in bursal irritation. Patient two has good posterior capsule mobility, as reflected in the patient's good range of humeral internal rotation and horizontal flexion, but this patient has poor control/strength of the scapular force couples required to upwardly rotate the scapula, resulting in inadequate rotation, a narrowed subacromial outlet during overhead activities and bursal irritation. Patient three also has a motor control/strength problem but not of the scapula; instead, the rotator cuff force couples responsible for maintaining humeral head depression during elevation are ineffective resulting in increased superior translation and, again, bursal irritation. Knowledge of common contributing factors to different clinical problems combined with skilled reasoning to establish their relevance is essential. Although treatment directed to the hypothesized source of the patient's nociception is often effective in relieving symptoms, contributing factors must be addressed in order to minimize reoccurrence.

Precautions and Contraindications to Physical Examination and Treatment

Patient safety is paramount, and there is a range of decisions within this hypothesis category that clinicians must consider, including the following:

- Whether a physical examination should be carried out at all (versus immediate referral for further medical consultation/investigation) and if so, the extent of examination that can be safely performed that will minimize the risk of aggravating the patient's symptoms
- Whether specific safety tests are indicated (e.g. cervical arterial dysfunction testing, neurological examination, blood pressure/heart rate, instability tests, etc.)
- Whether any treatment should be undertaken (versus referral for further consultation/investigation)
- The appropriate dose/strength of any physical interventions planned

A number of factors will contribute to determining the extent of physical examination and treatment that is safe to perform, including the following:

- Presence of symptoms that have known association with more serious pathologies (e.g. cervical arterial dysfunction, aortic aneurysm, spinal cord, cauda equina, cancer, fracture, acute compartment syndrome, etc.)
- Dominant pain type (neuropathic and nociceptive pain types typically require more caution in not flaring up symptoms and caution with the patient's potential over-focus on symptoms and pathology)
- Patient's perspectives (anxious, fearful, angry patients, particularly with negative past medical/physiotherapy experiences require more caution)
- Severity and irritability of symptoms ([Hengeveld and Banks, 2014](#))
- Nature of known pathologies (e.g. rheumatoid arthritis or osteoporosis require caution due to weakened tissues)
- Progression of the presentation (e.g. worsening problems require more caution)
- Presence of other medical conditions that may masquerade as a musculoskeletal problem or co-exist and require consideration and monitoring so that musculoskeletal interventions do not compromise the patient's other health problems (e.g. cardiac and respiratory conditions).

General Health Screening

General health screening for other health problems is essential to hypotheses regarding precautions and contraindications. This requires knowledge of the body systems and common features of medical conditions, particularly those that overlap with neuromusculoskeletal problems. This form of screening is not for the purpose of assigning a medical diagnosis; rather medical/general health screening by musculoskeletal clinicians is for the purpose of identifying patients who may have medical conditions that require further investigation and medical consultation. This is particularly important to first-contact practitioners who see patients who have not previously been evaluated by a medical practitioner, but it is also important to clinicians practicing under referral because non-musculoskeletal conditions may have been missed or developed since the patient last saw a doctor. Clinicians should be familiar with recognized 'red flags', which are symptoms and signs that may indicate the presence of systemic or more sinister pathology / disease and non-musculoskeletal disorders masquerading as musculoskeletal that require further medical investigation. Red flag screening has poor diagnostic utility in patients with low back pain (e.g. [Cook et al., 2017](#); [Downie et al., 2013](#)) highlighting the importance of integrating red flag screening into a reasoning process. Although some patient presentations warrant immediate medical attention (e.g. clinical features of cervical arterial dissection or cauda equina), single red flags (or even a cluster of red flags) do not necessarily necessitate medical referral ([Goodman, Heick & Lazaro, 2017](#)). The inevitable costs from further investigations on the basis of red flags with poor diagnostic utility is not justified ([Cook et al., 2017](#)). Instead, red flags must be interpreted in the context of the patient's full presentation with recognition of what constitutes a medical emergency and when "watchful waiting" is advised where red flags are monitored as treatment progresses ([Cook et al., 2017](#)). If physiotherapy and other management does not produce the expected improvement and when non-investigated red flags persist or worsen then medical consultation is warranted. There are different lists of red flags available in the literature, and the texts by [Boissonnault \(2011\)](#), [Sebastian \(2015\)](#), and [Goodman, Heick & Lazaro \(2017\)](#) are excellent resources written for musculoskeletal clinicians.

Management and Treatment

Management in this context refers to the overall health management of the patient, including consultation and referral to other health professionals, health promotion interventions (e.g. fitness assessment and management) and patient advocacy as required (e.g. with insurers or employers). Treatment refers to the specific therapeutic interventions (educational and physical) carried out during an appointment and the underlying reasoning required to determine what to address first, the strategy/procedure to use, the content and delivery of education, the dosage of the intervention, the outcome measures to reassess and the 'homework' or self-management appropriate for optimizing change (in understanding, impairment, activity and participation).

Most important to skilled reasoning is that there are no recipes! Health care in general and musculoskeletal practice in particular are not an exact science. Although clinical trials, clinical guidelines, clinical prediction rules and theory extrapolated from basic science all provide helpful guides to management for different problems, these should not be taken as prescriptions ([Greenhalgh et al., 2014](#)). Instead, clinicians must judge how the patient matches the population in the research reported and then tailor management to the individual patient's unique lifestyle, goals, activity and participation restrictions, perspectives and social circumstances, pain type, potential pathology and physical impairments. Because research-supported management efficacy is still lacking for most clinical problems, skilled reasoning is the clinician's best tool to minimize the risk of mismanagement and over-servicing.

The biopsychosocial model highlights the need for management to be holistic (i.e. addressing physical, environmental, psychosocial as required) with systematic and thorough re-assessments to determine inter-relationships between different physical impairments (e.g. presence of a neurodynamic impairment secondary to a soft tissue interface impairment) and between physical impairments and psychosocial factors (e.g. education to improve understanding leading to a decrease in patient fear and concurrent improvement in movement impairments). Management of contributing factors is essential to minimize the risk of reoccurrence, and patient understanding and active involvement are critical to promoting self-efficacy, self-management and long-term success.

Prognosis

Clinical judgment about prognosis refers to the therapist's informed hypotheses regarding the natural course of musculoskeletal problems, the efficacy of therapeutic interventions addressing their patient's unique presentation, and an estimate of how long this will take. Whether a patient's problem can be resolved, improved or the patient can be assisted to live with it depends in part on whether the factors underpinning the problem are modifiable or not. Prognostic research in low back pain explains less than 50% of the outcome variability due to methodological shortcomings in prognostic research and the multifactorial nature of patients' pain and disability (Hayden et al., 2010). In addition, there is insufficient understanding around the relative influence factors such as genetics, pathology, physiology and psychosocial influences. Musculoskeletal clinicians therefore need to be aware of the broad range of factors that may influence prognosis and recognise those that may be modified. Broadly, a patient's prognosis is determined by the nature and extent of the patient's problem(s), the natural course of the problem, the efficacy of therapeutic interventions and his or her ability and willingness to make the necessary changes (e.g. in lifestyle, psychosocial and physical contributing factors) to facilitate recovery or improved quality of life. Clues will be available throughout the subjective and physical examination and the ongoing management including the following:

- Patient's perspectives and expectations (including readiness, motivation and confidence to make changes)
- External incentives (e.g. return to work) and disincentives (e.g. litigation, lack of employer support)
- Extent of activity/participation restrictions
- Nature of problem (e.g. systemic disorder such as rheumatoid arthritis versus local ligamentous such as ankle sprain)
- Extent of 'pathology' and physical impairments
- Social, occupational and economic status
- Dominant pain type present
- Stage of tissue healing when overt injury has occurred
- Irritability of the disorder
- Length of history and progression of disorder
- Patient's general health, age and pre-existing disorders

Although prognostic decisions also are not an exact science, it is helpful to consider a patient's prognosis by reflecting on the positives and negatives from this list.

How to Use the Hypothesis Categories Framework

The decisions required in clinical practice will determine the information sought (e.g. safety information considered important necessitates safety-oriented questions and physical tests). However, the hypothesis category framework is not intended to direct the order in which information is obtained or the precise inquiries and physical tests utilized to obtain that information. Rather, simultaneous with thorough questioning and listening to understand a patient's story, followed by thorough screening of physical function, clinical reasoning within the hypothesis category framework involves consideration of the different categories of decisions as information unfolds. Although examinations must occur with immediate interpretation and ongoing synthesis of findings, narrow formulation of the problem into limited lists of hypotheses generated by the 'diagnosis', symptoms or duration of problem that are then ticked off through select testing lead to errors of omission (see Chapter 31). It is not possible or desirable to stipulate what hypothesis categories a clinician should be considering at any given point in time (e.g. it is not realistic or cognitively efficient to consider every hypothesis category after every new piece of information is obtained). However, equally, the clinician should not simply be obtaining information without thinking. In fact, by the end of the subjective examination, the clinician will typically have opinions (hypotheses) in most hypothesis categories in order to judge how much physical examination can be safely performed and which physical examination procedures are most important to prioritize at the first appointment. Clues to each category of hypothesis are available throughout the examination and ongoing management, with decisions eventually reached on the strength of supporting versus negating evidence.

Initial hypotheses generated (in any category) are ‘tested’ against further information obtained, which may also elicit consideration of a new, previously unconsidered hypothesis. Hypothesis generation and testing occurs through routine questions and physical assessments but may also be hypothesis driven as with the question asked or physical assessment performed with a specific hypothesis in mind (e.g. specific questioning regarding back versus hip postures and movements for a patient with groin pain; or clinical testing for instability in the patient with subjective features of instability). Clinical reasoning is therefore a dynamic, cyclic process that is ‘hypothesis-oriented’ (hypothesis generation, testing, reformulation) that leads to an evolving understanding of both the patient and the patient’s problem(s). Although the physical examination is not limited to hypotheses formulated in the subjective examination as with a checklist, existing hypotheses logically still inform physical testing and prioritizing which tests are most important at the first appointment. That is, a structured physical examination is important to screen all relevant systems (e.g. articular, neural, muscular, soft tissue, fitness, etc.), but not every physical test is necessary for every patient, and a clear rationale (as opposed to following a rigid routine without reasoning) is needed for all assessments. Physical examination findings, including patient perspectives elicited during the physical such as fear of pain and movement, are then synthesized with existing hypotheses resulting in an evolving understanding sufficient for initial decisions on management and treatment. It is this ability to think on your feet through the examination and ongoing management that leads to variations in subjective questioning (e.g. qualification of patient responses and aspects of stories explored further) and physical assessments. Explicit consideration of different categories of clinical judgment or hypotheses and the scope of information informing each may assist in minimizing the ‘What You See Is All There Is’ and associated biases ([Kahneman, 2011](#)) described at the start of this chapter.

Key Point

Understanding the scope of clinical judgments required across the different foci of clinical reasoning in a biopsychosocial framework assists comprehensive analysis of patient information obtained (e.g. answers to questions, physical findings, medical tests and treatment re-assessments). ‘Hypothesis categories’ proposed include activity capability/restriction, participation capability/restriction, patient’s perspectives on their experience and social influences, pain type, sources of nociception and associated pathology, physical impairments and associated body structures/tissues involved, contributing factors to the development and maintenance of the problem, precautions and contraindications to physical examination and treatment, management/treatment selection and progression, and prognosis. Clues to each category of judgment are available throughout the examination and ongoing treatment re-assessments. Hypotheses generated are ‘tested’ against further information obtained, providing support, no support or consideration of new hypotheses, with ongoing evolution of understanding.

Inferences Within the Different Hypothesis Categories: Deduction, Induction/Pattern Recognition and Inference to the Best Explanation (Abduction)

When established criteria exist for making decisions and those criteria are fulfilled within the patient assessment, the judgment or inference made can be considered a deduction based on the premises or criteria. In logic, a correct deduction is simply judged on whether the criteria have been met or not, regardless of whether the original criteria themselves are correct. Given that the criteria on which we base the majority of our clinical decisions have not been explicitly validated and should constantly be critiqued for their accuracy, it is best to keep these deductions as hypotheses rather than fixed conclusions, thereby encouraging openness to revision.

When judgments are made that generalize from limited information (i.e. without checking all criteria normally expected), this inference represents an induction as when a clinical pattern is quickly recognized on the basis of limited key features. Inductive pattern recognition is not limited to diagnostic pathology or syndrome categorization, as such generalizations are also common regarding psychosocial status, pain type, precautions/contraindications and prognosis. In fact, research in

medical education (e.g. [Boshuizen and Schmidt, 2008](#)) has demonstrated that experienced clinicians' pattern retention, and hence recognition, is more inclusive, incorporating enabling or predisposing factors, pathobiological and psychosocial processes and the resulting consequences or disability:

- Enabling conditions: conditions or constraints under which a disease or problem occurs, such as personal, social, medical, hereditary and environmental factors
- Fault: the pathobiological and psychosocial processes associated with any given disease or disability
- Consequences of the fault: signs and symptoms of the particular problem as well as its functional impact on the patient's life

Such patterns can exist generically (e.g. tendinopathy, spinal stenosis, etc.) but will also be recalled as specific cases of past patients that facilitate diagnoses with new patients ('instantiated scripts'; [Boshuizen and Schmidt, 2008](#)). Clearly, inductive pattern recognition relies on a good organization of biopsychosocial knowledge linked to clinical presentations. Although inductive reasoning or pattern recognition is common in experienced clinicians who typically possess a large repertoire of patterns to draw from ([Edwards et al., 2004a](#); [Edwards and Jones, 2007b](#); [Kaufman et al., 2008](#); [Marcum, 2012](#); [Norman, 2005](#); [Schwartz and Elstein, 2008](#)), like all 'fast thinking', it is prone to error and ideally should therefore be supported by slower, analytical deductive hypothesis testing, particularly in more complex presentations and by less experienced clinicians.

But how can we explain the theorizing, typically regarding causal mechanisms, we regularly engage in when confronted with unexpected or unfamiliar information that cannot be deduced from established or accepted prior knowledge? What occurs prior to criteria having been developed on which deductions and later inductions are made? Inference to the best explanation (also called abduction) is a creative explanation used when clear deductions are not available ([Lipton, 2004](#)). Clinically, this is required when trying to account for what may initially present as disparate, unclear information or situations. It is essentially an unproven explanatory hypothesis that best explains the evidence, much like the detective who must entertain the best explanation that could account for a crime. Although inference to the best explanation may emerge through slow analytical reflection of competing explanations, it can also come as an unexpected flash of insight ([Råholm, 2010](#)). This real and frequently used form of inference used without further critique (clinical as well as research) is fraught with error and likely to only result in self-confirming beliefs (analogous to Kahneman's 'associative coherence' System 1 bias). Bias can be minimized through critique – both your own, through critical application of personal theory to other patients, and from the profession, through discussion, debate and research. However, the creative insight of seeing patterns (explanations) in previously unlinked information through inference to the best explanation is an inevitable and necessary first stage to understanding unfamiliar phenomena and to generate new ideas.

Key Point

Generating, testing and accepting hypothesis judgments in clinical reasoning within established medical and musculoskeletal specific knowledge frameworks involves a combination of deductive inference as to whether established criteria for the judgment have been met and inductive inference to recognize clinical patterns on the basis of limited information. Clinical patterns exist and can be learned for pathology/syndrome, pain type, precautions/contraindications and prognosis. Experienced clinicians possess a large repertoire of patterns to draw from that include both generic patterns typical across patients and 'instantiated' patterns, or recall of the key features, or stories, about individual patients they have seen and learned from. When confronted with unexpected and unfamiliar information, where established criteria for deductive and inductive inferences don't apply, clinicians theorize about the 'best explanation' through abductive inference. Inference to the best explanation, typically about causal mechanisms, is important to the discovery of new ideas. However, to avoid the human bias of simply following self-confirming beliefs, it is important to subject personal theories of explanation to critique – both your own, through critical application to other patients, and from the profession, through discussion, debate and research.

Thinking on Your Feet: Interpreting Information Across Different Hypothesis Categories

Patient information will inform several hypothesis categories at the same time. Just as the clinician may be asking a pathology-/impairment-oriented question but receive a patient answer that sheds light on the patient's perspectives (i.e. psychosocial status), a question directed at understanding the patient's activity capability and restrictions will often provide clues to other hypothesis categories at the same time. Consider, for example, a 72-year-old patient's response to a question regarding what aggravates his back and bilateral leg pains:

Walking, I'm afraid to even try anymore. Even short 5- to 10-minute walks make the back and legs worse, and then I have to sit down to ease it off. Sitting is good but I can't sit all day! I can't even help out around the house anymore or get over to see the grandchildren. I'm really worried it might be something serious.

This one answer provides information regarding multiple hypothesis categories:

- Activity restriction: walking
- Activity capability: sitting
- Participation restrictions: helping around house and seeing grandchildren
- Patient Perspectives: afraid to try walking, worried it may be serious
- Pain type: behaviour of symptoms clues to nociceptive and/or neuropathic pains
- Sources of nociception and associated pathology: back and leg symptoms related; lumbar joints and nerve roots implicated; consistent with spinal stenosis clinical pattern (age and behaviour of symptoms)
- Contributing factors: age
- Precautions: age, easily aggravated, bilateral leg pain, patient's fears/worry
- Prognosis: (-'s) age, disability, extent of symptoms, neurogenic, perspectives; (+'s) easing factor

Having a clear framework of the categories of judgments needed to understand patients and their problems for the purpose of guiding management enables clinicians to pick up cues beyond the intent of their question or physical assessment and relate judgments in one area to others. In the end, the clinician gains clues to the different hypothesis categories throughout the whole examination and ongoing management that must be interpreted, weighed for significance and analyzed with other supporting and negating information. The hypothesis categories also provide a biopsychosocially oriented organizing framework to link academic knowledge to clinical reasoning through the patient examination-treatment-re-assessment process, facilitating the learning of clinical patterns.

Key Point

Awareness of the different categories of judgments needed to understand patients and their problems for the purpose of guiding management, such as the proposed hypothesis categories framework, enables clinicians to be alert to patient information forthcoming that was beyond the intent of their question or physical assessment. Although clinicians will follow their own structured patient examination, it is important that information obtained from both the subjective and physical examination is interpreted and synthesized as it unfolds. Generally, most patient information obtained will have relevance to more than one hypothesis category, and decisions eventually made should be linked to the cumulative information (often incorporating both supporting and non-supporting information to a decision) synthesized over the full examination (and later re-assessment of treatment interventions).

Factors Influencing Clinical Reasoning

Understanding the cognitive processes used in clinical reasoning (including abductive inference to the best explanation theorizing; fast System 1 first impressions, inductions or

pattern recognition; and slow System 2 deliberations, testing of hypotheses and deductions) assists critique and focused practice to improve reasoning. Although it is tempting to reduce clinical reasoning to these cognitive processes, this fails to recognize other dimensions that are also parts of the gestalt or whole of clinical reasoning. Simply understanding the cognitive processes will not ensure skilled reasoning. Numerous factors influence proficiency in clinical reasoning, including associated attributes of critical thinking, higher-order metacognition, knowledge organization, data-collection and procedural skills, and patient–therapist therapeutic alliance – incorporating communication effectiveness, emotional intelligence and skills in ‘interactive’, ‘collaborative’ and ‘ethical’ reasoning.

Critical Thinking

Although generic thinking skills are themselves insufficient for expertise in clinical practice (Boshuizen and Schmidt, 2008; Elstein et al., 1978), skilled clinical reasoning incorporates the fundamentals of critical thinking. Critical thinking generally involves analyzing and assessing information, issues, situations, problems, perspectives and thinking processes (Paul and Elder, 2007). It underpins the different forms of inference. Rather than unquestionably accepting information, critical thinking fosters a sort of healthy scepticism that appraises information for its accuracy, completeness and relevance to facilitate understanding and identification of solutions. Inherent in critical thinking is reflection and awareness of the assumptions under which we, and others, think and act (Brookfield, 2008). Assumptions are taken-for-granted beliefs acquired through life and through formal education that are often tacit and hence typically not considered or challenged. Uncritically accepted assumptions often emerge from professional philosophies or approaches to practice or from personal experiences that have shaped one’s views. Without scrutiny, such assumptions place us at risk of reasoning on the basis of inaccurate and biased ‘knowledge’ (i.e. unsubstantiated views and popular opinions), making us vulnerable to misinterpretations, inaccurate judgments and, ultimately, less effective health care. Unjustified assumptions in clinical practice can be minimized through a range of safeguards, including the following:

- Qualifying patients’ meaning
- Screening to ensure information is not missed
- Testing for competing hypotheses
- Attending to ‘negatives’ or features of a presentation that do not fit favoured hypotheses and explanations
- Openly subjecting and comparing your own reasoning to that of others

Examples of screening topics that optimize thoroughness and avoid clinical assumption include the following:

- Screening for additional symptoms not spontaneously volunteered (e.g. other body areas, vascular, neuropathic, psychological, etc.)
- Screening for additional activity and participation restrictions and capabilities not volunteered
- Screening for psychosocial factors and their relationship to the clinical presentation
- Screening for general health comorbidities and red flags

Metacognition

Metacognition is a form of self-awareness that incorporates monitoring of yourself (e.g. your thinking, your knowledge, your performance) as though you are outside yourself observing and critiquing your practice. There is an integral link between cognition, metacognition and knowledge acquisition that facilitates learning from clinical practice experience (Higgs et al., 2008a; Marcum, 2012; Schön, 1987). This self-awareness is not limited to the formal hypotheses considered and treatments selected; metacognitive awareness of performance is also important. This, for example, underpins the experienced clinician’s immediate recognition that a particular phrasing of a question or explanation was not clear. Similarly, metacognitive awareness of the effectiveness of a physical procedure enables immediate recognition that the procedure needs to be adjusted or perhaps should be

abandoned as, for example, when cues such as an increase in muscle tone or the patient's expression signal the procedure was not achieving its desired effect. Lastly, metacognition is important to recognizing limitations in knowledge. The student or clinician who lacks awareness of his or her own knowledge limitations will learn less. Experts not only know a lot in their area of practice, they also know what they don't know. That is, experts are typically very quick to recognize a limitation in their knowledge (e.g. a patient's medication they are unfamiliar with, a medical condition, a peripheral nerve sensory and motor distribution) and act on it by consulting a colleague or appropriate resource.

Knowledge Organization

Well-structured knowledge is essential to domain competence (Glaser and Bassok, 1989; Ruiz-Primo et al., 2001). Research studies in cognitive psychology and artificial intelligence (e.g. Greeno and Simon, 1986), categorization (e.g. Hayes and Adams, 2000), expertise (e.g. Boshuizen and Schmidt, 2008; Jensen et al., 2007) and education (e.g. Pearsall et al., 1997) have collectively demonstrated the importance of well-developed knowledge to successful performance. Well-structured knowledge is not simply how much an individual knows but how that knowledge is organized, including the differentiation and relationships between core concepts. All forms of knowledge are important, including clinicians' broader worldview, their philosophy of practice and their medical and profession-specific knowledge. Knowledge emerges from what we believe or hold to be true (Higgs et al., 2008b). Clinicians utilize a combination of propositional knowledge ('knowing that') generated formally through research and scholarship and non-propositional knowledge ('knowing how') generated primarily through practice experience. Non-propositional knowledge can be divided further into professional craft knowledge and personal knowledge. Craft knowledge comprises professional knowledge such as procedural, communication and teaching knowledge and skills, based on academic propositional knowledge (e.g. anatomy, biomechanics, neurophysiology, learning theory, psychology, sociology, etc.) that has been refined and contextualized through clinical experience. Personal knowledge includes that knowledge acquired through personal life experiences (including community and cultural) that contributes to shaping a person's beliefs, values and attitudes. Clinicians who are alert to both community and their own attitudes (i.e. personal knowledge) regarding, for example, different population subgroups (e.g. ethnic, workers compensation, substance abuse) are better able to safeguard against their own assumptions, biases or prejudices leading to premature or incorrect judgments. Understanding and successfully managing patients' problems requires a rich organization of all three types of knowledge. Propositional knowledge provides us with theory and research substantiation on which to base our practice, whereas non-propositional professional craft knowledge provides us with the means to use that theory and research evidence in the clinic.

Data-Collection and Procedural Skills

Given clinical reasoning is based on information obtained from and about the patient, the accuracy and effectiveness of our clinical judgments is influenced by the quality of information (e.g. patient interview, physical examination, outcome re-assessments) on which those judgments are based. Within the patient interview clarification for meaning is essential to enhance accuracy, completeness and relevance of information obtained.

There are many situations where the patient makes a general statement that requires clarification to accurately understand the meaning. Examples include such things as constancy of symptoms (where clarification of 'constant' reveals daily symptoms but not every moment of the day), area of symptoms (where, for example, the patient's perception of the 'shoulder' is clarified to actually be the supraspinous fossa) and aggravating factors (where, for example, 'walking' requires clarification regarding what aspect of the walking is a problem – time, speed, distance, surface, phase of gait, etc.). Screening questions such as other symptoms, aggravating or easing factors and general health represent clarification for completeness. Clarification of meaning to establish relevance is always needed to establish relationships between symptoms and predisposing and aggravating factors established through the history

and behaviour of symptoms. This is particularly important to judgments regarding patient perspectives and social factors (psychosocial status). Clarifying relationships between beliefs, cognitions, emotions, perceived and actual support, and behaviours to the history and behaviour of the patient's symptoms assists recognition of unhelpful beliefs and stressors that are contributing to one patient's pain and disability experience versus co-existing but not adversely affecting another's. The importance of clarification for meaning and relevance is also evident with questions regarding a patient's understanding of his or her problem that often only elicit superficial accounts of what the patient's doctor or others have told the patient but not necessarily what it means to the patient with respect to the cause, management and the future. Because patient perspectives cannot be judged on face value as normal versus abnormal (or maladaptive) in the same way physical health (e.g. blood pressure, range of movement, strength) can be judged, it is essential that perspectives are clarified and explored further. For example, the persistent pain patient who volunteers praying as a coping strategy may be erroneously judged to be passively relying on others and lacking in motivation to take an active role. If that statement is clarified and explored further, there will be some patients for whom praying functions as a motivating source of support and conviction to do all they can to help themselves, further highlighting the need for continual clarification.

The quality of physical assessment data (as influenced by procedural skills) to clinical reasoning judgments is equally important. Errors in subjective assessments of physical tests (e.g. posture, range of active and passive movement, kinematics, judgments regarding stiffness, laxity/instability, motor performance and soft tissue, etc.) underpin the importance of using reliable objective measures wherever possible and diagnostic procedures with the greatest validity. When objective measurement is not available, findings should be re-checked for consistency, related to other findings (e.g. passive accessory movement findings considered for congruence with physiological movement findings), and cautiously integrated with more objective findings for guiding reasoning judgments.

Patient–Clinician Therapeutic Alliance

The patient–clinician therapeutic alliance encompasses rapport, emotions (Marcum, 2013; Pinto et al., 2012), patient–clinician collaboration (Barr and Threlkeld, 2000; Edwards et al., 2004b, Pinto et al., 2012; Trede and Higgs, 2008) and ethical deliberations (Edwards and Delany, 2019).

Rapport

The manner in which an examination and therapy is provided with respect to patient rapport and the level of clinician interest, empathy and confidence conveyed influences patients' information volunteered, motivation for change, willingness to participate in self-management and their outcomes in general (Ferreira et al., 2013; Hall et al., 2010; Klaber Moffett and Richardson, 1997). Despite specific questions and sequence of questions asked varying according to education and personal experience, the aim should be the same, that is, to understand the patient's problems and his or her individual pain/disability experience in order to inform effective, collaborative management. Although the patient interview and examination are largely about gaining information to understand the patient and his or her problems, the nature and manner (e.g. tone, non-verbal behaviours, time allowed) of the clinician's questions, instructions and responses to patient questions and answers will influence the interest the patient perceives the clinician has in him or her, the confidence the patient has in the clinician and the success of the therapeutic relationship in general (Ferreira et al., 2013; Hall et al., 2010; Klaber Moffett and Richardson, 1997). That is, our questions and responses (verbal and non-verbal) are interpreted by patients as conveying our thoughts. Many patients report negative experiences with medical and other health professionals who they felt didn't listen or believe them (e.g. Johnson, 1993; Matthias et al., 2014; Payton et al., 1998). Without good rapport, the patient is less likely to collaborate in providing the necessary information or in the management, potentially compromising clinical reasoning and jeopardizing the eventual outcome.

Emotions

Perceptual judgments are influenced by emotions (Kahneman, 2011; Langridge, Roberts and Pope, 2016; Lehrer, 2009; Marcum, 2013). One only needs to recall the negative emotions elicited from an unpleasant encounter with a patient, or perhaps a patient you felt showed no interest in getting better, to reflect on whether emotions influence your own reasoning. The ability to accurately perceive, appraise and express emotions and to recognize emotion-elicited thoughts and judgments has been characterized as 'emotional intelligence' influencing clinical reasoning (Marcum, 2013). This metacognitive awareness and strategies for optimizing communication in difficult patient–clinician interactions are important to minimizing the adverse effects of emotions on clinical reasoning (Langridge, Roberts and Pope, 2016). For example, interactive reasoning, defined earlier as reasoning associated with purposeful establishment and management of rapport, underpins many successful communicators' abilities to effectively interact with difficult patients. Although no single communication strategy works for every circumstance, finding and fostering common ground (e.g. sports, movies, children, etc.) will often facilitate rapport. Better rapport generally leads to better provision of information and better collaboration. Better rapport may also enhance patient understanding of education and advice offered as 'the insecure and threatened self appears to disable understanding' (Osborn, 2014, p. 753).

Perception and Empathy

Clinical reasoning is largely grounded in human perception (tacit and conscious) that precedes inferential judgments. As such, perception could be considered to initiate clinical reasoning as with recognizing and responding to perceived cues in patients' answers and physical presentations. Such perceptions are influenced by prior knowledge and philosophy of practice biasing what is attended to. Strategies such as screening questions, explained earlier, or looking at posture and movement from different perspectives can minimize the error of only perceiving (hearing, seeing, feeling) what you are looking for. A unique form of perception (that can also be associated with emotion) important to understanding the person behind the problem (i.e. their pain experience), and also integral to developing rapport and therapeutic alliance, is empathy. Empathy in a clinical context refers to clinicians' cognitive abilities to understand what their patients are experiencing and clinicians' affective abilities to imaginatively project themselves into their patients' situations (Braude, 2012). Having and conveying empathy probably constitute a personal skill acquired through life, but when applied in practice, patients are more likely to feel they have been given a voice, have been heard and have been believed, all of which strengthen the therapeutic alliance.

Patient–Clinician Collaboration

The importance of 'collaborative reasoning' as a reasoning strategy is underscored by the evidence that patients who have been given an opportunity to share in the decision-making take greater responsibility for their own management, are more satisfied with their health care and have a greater likelihood of achieving better outcomes (Arnetz et al., 2004; Edwards et al., 2004b, Trede and Higgs, 2008). Rather than promoting passive patient compliance, patient-centred health care promotes motivation for change and active patient participation in decision-making requiring collaboration in assessment, goal-setting and management. Patient self-efficacy to contribute to change, learning (i.e. altered understanding and improved health behaviour), and shared responsibility in management are primary outcomes sought in a collaborative reasoning approach. Specific strategies for involving patients in their health care, including when differences in opinion exist, and motivating patients to make changes are addressed by Edwards et al. (2004b), Trede and Higgs (2008) and Miller and Rollnick (2012).

Ethical Reasoning

On the surface 'ethical reasoning' as a strategy or focus of thinking and decision-making mostly brings to mind the formal codes of practice (i.e. ethics) each country's professional

associations have in place. Although the four principles that underpin traditional codes of practice (i.e. autonomy, non-maleficence, beneficence and justice; [Beauchamp and Childress, 2013](#)) retain their importance, contemporary literature in ethics highlights the challenges of applying black-and-white principles in actual practice and argue for a broader perspective on ethics. Because ethics and ethical reasoning have historically not been prominent in professional education, it is not surprising many clinicians either lack the moral sensitivity to recognize ethical issues or lack the knowledge of ethics theory to critically apply ethical reasoning in practice. [Edwards and Delany \(2019\)](#) make the point that just as clinical educators should not accept students' diagnostic clinical reasoning based simply on personal inclination (without sound theory and research supported rationale linked to the patient's presentation), similarly, ethical reasoning, as required, for example, in understanding cultural influences on decisions made by patients regarding their health, needs to be based on ethics theory applied to the particulars of the patient's circumstances. Readers are referred to the work of Edwards ([Edwards and Delany \[2019\]](#) regarding ethical reasoning in clinical practice generally; [Edwards et al. \[2014\]](#) regarding ethical reasoning as it relates to chronic pain) for overviews of ethics theory and recommendations for applying that theory to practice.

Key Points

- Numerous factors influence proficiency in clinical reasoning, including associated attributes of critical thinking, higher-order metacognition, knowledge organization, data-collection and procedural skills, and patient–clinician therapeutic alliance – incorporating communication effectiveness, emotional intelligence and skills in 'interactive', 'collaborative' and 'ethical' reasoning.
- The critical thinking attribute of 'healthy scepticism' ensures information is scrutinized for its accuracy, completeness and relevance and assumptions within your own and others' perspectives are critically examined. Unjustified assumptions in clinical practice can be minimized through regular qualification of patient meaning, screening to ensure information is not missed, testing for competing hypotheses, attending to 'negatives' when judging hypotheses and openly subjecting and comparing your reasoning to that of others.
- Metacognition, or self-awareness of your own thinking, knowledge and performance, facilitates learning in clinical practice.
- Clinical reasoning is informed by a broad range of knowledge, including the propositional biological and psychosocial knowledge within health, personal know-how or craft knowledge of musculoskeletal practice, and self-knowledge of your own beliefs, values and attitudes.
- Clinical reasoning is only as good as the information (data) on which it is based, necessitating regular use of strategies to avoid assumptions such as clarification of patient meaning, screening questions, objective measurement where possible, and cautious use of subjective assessments.
- Clinician interest, empathy and confidence all contribute to developing rapport important to the therapeutic alliance and patient participation in therapy, including information provided and motivation for change. 'Emotional intelligence' to accurately perceive, appraise, and express emotions, while safeguarding your own emotions do not unfairly bias your clinical judgments, combined with 'interactive reasoning' skills to optimize rapport will indirectly contribute to better clinical reasoning.
- Patient–clinician collaboration in assessment, goal-setting and management facilitates patient responsibility in self-management (and consequently self-efficacy), patient satisfaction and better outcomes.
- Clinicians need to expand on their knowledge of the traditional principles of ethics underpinning formal codes of practice (i.e. autonomy, non-maleficence, beneficence, justice) to include greater understanding of ethics theory, greater recognition of ethical issues, and greater ability to critically apply ethical reasoning in practice.

Skilled Clinical Reasoning Contributes to Clinicians' Learning

Critical reflection is unanimously promoted as necessary throughout the critical thinking, clinical reasoning and education literature to perceive, critique, discuss and revise our research- and experience-based knowledge and actions (e.g. Brookfield, 1987; Clouder, 2000; Cranton, 2006; Higgs and Jones, 2008; Mezirow, 2000; Mezirow, 2012; Rodgers, 2002; Schön, 1983, 1987; Taylor and Cranton, 2012). Constructivist learning theory broadly recognizes learning as experiential and individual, involving the processes of reflection, experimentation and evaluation that ultimately result in personal change. Within this philosophy of learning, knowledge is constructed by the individual through the transformation of experience (e.g. Cranton, 2006; Mezirow, 2000; Taylor and Cranton, 2012). When clinical reasoning is supported by metacognitive awareness of knowledge (e.g. biomedical, psychosocial, professional, clinical beliefs and research evidence), clinical judgments and proficiency in management skills and is subjected to regular critical reflections, both clinical reasoning and learning through clinical reasoning are facilitated. Learning theory and strategies for facilitating clinical reasoning are discussed in detail in [Chapter 31](#). Although System 2 critical reflection provides a safeguard to our fast, intuitive, first impression System 1 thinking that will also lead to learning, it is not the only means by which new ideas, perspectives and professional directions are created.

Creative, Lateral Thinking

In his seminal text *The Structure of Scientific Revolutions*, Thomas Kuhn (1970) points out that many of the major breakthroughs in science did not occur due to carefully controlled scientific research; rather, they often emerged from accidents or the lone insight of an individual. If we only encourage logical thinking and practice within the realm of what is 'known' or substantiated by research evidence we limit the variability and creativity of thinking that is important to the generation of new ideas. Where logical thinking encourages making justified deductions, lateral thinking involves restructuring and escape from old patterns and looking at things in different ways (DeBono, 2014). The logical thinker attends only to what is obviously relevant, whereas the lateral thinker recognizes that sometimes seemingly irrelevant information assists in viewing the problem from a different perspective. Strategies for facilitating both logical and lateral thinking in clinical reasoning are reviewed in [Chapter 31](#).

Summary

Musculoskeletal clinicians need to be able to think fast and slow in clinical practice. Reasoning across the full spectrum of straightforward/common to more complex problem presentations requires a rich blend of biopsychosocial knowledge, professional know-how, and skilled diagnostic and non-diagnostic clinical reasoning. Understanding different foci of reasoning (i.e. diagnostic, narrative, procedural, interactive, collaborative, predictive, ethical, and teaching as reasoning) and key categories of clinical decisions required across these reasoning strategies (i.e. hypothesis categories) assists clinical reasoning in a biopsychosocial framework. Numerous factors influence how well clinicians reason in practice, including the cognitive processes they use (e.g. abductive inference to the best explanation theorizing; fast System 1 first impressions, inductions or pattern recognition; and slow System 2 deliberations, testing of hypotheses and deductions), their 'critical thinking', their higher-order metacognition, their knowledge and knowledge organization, their data-collection and procedural skills and their patient–therapist therapeutic alliance. As clinical reasoning skills improve, learning from clinical practice improves. Equipped with skills in deductive and inductive inference, critical thinking to minimize bias and abductive inference to contemplate new explanations, logical thinkers can and should also look at problems from different perspectives to discover new patterns and ideas through lateral thinking.

The clinical reasoning theory presented here provides the foundation for the clinical reasoning discussed in the other theory chapters and the Reasoning Questions and Commentary integrated throughout each of the 25 cases of the book. Improvement in clinical

reasoning requires practice in clinical reasoning, and to optimize that learning, the cases should not simply be read passively; rather, readers should attempt to answer Reasoning Questions posed prior to reading the case Answers, and then compare and critique their reasoning with the reasoning put forward through the case.

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2

Understanding Pain in Order to Treat Patients in Pain

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Pain is not the only reason people seek the care of musculoskeletal practitioners, but it is clearly one of the most common symptoms patients report. Pain-associated musculoskeletal conditions are the leading cause of global disability and, despite advances in knowledge and an exponential increase in healthcare costs, the problem only appears to be worsening (Vos et al., 2012). Given the prevalence of pain in the community, it is remarkable that pain is rarely the focus of medical and allied health graduate programs (Briggs et al., 2011, 2013; Jones and Hush, 2011).

Understanding pain, and the factors that contribute to it, is an important first step toward effectively treating and managing patients with pain. Knowledge of pain theory and biology enables clinicians to better understand and explain the full spectrum of pain presentations they encounter, from simple to complex (Moseley, 2003). It affords them an ability to reason through the potential contributors to a patient's pain, informing hypotheses regarding diagnosis, management and prognosis (see Chapter 1 for a full discussion of the hypothesis category clinical reasoning framework) (Jones et al., 2002). Importantly, an understanding of pain ensures all of the hypothesized contributors to pain are appropriately managed or addressed.

In this chapter, we review the complexity of pain from a theoretical perspective and briefly describe the biological and pathobiological processes associated with it. We introduce pain type as an important hypothesis category and attempt to link the clinical signs and symptoms observed in patients with pain to the mechanisms that may underpin them. In conclusion, we consider how reasoning about the contributors to pain can potentially improve patient outcomes.

Understanding Pain

With rare exception, we have all experienced pain, and these experiences influence our understanding of pain. That a small scratch generally hurts less than a deep graze and that pain seemingly lessens as an injury heals imply that the degree of pain we feel relates directly to the extent of an injury. Pain is thus usually interpreted as a symptom indicative of damage to the body. If pain persists, the intuitive explanation is that the injury or disease process that initiated it has failed to resolve.

Unfortunately, the training many clinicians receive reinforces intuitive understandings of pain. Pathoanatomical models of pain that depict pain as a marker of tissue damage remain influential. Most undergraduate textbooks inadvertently portray pain as an inevitable consequence of the activation of a specialized three-neurone 'pain pathway' – pain is considered a symptom of pathology that resolves only after an injury has healed (Martini, 2006; Snell, 2010). Rarely is it acknowledged that such depictions are not fact but trivializations that reflect the ideas of antiquated pain theories that do not stand up to scrutiny (Gatchel et al., 2007; Moayed and Davis, 2013).

Misunderstandings regarding pain are unhelpful for patients and clinicians alike. Patients who view pain as a marker of the state of the tissues may be reluctant to participate in treatment and activities of daily life (George et al., 2006; Pincus et al., 2002). In acute pain presentations, these patients may rely on passive treatment strategies alone and not see a need to address predisposing and contributing factors that are relevant to both

immediate outcome and minimization of recurrence. In persistent pain presentations, these patients may adopt maladaptive pain-escape coping strategies such as rest or altering the way they move or position themselves in an attempt to protect the painful body part (Darlow et al., 2015; Waddell, 1998) (see Chapter 3 for further discussion of stress and coping theory). They may seek passive treatment strategies that provide only temporary relief, perhaps trying one therapy after another in the search for relief or an explanation for their pain that makes sense (Watson, 2013). Clinicians who view pain as a symptom of pathology will approach the management of people in pain from a purely biomedical perspective – one that focuses solely on the tissues. They may misinform patients about the meaning and source of their symptoms or unintentionally reinforce negative attitudes toward pain in their patients (Bishop et al., 2008; Coudeyre et al., 2006; Darlow et al., 2013). In cases of persistent pain, some clinicians might rely only on passive treatments that offer temporary pain relief but do not address contributing factors. Failure to understand the biopsychosocial nature of all pain may result in some clinicians stigmatizing patients with persistent pain, who do not respond to treatment based on a biomedical model, as having ‘psychogenic pain’ or being malingerers – adding to the suffering of these patients rather than relieving it (Synnott et al., 2015).

There are compelling arguments as to why solely tissue-based understandings of pain must be rejected. Stories abound of people who sustained serious injuries but felt no pain – for example, soldiers who report horrific yet painless injuries in the midst of battle, shark-attack victims who report painless amputations and sportspeople who play on through injury without pain (Butler and Moseley, 2013; Melzack and Wall, 1996). Everyday experiences such as those scratches or bruises we notice on our bodies but are unable to recall when they occurred attest to this too. Such examples demonstrate that injury, and the sensory information it generates, can occur independent of pain. Conversely, the accounts of phantom limb pain highlight that pain can be felt in the clear absence of pathology and sensory information (Melzack, 1999; Ramachandran and Blakeslee, 1999).

The relationship between pain and pathology is also unclear. One in two people with moderate to severe radiographic osteoarthritic changes in their knees is asymptomatic, whereas 1 in 10 people with severe knee pain will have no evidence of radiographic arthritis (Bedson and Croft, 2008). A similar discordance is noted in spinal pain, where imaging findings of degeneration are highly prevalent in asymptomatic people and appear to be a normal part of aging (Brinjikji et al., 2015). The same holds true for neuropathies. In a large-scale study of patients with diabetes, only 60% of those with severe neuropathy reported pain (Abbott et al., 2011). Indeed, it has been stated that no study to date, for any pain-related condition, has demonstrated a direct relationship between pathology and pain (Clauw, 2015). That is, neither the presence or absence of pain nor the intensity of pain can be accurately predicted by the presence or absence of pathology.

Every pain, whether associated with significant injury or a momentary feeling that facilitates protection, is dependent on meaning and context. Experiments that manipulate the meaning of a noxious stimuli or the mood of the participants receiving the stimulus directly influence the intensity of pain (Arntz et al., 1994; Butler and Moseley, 2013; Moseley and Arntz, 2007). Clinically, the severity of pain has been shown to vary depending on the perceived cause. Soldiers injured in battle report less pain and require less analgesia than civilians undergoing procedures of comparable impact (Melzack and Wall, 1996), and mastectomy patients who attribute pain to returning cancer report higher levels of pain than those who do not (Smith et al., 1998). These examples seemingly suggest that the meaning of pain, survival versus a potentially life-changing event in the first instance and expectations of mortality in the second, influence how much pain is experienced. A growing clinical literature demonstrates that both pain intensity and duration are associated with mood factors, catastrophization, fear and poor expectation of recovery (Chapman and Vierck, 2017; Edwards et al., 2016).

Rather than an accurate marker of tissue pathology, pain is an unpleasant feeling (Moseley and Butler, 2017) that has both sensory and emotive aspects that cannot be extricated (Merskey and Bogduk, 1994). Pain is influenced by factors from the biological, psychological and social domains (Gatchel et al., 2007) and urges the protection (whether it is needed or not) of the body part in which it is felt. In the next section, we consider how the brain theoretically determines the need for protection and how it constructs a pain experience.

We also briefly describe some of the key mechanisms that underpin pain, extrapolating from the basic and clinical sciences.

Key Point

Pain is not an accurate marker of the presence or extent of tissue injury. Patients who view it as such may be reluctant to participate in treatment and activities of daily life. Clinicians who view it as such will approach the management of people in pain from a purely biomedical perspective.

The Biology of Pain – A Brief Primer

Pain Is a Feeling

Pain is a feeling – it occurs in consciousness. It is an unpleasant feeling, and it has a location. These characteristics separate it from ‘senses’, which are engaged whether or not they are felt, and separate it from emotions, which conventionally refer to automatic bodily responses. Pain is perhaps best considered as a protective feeling, alongside other feelings such as hunger, thirst and dyspnoea – all unpleasant and all compelling triggers for whole-organism behaviour. When we consider ‘pain-related mechanisms’, we must consider mechanisms by which feelings emerge into consciousness – arguably ‘the difficult problem’ of life science; we must consider the detection of potentially dangerous tissue events; we must consider everything that occurs in between.

Despite a vast amount of thinking, humans have not yet discovered how consciousness emerges. There are metaphorical accounts, and there are frameworks and even guiding principles, but the notion of hardware – neural and immune cells in the brain – producing such things as feelings remains in the ‘magic’ category and may well remain there for some time to come. Although we do not know *how* feelings emerge, we do have some solid frameworks that can explain much of *when*, *why* and *to what extent* they emerge.

Neurotags

Contemporary theory regarding how the brain produces the wide array of outputs it does is captured to some extent by a model of the brain as a massive collection of neuroimmune networks, or representations, that are in a constant state of collaboration and competition. In modern pain parlance, these representations are often referred to as ‘neurotags’ (Butler and Moseley, 2013). Neurotags can be thought of as the pain-related mechanism most ‘proximal’ to pain – the last thing that happens. A full account of neurotags is beyond the scope of this chapter – the reader is referred elsewhere for this (see Moseley and Butler [2017]) – but understanding the main principles that govern the operation of neurotags will allow the reader to integrate the diverse range of factors, covered in theory Chapters 3 and 4 and the case study chapters through this book, that need to be considered when one analyzes why someone is hurting.

A neurotag can be labelled according to the output it generates. For example, a neurotag that results in a given movement command can be labelled as the neurotag for that movement command. A neurotag that results in back pain can be labelled ‘back pain neurotag’. The likelihood that back pain will occur at any given point in time can be considered according to the influence of the back pain neurotag. Factors that govern the influence of a neurotag include the efficacy of its synaptic (neuro-neural and neuro-immune) connections, the number of cells involved (its ‘mass’) and the precision of its connection. One can readily see that the longer one has back pain, the more efficacious its connections become (‘neuroplasticity’) and the greater its influence. Clinically, this would manifest as allodynia (pain due to a stimulus that does not normally provoke pain) and hyperalgesia (increased pain from a stimulus that normally provokes pain).

The truly biopsychosocial nature of pain is also captured by this neurotag model. Each neurotag is under the influence of a potentially infinite number of other neurotags. For example, a noxious event in the back may well lead to activation of a ‘back nociception’

neurotag, which is highly influential over the ‘back pain’ neurotag; if the patient believes he or she has a back that ‘goes out’, is ‘worn’ or is ‘degenerated’, then each of these beliefs will be held by neurotags. Each of these neurotags will exert some influence over the back pain neurotag. The magnitude of that influence will be determined by the synaptic efficacy, mass and precision of those neurotags.

This idea that neurotags compete and collaborate for influence offers sensible explanations for many observations that are not easily explained by previous models. For example, intriguing perceptual experiments such as those showing very cold stimuli feeling hot, and more painful, when they coincide with a red visual cue (Moseley and Arntz, 2007), more expensive wines tasting better (and activating brain reward circuits) and a raft of visual illusions are all consistent with competing influences of neurotags on other neurotags. Consider also that fear tends to trump pain: the fear neurotag and the back pain neurotag *compete* for priority; any cue that suggests the entire organism is in danger and needs to take protective action will increase the probability of activating the fear neurotag; any cue that suggests a particular body part should be protected will increase the probability of activating the pain neurotag. This makes ecological and evolutionary sense: given the option to protect one’s life, or protect one’s arm, for example, it would seem most beneficial to do the former. The interactions of diverse neurotags and the individual nature of neurotags, corresponding to patients’ unique biopsychosocial makeup, highlight the need for explicit and comprehensive assessment of biological, psychological and social factors (see Chapters 3 and 4 for further discussion of psychological and social factors).

Danger Detection Is Important

It is sensible, when thinking about pain-related mechanisms, to have a sound understanding of how danger is detected and transmitted to the brain. This capacity to detect, transmit and represent danger is called nociception. According to what we currently know about brain activity associated with nociception, nociceptive neurotags are large and have high synaptic efficacy, which means they will be highly influential over pain neurotags.

Nociception is well studied. The tissues of the body are by and large very well innervated by free nerve endings. These free nerve endings are primarily small-diameter and thinly myelinated (A δ) or unmyelinated (C) fibres, although some are wide-diameter myelinated (A β) fibres. Free nerve endings vary in many ways. For example, some have a low threshold, some high; some adapt quickly, some slowly; some have small receptive fields, and some have large ones. In a normal physiological state, it is the high-threshold free nerve endings that function most like nociceptors (or ‘danger detectors’) – they only respond to large and rapid changes in the tissue environment.

Free nerve endings terminate in the spinal cord, where they enter a complex matrix of neurones, interneurons and immune cells. Contemporary neurophysiological models of the grey matter of the spinal cord relate most closely to those of the brain. We can apply the neurotag idea here as well, conceptualizing the spinal cord as a long tube of brain-like neuroimmune networks, or neurotags, surrounded by the white matter ‘freeways’ via which messages travel quickly and without interruption to and from higher centres (Moseley and Butler, 2017). The output of spinal neurotags will be to either influence other spinal neurotags or activate projection neurones that terminate in the body (these are motor neurones, which emerge from the ventral horn of the spinal cord) or supraspinally (these are spinal nociceptors, which emerge from the dorsal horn and join the ascending ‘freeway’ to the thalamus). This complex matrix within the spinal cord offers a mechanism by which massive computational capacity can occur at a spinal level. Indeed, contemporary pain theory rejects the idea of the dorsal horn working as a relay station for nociceptive input, endorsing instead the idea of the dorsal horn working as a processing station that determines the spatial and temporal features of any further signals of danger that are transmitted to the brain.

Danger detectors have a wide variety of sensors in their walls – ion channels that respond to chemical, thermal or mechanical changes in the tissues or to a shift in the voltage across the cell membrane (Ringkamp et al., 2013) (for full review in accessible language, see Moseley and Butler [2017]). The response profile of a given danger detector will reflect the mix of ion channels in its membrane – some respond to small and innocuous changes in the

tissue environment (including one sub-class of nociceptors that responds to light, ‘sensual’ touch – coined ‘C-aress fibres’ [Abraira and Ginty, 2013; McGlone et al., 2014]); some have such high thresholds that they are effectively silent in the absence of inflammation.

Peripheral Sensitization, Primary Allodynia and Hyperalgesia

One remarkable characteristic of danger detectors is their response to inflammation. Injury triggers inflammation – the first stage of tissue repair. A range of sensors on danger detectors triggers a series of events that occur *inside* the neurone and render its chemical, thermal, mechanical and voltage-driven sensors more sensitive. The effect of this response is to sensitize the danger detectors and to ‘bring online’ those very high-threshold danger detectors that are normally silent. These adaptations in the stimulus–response profile of danger detectors is called peripheral sensitization.

The effect of peripheral sensitization on spinal nociception obeys the mass-based principle of neurotags: more spinal neurotags activated equates to more influence over spinal nociceptors. As such, the stimulus–response advantage mediated at the tissue level by inflammation is replicated in the spinal cord. All things being equal (which they never really are), the clinical result will be a reduced pain threshold (allodynia) and an increased response to a given noxious stimulus (hyperalgesia). Peripheral sensitization will follow the inflammatory state of the tissues, and as such, nociceptive sensitivity is closely tied to immune activity. A full review is well beyond the scope of this chapter, but suffice it here to suggest that under normal conditions, inflammation will begin to recede within a week of injury, a process that usually triggers the resolution of sensitivity.

Spinal Sensitization, Secondary Allodynia and Hyperalgesia

Activation of spinal neurotags triggers learning within the dorsal horn. According to the synaptic efficacy principle of neurotags, this learning, or enhanced synaptic efficacy, increases the influence of spinal neurotags and therefore further enhances the stimulus–response adaptations. The mechanisms by which this learning occurs include transient shifts in baseline voltage across post-synaptic membranes, increased production of post-synaptic receptors and a shift in the immune-mediated ‘set point’ of the synapse. This process was for some time referred to as central sensitization (as distinct from peripheral sensitization) but is probably better labelled ‘spinal sensitization’. It produces a shift in stimulus–response profiles and increased receptive fields of spinal nociceptors, which manifests clinically as reduced pain thresholds to mechanical input (‘secondary allodynia’) and increased response to a given noxious stimulus (‘secondary hyperalgesia’). These effects can be so profound that the spinal neurotags associated with tactile input can gain access to spinal nociceptive neurotags. Clinically, this can manifest as pain on light touch, a cardinal sign of neural disease or injury (neuropathic pain).

Descending Modulation of Nociception

The nociceptive system is a two-way system. Spinal neurotags are under a wide range of descending modulatory inputs. Projection neurones from midbrain nuclei (most famously the periaqueductal gray, or PAG), terminate in the grey matter of the spinal cord. These descending projections can exert facilitatory influences or inhibitory influences, categorized as ‘descending facilitation’ or ‘descending inhibition’. Midbrain nuclei receive projections from many different brain areas, providing the hardware for potent and diverse brain-driven modulation of spinal nociception. This capacity brings the truly biopsychosocial nature of pain and protection into relevance for any painful episode, acute or longstanding, because of the clear capacity for any cue from across the biological, psychological and social domains to influence activity and learning in the spinal cord.

Whereas the function of the nociceptive system is affected by activity, inflammation and modulatory influences, the integrity of the nociceptive system can be affected by

damage or disease of the hardware – the peripheral nerves, dorsal root ganglia, nerve roots or central nervous system components. Disruption of the capacity of wide-diameter neurones to transmit messages will compromise sensibility or strength – so-called negative signs. Perhaps counterintuitively, disruption of free nerve endings, or spinal nociceptors, to transmit messages can result in more sensitivity, not less – so-called positive signs (Nee and Butler, 2006). Peripheral mechanisms include problems with the cell wall, resulting in abnormal impulse generating sites (AIGSs), which are usually mechanically sensitive such that mechanical stimulation triggers a discharge that outlasts the stimulus itself by up to 2 minutes. Even for very slowly adapting free nerve endings, this time frame is very abnormal. Such a disruption can result in pain of a similar time profile. AIGSs can also result in spontaneous firing, which will enhance synaptic efficacy upstream, thereby replicating the spinal sensitization effects described earlier. Disruption of free nerve endings, or central nociceptive neurotags, can also result from disease, for example, diabetic neuropathy or multiple sclerosis; severe trauma, for example, gunshot-related wounds or amputation; excessive sustained or repetitive mechanical loading, for example, compartment syndrome; and chemical irritation or blood flow compromise, for example, nerve root irritation or tumour.

Central Sensitization – Tertiary Allodynia and Hyperalgesia

The mechanisms by which spinal neurotags become more influential – learning (synaptic efficacy principle) and collaboration (mass principle) – also apply to cortical neurotags. However, when the cortical neurotags that represent nociception undergo these changes, the effects are, predictably, more widespread. Moreover, when the neurotags that produce protective outputs (including pain but also protective motor, endocrine, descending modulatory, autonomic and immune responses) undergo these changes, the effects now increase the influence of any cues related to protection. Considering the biopsychosocial nature of pain, sensitivity in these protective neurotags will result in reduced pain thresholds for any combination of cues from across biological, psychological and social (importantly capturing context here) domains and increased pain for a given combination of those cues. The manifestation of these changes can be conceptualized as tertiary allodynia (reduced pain thresholds) and tertiary hyperalgesia (increased pain in normally painful situations).

There are other changes that occur in spinal and cortical function when pain persists. These changes are well studied from a clinical and behavioural perspective and from a brain-imaging and neurophysiology perspective. Several groups are working to integrate these two fields. Many of the more ‘bizarre’ presentations of people with persistent pain, for example, the feeling of swelling when none exists or the feeling that one no longer ‘owns’ a painful body part, can be explained by those changes in function. One model that seeks to make sense of that wider body of literature is the cortical body matrix, and the reader is referred elsewhere for more information pertaining to that subject (Moseley et al., 2012).

Key Point

Pain is a feeling; it is unpleasant, localizable in the body and serves to protect when protection is needed. Pain is one of several protective responses (motor, endocrine, descending modulatory, autonomic and immune responses) that are initiated when the ‘best guess’ computation concludes that body tissue is in danger; together, these responses normally ensure the optimal conditions for escaping injury or recovering after injury. In addition, the nervous system adapts in its ability to detect danger by becoming more sensitive, and this sensitization serves to increase the likelihood of pain. Sometimes, however, pain persists when protection is no longer required. Biological, psychological and contextual factors can each influence the persistence of pain and nervous system sensitization and lead to dysregulation of the other protective systems.

Classifying Pain

Pain is typically categorized in terms of where it is felt, how it is described (e.g. aching, burning) and how long it has persisted. *Acute* refers to pain of recent onset, whereas *chronic* refers to pain which has persisted past the normal time of healing (Bonica, 1953), which, in practice, may be less than 1 month or more than 6 months, depending on the extent of injury and the bodily tissues affected (Treede et al., 2015).

Pain is also categorized in terms of why it might occur, and this underpins the notion of *pain type* (Butler, 2000; Gifford, 1998; Jones et al., 2002). Pain type is an attempt to categorize pain by the mechanisms hypothesized to be contributing to it. These contributors are deduced from clinical findings and associated investigations. Although multiple mechanisms are inevitably present in every pain presentation, clinicians can make informed hypotheses regarding which contributors are dominant and likely to be driving a pain state. The reasoning process is informed by a comprehensive understanding of pain-related mechanisms and the symptoms and signs that are thought to infer their presence.

The types considered here are those most widely discussed in the literature – nociceptive, inflammatory, neuropathic, mixed, nociplastic and augmented pain. It has been acknowledged, however, that this list is not exhaustive, and other contributors, including autonomic, neuroendocrine and neuroimmune, may dominate some presentations (Smart et al., 2011). Nonetheless, the categories discussed in this chapter incorporate these other contributors in principle, thus accounting for the majority of clinical presentations. Here, we review the symptoms and signs associated with each type, referencing the biological mechanisms they likely infer.

Nociceptive Pain

Nociceptive pain refers to pain that is associated with actual or threatened damage to non-neural tissue and involves the activation of peripheral nociceptors (IASP Taxonomy, 2015). It is important to note that the term *nociceptive pain*, which is widely accepted in the literature, does not imply causation (i.e. nociception equals pain) because every pain experience involves cognitive, contextual and mood factors. Rather, it suggests that tissue-based nociceptive mechanisms are dominant contributors to the experience. Nociceptive pain is clearly advantageous because it facilitates protection. It may occur with excessive strain or a shift in chemical environment, without overt injury, for example, posture-associated nociception triggered by a local increase in lactic acid. In the event of injury, *inflammatory* (i.e. inflammation-related) *pain*, a subtype of nociceptive pain (Loeser and Treede, 2008), ensures behaviours that optimize recovery are adopted and usually resolves as injured tissues heal (Costigan et al., 2009). In some conditions, for example, osteoarthritis or rheumatoid arthritis, nociceptive pain may persist, although such cases are also associated with spinal and cortical sensitization (see following discussion of nociplastic pain). Notably, radiological findings do not constitute evidence of inflammatory pain.

Because nociceptive pain suggests a significant contribution of free nerve endings, it may be associated with evidence of pathology, such as the cardinal signs of inflammation or radiographic findings that are in accord with the clinical presentation and, where appropriate, the reported mechanism of injury (Costigan et al., 2009; Woolf, 2010). Pain severity in this pain type is reasoned to be ‘proportionate’ (but not equal) to the extent of the injury (Nijs et al., 2014; Smart et al., 2010), suggesting that psychological or contextual factors, although relevant, are not augmenting pain to any great degree. Nociceptive pain may be associated with some somatic referral but is generally localized to the area of injury. The presence of inflammation infers the development of both peripheral and spinal sensitization; hence, some localized allodynia and hyperalgesia around the injured region would be expected but ‘proportionate’ to the suspected pathology.

In keeping with the hypothesis of peripheral sensitization, it is reasonable to expect nociceptive pain presentations to have clear mechanical patterns of aggravation and easing factors and a recognizable mechanism of onset (history), for example, overt trauma or some form of overuse or excessive strain (Smart et al., 2010). Movement and palpation

tests that assess injured tissue should reliably elicit pain and reproduce the patient's symptoms. Nociceptive pain, when associated with acute injury, should resolve well within normal tissue healing times (Costigan et al., 2009).

Neuropathic Pain

Neuropathic pain refers to pain that is associated with a lesion or disease of the somatosensory nervous system (Treede et al., 2008). It can be further categorized by location depending on whether the lesion affects the peripheral or central nervous system (Merskey and Bogduk, 1994), but here we limit our discussion to peripheral neuropathic contributors. To be classified as neuropathic pain, clear evidence of a neuropathic lesion or disease is required (Jensen et al., 2011), and a grading system of certainty has been proposed (Finnerup et al., 2016). The requirement of evidence prevents painful conditions with proposed but undetectable neuropathic contributors, for example, small-fibre neuropathic contributors, from being included in this category (Jensen et al., 2011). It also excludes conditions characterized by signs of spinal or central sensitization in the absence of demonstrable neuropathic drivers. It is worth iterating here that neuropathy is not necessarily painful, and of those acute nerve injuries associated with pain, the majority resolve. As with nociceptive pain, neuropathic pain infers neuropathic mechanisms are the dominant, but not the only, contributors to the experience.

Although sophisticated neurophysiological techniques have been described, a thorough patient interview and physical examination is still considered most appropriate (Haanpää et al., 2011). A patient's mechanism of injury, past medical history or surgical history may infer neural tissues have been injured, mechanically compromised or diseased.

Neuropathic pain is generally localized to the distribution of the nerve thought to be affected (although spinal processing may lead to non-dermatomal variations [Schmid et al., 2013]) and may be accompanied by the other signs indicative of neuronal dysfunction, such as pins and needles, numbness and weakness. Indicative of AIGS formation, neuropathic pain may be described as burning, shooting, sharp, aching or like an electric shock (Smart et al., 2010). It may be triggered mechanically by movement or may be spontaneous in nature with a lingering aftersensation. Hence, neuropathic pain can be easily irritated. Provocation of pain with neurodynamic tests (e.g. straight leg raise) that physically load neural tissue or direct palpation of nerves in the area thought to be compromised (e.g. Tinnel's test) may reproduce patients' symptoms (Nee and Butler, 2006).

If neuropathic pain is hypothesized, a thorough neurological assessment should be included as part of the physical examination. Assessment of tactile sensation, pinprick, vibration, cold and warmth provides evidence of the positive and negative signs associated with neuropathy (Haanpää et al., 2011).

Several questionnaire-based screening tools have been devised to assist clinicians in screening for potential neuropathic contributors. Although alone they are considered inferior to clinical assessment, they can assist non-clinicians to differentiate between the likely dominance of nociceptive and neuropathic contributors. They also provide a measure of pain type along a continuum for reporting purposes and can be facilitated over the telephone or Internet if patients are treated from remote locations (Haanpää et al., 2011). Some recommended tools, including painDETECT (Freynhagen et al., 2006) and Douleur neuropathique (DN4) (Bouhassira et al., 2005), consist solely of self-report items, whereas others, such as the Leeds assessment of neuropathic symptoms and signs (LANSS) (Bennett, 2001), include both self-report items and physical assessment items.

Mixed Pain

Mixed pain refers to presentations that include evidence of both neuropathic and nociceptive contributors. Although every presentation includes multiple contributors, mixed pain as a category is reserved for those cases that have clear nociceptive and neuropathic

contributors that may be directly or indirectly related and require equal consideration in management.

Nociplastic Pain

How to define the type of pain that persists in the absence of overt tissue or nerve pathology is a contentious issue because it is a category based on inference rather than evidence (Hansson, 2014; Woolf, 2014). Several descriptors have been put forward, including maladaptive algopathic, nocipathic and central sensitization pain (Kosek et al., 2016; Nijs et al., 2014). What they share in common is reference to functional changes within the central nociceptive pathways, although, as noted previously, such changes are associated with nociceptive and neuropathic pain also. Here, we refer to this category of pain as nociplastic; a term endorsed by the IASP (International Association for the Study of Pain) Task Force on Taxonomy that captures the nociceptive plasticity (Kosek et al., 2016). Nociplastic pain is clearly dysfunctional as it serves no protective benefit to the people experiencing it.

Nociplastic pain is significantly disproportionate to any plausible tissue contributions, persists beyond expected tissue healing times and may be recurrent in nature. It is characterized by widespread allodynia and hyperalgesia that persist in the absence of overt neuropathic or tissue-based drivers. It is thus inferred that sensitization is maintained due to alterations in the descending modulatory pathways and dysregulation of the other protective systems. In the absence of reliable biomarkers, it is, however, a clinical category of exclusion (Vardeh et al., 2016).

Nociplastic pain is often associated with psychological distress (Smart et al., 2010); maladaptive beliefs; poor self-efficacy; disproportionate physical impairment; disrupted family, work and social life; and disturbed sleep (Edwards et al., 2016). These factors are both consequences of, and contributors to, pain. Conceptualized as neurotags, unhelpful beliefs, for example, may influence and contribute to the persistence of pain while facilitating sensitivity in spinal neurotags via the descending pathways. Psychological stressors or mood factors may activate protective systems, indirectly influencing peripheral and spinal sensitization. Conditions such as fibromyalgia, non-specific chronic back pain, complex regional pain syndrome (type 1) or irritable bowel syndrome are examples of this pain type (Clauw, 2015; Woolf, 2011).

Nociplastic pain may be disproportionately severe, diffuse in nature and vary in response physical or functional tests. Patients may have difficulty localizing their pain or may report it having a migratory nature. Pain may be reported in multiple body regions, and it may be reflected on the contralateral limb. Allodynia may be widespread and not follow a logical anatomical distribution (Smart et al., 2010). Patients may also report perceptual disturbances such as feelings of swelling or neglect-like symptoms (Bray and Moseley, 2011; Moseley et al., 2006; Stanton et al., 2012).

The Central Sensitization Inventory (CSI) has been developed to assist clinicians in screening for symptoms indicative of central sensitization (Mayer et al., 2012). It contains 25 items that assess pain- and health-related symptoms, providing a total score between 0 and 100. Scores greater than 40 have been shown to correctly differentiate patients with and without central sensitization-related syndromes (Neblett et al., 2013). An algorithm approach, incorporating the CSI, has been described to specifically identify those patients with nociplastic pain (Nijs et al., 2014). The approach prioritizes the exclusion of neuropathic contributors, then looks to differentiate nociplastic pain from nociceptive pain. Two criteria are considered key: pain disproportionate to the injury or pathology and pain that is diffusely distributed. The former is considered essential, whereas the presence of the latter either confirms the verdict or advises further interrogation via the CSI (Nijs et al., 2014) (see also case Chapter 25 where this algorithm is applied in the reasoning differentiation of pain type). Specific tools to detect the presence of pain-related perceptual disturbance have been developed and validated for some pain populations. The Fremantle Back Awareness Questionnaire (Wand et al., 2016) and Neurobehavioral Questionnaire for patients with complex regional pain syndrome (Galer and Jensen, 1999) are examples.

Augmented pain, a subtype of nociplastic pain, refers to nociceptive or neuropathic presentations whereby pain and pain-related behaviours are clearly disproportionate

to the contributions of peripheral drivers. As with nociplastic pain, augmented pain is associated with psychological distress and expectations of poor recovery. It is well documented that the likelihood of successful recovery diminishes the longer pain persists (Costa et al., 2009; Itz et al., 2013; Waddell, 1998). For this reason, we have chosen to differentiate augmented pain from nociplastic pain to highlight the need to identify acute patients who are at significant risk of chronicity. Augmented pain thus presents with clinical signs and symptoms indicative of tissue or neural pathology in conjunction with psychological, social and environmental risk factors, so-called yellow flags (see case [Chapter 14](#) for an example of a patient presentation hypothesized to represent augmented pain).

Yellow flags were developed as guidelines to assist clinicians in identifying risk factors in patients with low back pain (Kendall et al., 1997) and have since been adapted to other chronic pain conditions. They are categorized broadly under the following headings: beliefs (including appraisals and judgements), behaviours and emotional responses (Nicholas et al., 2011). Beliefs include, but are not limited to, patients' understanding of pain (Moseley and Butler, 2015), catastrophising (Sullivan et al., 2001), perceived control (Jensen et al., 2002; Nicholas et al., 2011) and expectations of recovery (Iles et al., 2008). Behaviours include avoidance activities (Leeuw et al., 2007) and passive coping strategies such as resting at times of pain, medication seeking and withdrawal from physical activity (Watson, 2013). Assessment and treatment require attention to the patient's understanding of his or her condition, including the patient's threat appraisal, and management of expectations. Ensuring patients understand conflicting or complex diagnoses and results of further investigations is essential, as is the avoidance or clarification of diagnostic jargon. As noted previously, many different emotions are expressed by patients in pain, the majority being negative. These include depression and anxiety, but also frustration and anger (Gatchel et al., 2007). Ensuring patients can express these emotions freely and that each is considered in the management plan is essential. Although they are unhelpful and potential barriers to recovery, yellow flags should be considered normal psychological reactions to musculoskeletal symptoms that can be amenable to change by trained members of the multidisciplinary team when identified early (Nicholas et al., 2011).

Other colours that have been introduced to the flag system include orange, blue and black. Orange flags distinguish psychological risk factors that are considered abnormal – psychiatric factors that meet the criteria for psychopathology and require specialist mental health referral (e.g. clinical depression, personality disorder) (Main, 2013; Nicholas et al., 2011). Blue and black flags that relate to the perception (e.g. perceived time pressures, lack of job satisfaction, employer support, stressful work environment) and the characteristics (e.g. rates of pay, working conditions) of the patient's workplace, respectively, should also be considered and addressed (Main and Spanswick, 2000).

Other risk factors worthy of note include high levels of pain, age and gender, where older persons and females are at higher risk. Also of note are social isolation, relationships (overly supportive and unsupportive), a primary language different from that of the country of residency, low levels of education and longer duration of pain or a greater period of reduced activity before consultation (Costa et al., 2009; Flor et al., 1987; Henschke et al., 2008; Nicholas et al., 2011; Romano et al., 1995; van Hecke et al., 2013) (also see discussion under Social Relationships and Health in [Chapter 3](#)).

Several screening tools have been devised to assist clinicians in identifying yellow flags associated with augmented or nociplastic pain presentations, and these have been discussed in more detail elsewhere (see the discussion of psychological factor screening by questionnaire in [Chapter 4](#) of this book). Noteworthy examples include the Orebro Musculoskeletal Pain Questionnaire (Linton and Halldén, 1998), the Pain Catastrophizing Scale (Sullivan et al., 1995), Pain Self-Efficacy Questionnaire (Nicholas, 2007), Neurophysiology of Pain Questionnaire (Moseley, 2003) and the Depression, Anxiety and Stress Scale (Lovibond and Lovibond, 1995), with each showing reasonable psychometric properties (Catley et al., 2013; Di Pietro et al., 2014; Parkitny et al., 2012; Walton et al., 2013; Westman et al., 2008).

If a nociplastic or augmented pain type is reasoned, a multifaceted and often multidisciplinary management approach that targets each hypothesized contributor is indicated. In augmented pain, reduction of pain intensity is a treatment priority. However, for nociplastic pain, the emphasis usually shifts toward function.

Key Points

Pain type refers to the categorization of pain in terms of the mechanisms hypothesized to be contributing to it. Categories include nociceptive, inflammatory, neuropathic, mixed, nociplastic and augmented pain. Because multiple mechanisms are present in every pain presentation, these descriptors do not infer cause but rather describe or qualify the dominant contributing mechanism. The contributing mechanisms are deduced from clinical findings and associated investigations.

Implications of Pain Type Categorization

Consideration of pain type encourages a biopsychosocial approach to patient care. It is informed by a comprehensive patient interview and physical examination. Understanding patients' symptom(s) presentation, their activity and participation capabilities and restrictions, their perspectives on their pain and disability experiences (see [Chapter 4](#) for suggested categories of information to screen regarding patients' perspectives) and their social circumstances (i.e. "narrative reasoning") provides a holistic overview that enables pain type to be hypothesized for further 'testing'/inference through the physical examination and ongoing re-assessments of intervention strategies.

Reasoning through the plausible contributors to pain informs diagnosis, prognosis and management. Note that in this text, diagnostic reasoning is not limited to the traditional medical categorization of pathology or disease. Instead, as discussed in [Chapter 1](#), musculoskeletal practice diagnosis encapsulates the clinician's analysis of the patient's functional limitation(s) and associated physical and movement impairments with consideration of pain type, tissue pathology and the broad scope of potential contributing factors. Contributing factors to the development and maintenance of the patient's problem(s) can be psychological, social, environmental, physical and hereditary. For example, in some conditions such as acute back pain, tissue contributions to pain may be unclear, but reasoning through the likely sources can inform clinical decisions regarding management and the advice provided to patients. Early identification of an augmented or nociplastic pain will ensure the treatment strategy is adapted appropriately to accommodate potential psychosocial barriers to recovery. It also informs prognosis, as patients with significant yellow flags will likely take longer to recover.

Consideration of pain type, however, must ensure red flags – signs suggestive of sinister pathology – are thoroughly investigated and not mistakenly attributed to nervous system sensitization ([Koes et al., 2010](#)). Around 50 red flags have been reported, and when considered in isolation, many have high false-positive rates ([Henschke et al., 2009](#); [Williams et al., 2013](#)). If acted upon uncritically, red flags could unnecessarily increase the cost of management and perhaps impede a patient's recovery; for example, there is a growing appreciation of the negative impact the overuse of imaging can have ([Brinjikji et al., 2015](#); [Darlow et al., 2017](#)). Nonetheless, the presence of some factors may indicate that immediate action should be taken (e.g. features of cauda equina syndrome), and a combination of red flags (e.g. trauma, age and sex) or the failed resolution of a flag (e.g. fever) may indicate the need for further investigations ([Henschke et al., 2009](#)).

Although pain type is an important consideration, there are several limitations of categorization that should be noted. First, pain type informs the reasoning process but is not a diagnosis. Any hypotheses regarding pain and therefore its management should be considered in the greater context of the patient presentation ([Rabey et al., 2015](#)) (see [Chapter 1](#) for discussion of pain type in the context of other hypothesis categories). Second, the mechanisms underpinning pain are complex and individual mechanisms, inferred by examination, are not necessarily unique to any particular pathological process ([Woolf and Mannion, 1999](#)). In a similar manner, pain contributors, especially those psychological and contextual contributors, vary continually on a moment-by-moment basis and may differ in influence over time, indicating that the reasoning process is a continuing one. Third, pain type categorization is dependent on the knowledge, expertise and experience of the clinician. Because the pain sciences are continually evolving as new knowledge surfaces, it is imperative

clinicians keep up-to-date with the literature and continue to develop their clinical skills. Fourth, pain type categories are yet to be comprehensively validated against 'gold-standard' neurophysiological techniques, such as quantitative sensory testing in any pain condition (Rabey et al., 2015). Rather, they are inferred by expert opinion on the basis of extrapolation of basic science evidence (Smart et al., 2010). Finally, clinical evidence to support the categorization of patients according to pain type to improve patient outcome is currently scant (Hensley and Courtney, 2014).

Conclusions

Pain is a feeling. It is influenced by a multitude of factors and is always about protection of the body. Understanding pain as a protective feeling rather than an accurate marker of tissue damage enhances clinician confidence when confronted with complex presentations, improves the therapeutic alliance between clinician and patient and facilitates a truly biopsychosocial patient-centred approach to management. Although the mechanisms underpinning pain are complex and not fully understood, informed clinicians are able to make hypotheses regarding the dominant contributors to pain through inference of the presenting signs and symptoms. Pain type, as a hypothesis category, reflects these dominant contributors whereby pain presentations can be broadly categorized as nociceptive, neuropathic and nociplastic. Although further research is needed to validate the profiling of patients and to determine whether categorization improves patient outcomes, when considered in the context of a reasoning framework, hypotheses regarding pain type inform decisions of diagnosis, management and prognosis and encourage a multifaceted and often multidisciplinary management approach, as recommended in most contemporary clinical guidelines.

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Influence of Stress, Coping and Social Factors on Pain and Disability in Musculoskeletal Practice

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Like individuals with any other health condition, individuals with either acute or chronic and recurring musculoskeletal conditions may need to adjust their behaviours and lifestyles while trying to maintain basic physical, social, vocational and recreational activities. To manage their musculoskeletal condition, individuals must try to understand the nature of their problem, create or learn self-care strategies for dealing with pain, manage and attempt to overcome functional problems and identify and utilize available support and resources wisely. [Chapter 4](#) reviews some of the psychological factors needed by individuals to influence positive treatment outcomes (e.g. self-efficacy) and reduce fears that may hinder outcomes. Individual coping characteristics are evidenced by the behaviours patients demonstrate in order to manage their condition. To date, the general musculoskeletal literature lacks a strong theoretical foundation for understanding health behaviours, particularly in comparison with research in other areas of chronic disease ([Painter et al., 2008](#); [Allegrante and Marks, 2003](#); [Taal et al., 1993](#); [Andersen, 2002](#); [Black and White, 2005](#); [Blank and Bellizzi, 2008](#)).

This chapter explores behavioural factors associated with the two main sources of stress in individuals with musculoskeletal disorders: pain and disability. The theoretical framework of this chapter is guided by the stress and coping model ([Lazarus and Folkman, 1984b](#)) and focuses on both individual-level and social-level factors that influence the experience of disability in patients with musculoskeletal conditions.

Theoretical Framework

A theoretical framework can help identify beliefs and behaviours used by patients who experience stressors and need to engage in coping in order to adjust to a musculoskeletal disorder. Two primary stressors have often been identified in the previous musculoskeletal literature: pain and disability. Differing experiences with a musculoskeletal disorder can result in different appraisals of the stressors of pain and disability by patients. Often individuals with similar musculoskeletal disorders have different outcomes related to the experience of pain and disability even with similar treatment approaches. We have many examples in practice of patients who may have similar musculoskeletal conditions and even may have similar testing results or scores on outcome measures, such as the Oswestry Disability Index or the Lower Extremity Functional Scale, yet one will do well with coping with the condition, and the other will be significantly limited in many life activities and participation. Prognostic factors may provide a predictive indication of which patients we may observe a positive outcome (regardless of treatment), whereas treatment effect moderators provide an indication of which patients will beneficially respond to specific treatments. Understanding psychosocial factors and coping behaviours may add additional insights into patient responses to treatments and potential for improved outcomes. In order to

understand the overall experiences of pain and disability, we examine two frameworks important to musculoskeletal clinicians' assessment, reasoning and management: the stress-diathesis model (Shanahan and Macmillan, 2008; Elder, 1994) and the International Classification of Functioning, Disability and Health (ICF) model (World Health Organization [WHO], 2001) framework of health and disablement (Shanahan and Macmillan, 2008; Rowland, 1989). Both models include identifying contributing factors and modifying resources that are available to patients that also influence outcomes.

The stress and coping model (Lazarus and Folkman, 1984b) is used to identify what coping behaviours preserve well-being in patients with musculoskeletal disorders while facing stressful experiences with acute or chronic conditions. Integrating the new lens of health as described by the ICF framework introduced in Chapter 1 requires consideration of the larger personal and environmental influences around the individual. Finally, this chapter explores self-rated health and self-efficacy from the perspective of social cognitive theory (Bandura, 1977b; Bandura, 1977a) and social support as a social resource for health in the stress and coping model (Lazarus and Folkman, 1984a, 1984b). Understanding both individual-level and social-level concepts will serve to broaden the understanding of health behaviours that influence patients with musculoskeletal disorders and ultimately influence treatment and related outcomes in caring for individuals with musculoskeletal disorders.

Behavioural Factors in Musculoskeletal Disorders

Individuals with musculoskeletal disorders often report decreases in physical health (Weinstein et al., 2008; Fritz et al., 1998; Whitman et al., 2003). Decreased physical health, either real or perceived, can impact an individual in many ways. Overall, it is known that those who have decreased physical health reduce or eliminate participation in daily living, physical, social and recreational activities. A lack of activity has been shown to lead to other stressors such as obesity and general physical deterioration that may eventually result in further disability with the onset of cardiovascular and other serious health problems (Pinsky et al., 1990). Activity restrictions may also lead to low self-confidence, fear-avoidance behaviours, depression and other psychological problems that further restrict the person with a musculoskeletal disorder from participation in activities of daily living (ADLs), physical activities, recreational activities, social activities and community functions (Shakil et al., 1999; Kirkaldy-Willis and Bernard, 1999; Hirsch and Liebert, 1998). Chapter 4 further explains how psychological factors such as maladaptive cognitions (e.g. pain and 'illness' representations or beliefs, catastrophizing), distress, fear based beliefs and related avoidance behaviours are negative influences on the stressors of pain and disability and result in declines in treatment success in musculoskeletal disorders in general (Waddell et al., 1993; Flynn et al., 2002; Buer and Linton, 2002). Psychological distress, from frustrations to anxiety and depression, and fear-avoidance behaviours correlate with reduced participation in functional daily tasks, indicating a higher risk for disability. Although diagnosis of depression is beyond the scope of practice of musculoskeletal clinicians, some studies have shown that depressive symptoms and high fear-avoidance scores can improve during some areas of musculoskeletal management and result in positive changes in patient outcomes of pain and disability (Fritz and George, 2002; Brox et al., 2003; Whitman et al., 2006). In addition, research has demonstrated that using an enhanced or multimodal team approach to treatment results in improved patient outcomes for musculoskeletal conditions such as low back pain (Sunderland et al., 1992; Whitman et al., 2006). Even though some physical, cognitive and psychological factors contributing to higher pre-treatment pain and disability and post-treatment outcomes have been identified in many musculoskeletal conditions, identifying all the behavioural factors that influence individuals with musculoskeletal disorders continues to be incomplete.

Similar to other health conditions, the daily lives of individuals with musculoskeletal disorders likely involve unanticipated challenges. Patients with musculoskeletal disorders must learn to navigate life with the stress of either acute or chronic pain, cope with reduced functioning, experience limitations to their physical and social abilities, manage through decreased activities, and face fears about recurrence or worsening of their condition. Previous research on arthritis and other health conditions has identified that persistent psychosocial needs can decrease the effectiveness of medical treatment, general

health status and quality of life while increasing healthcare costs (Sullivan et al., 2005; Brooks, 2002; Steiner et al., 2002). Although unidentified in many areas of musculoskeletal literature, unaddressed personal and social needs may contribute to reduced participation with treatment and follow-up recommendations, diminished self-care and reduced overall health management (Marinelli and Orto, 1999). Therefore, we recommend that clinicians have a good understanding of the patient's experience of stressors, understand coping behaviours and identify patient resources that may contribute to an improved outcome.

Stress and Coping Model

Pain and disability have been identified as primary stressors in previous musculoskeletal literature. Differing experiences with musculoskeletal disorders result in different appraisals of the stressors of pain and disability. Moreover, individuals with musculoskeletal disorders can have different outcomes related to the experience of pain and disability even with the same treatment approaches. To better understand these main stressors, this chapter uses the underlying theoretical concepts in the stress and coping model (Lazarus and Folkman, 1984b) to define both stress and coping as well as identify the relationship of these concepts in musculoskeletal disorders. Within the stress and coping model (Lazarus and Folkman, 1984b), stress involves the relationship between an individual and his or her environment. This relationship or transaction between individuals and their environment indicates that stress is more than an internal stimulation or specific pattern of physiological, behavioural or subjective reactions (see Fig. 3.1). Two key mediators within the person–environment transaction are cognitive appraisal and coping effort. Cognitive appraisals and coping efforts are influenced by moderators such as personal and situational factors that result in individual adaptations that impact health on many levels. An understanding of stress and coping constructs underpins musculoskeletal clinicians' assessment of individual patients' stressors and coping behaviours that then informs how these may be addressed within clinical management.

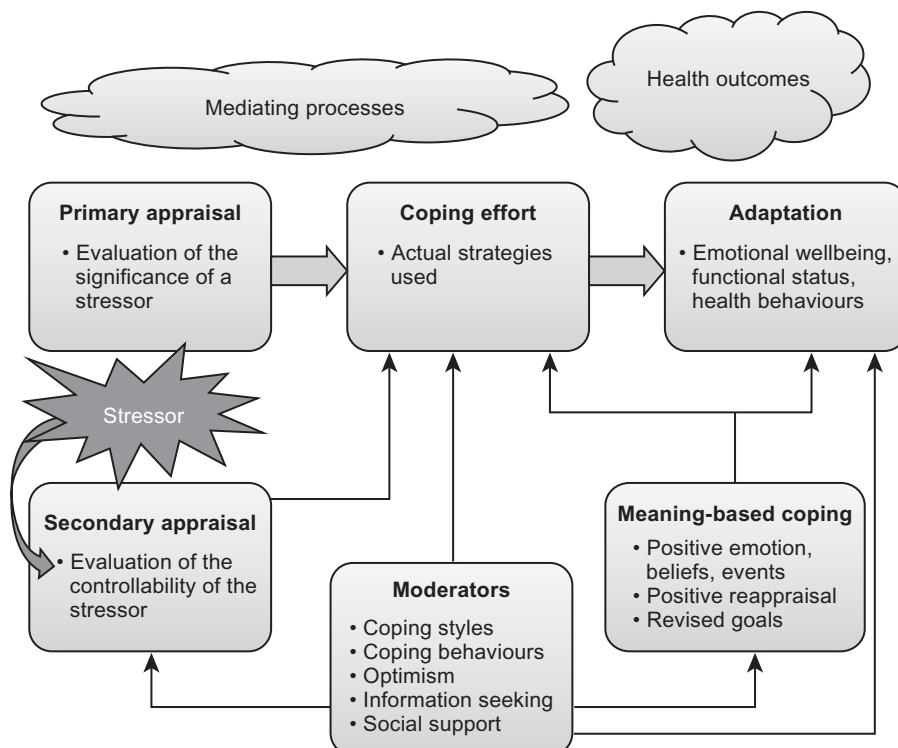


Fig. 3.1 Stress and coping model and stressful health conditions (Adapted with permission from Glanz et al. [2008].)

Cognitive Appraisal

The cognitive appraisal or evaluation by the individual is paramount to determining if the stress is threatening to his or her well-being or surpassing his or her resources. Upon appraising a stressor, the theory asserts that people engage in coping, defined as fluctuating behavioural exertions, in an effort to manage that stressor. The cognitive appraisal process helps an individual determine both the controllability and availability of coping resources identified as necessary to manage the stressor(s) (Lazarus and Folkman, 1984b).

Cognitive appraisal is a necessary component of dealing with a stressor. It accounts for the different ways in which individuals react to similar events. Health conditions such as those resulting in pain provocation and disability, as in many musculoskeletal disorders, can cause stress in nearly every person, yet people vary in their reactions and interpretations of the same event and condition (Lazarus and Folkman, 1984b). This variability in cognitive appraisals can change a person's level of vulnerability during a stressful health condition. Vulnerability is closely related to appraisal because vulnerability increases as a person appraises that he or she has reduced coping resources available. Vulnerability reflects the inability of individuals to withstand adverse impacts from a single stressor or multiple stressors to which they are exposed. It can be associated with a pattern of thought that is believed to predispose the individual to psychological problems and feelings of hopelessness. In addition, the variability of individual appraisals, as well as the individual's responses, helps to explain why some individuals experience similar health conditions but have differing quality, intensity and duration of physical, social and emotional outcomes.

Personal and Situational Factors

Two types of factors influence the cognitive appraisal process: personal factors and situational factors (Lazarus and Folkman, 1984a, 1984b). Personal factors consist of the personal values that motivate individuals to make certain decisions and beliefs that give the individual a personal sense of control. Therefore, at the individual level, commitments and beliefs are part of an individual's process of appraisal. Commitments are expressions of what is important to a person and can be related to vulnerability. For example, where a participation restriction may be an inconvenience to one patient that does not unduly add to the patient's stress, for another patient, the value and even self-identity he or she attaches to reduced or lost participation (e.g. work, sport) can represent a significant personal loss associated with increased vulnerability. The deeper a person's commitment, the greater potential for threat, but also the greater the push toward ameliorative action and hope. Beliefs are also important in determining how a person evaluates a stressful event or health condition. Beliefs of personal control over situations can relate to how an individual believes internal self-responses to situations (e.g. emotions) can be controlled. General control beliefs relate to the extent that the person believes the health-related outcomes can be controlled. For example, two patients may experience the same musculoskeletal injury, such as an anterior cruciate ligament rupture of the knee. One patient has had previous experience with an acute injury and rehabilitation and is confident he can emotionally manage this situation. The other patient is going through a difficult divorce and just went through the death of her mother. Her internal self-responses are exaggerated compared with normal and are highly emotional, so she does not believe that she can handle this additional life event. These beliefs will greatly impact each patient's evaluation of the stressful health condition and will ultimately affect the coping responses and strategies that they use to manage their knee rehabilitation. When working with the second patient who has negative health beliefs and a reduced sense of control, the clinician must work to address these beliefs and help improve her sense of control in order to help augment positive coping behaviours.

Another influence to the appraisal process is situational factors, which play a critical role in determining the external controllability of the stressor and what ameliorative action can be taken (Lazarus and Folkman, 1984a, 1984b). Situational factors can include predictability and uncertainty, temporal and life course factors and ambiguity. The modifiability of situational factors will vary, and as such, the potential to influence how and to what extent the stressor can be managed also varies. Although factors such as socio-economic status (SES) – recognized as a strong predictor of poor outcomes across a variety of health

conditions – are less modifiable (although resources for financial assistance can still be explored), adverse workplace relations may be a situational factor amenable to change. For example, adverse workplace relations are a common situational factor and can be a source of stress for patients. Musculoskeletal clinicians can contribute to addressing workplace factors such as alternative work tasks and performance modifications that may improve workplace relations as a management strategy. In addition, patients with musculoskeletal disorders often vary in their stages of life and have aging-related concerns related to their potential for healing, recovery and future work or recreation opportunities. These age-related concerns are another example of a situational factor that could be a component of what a patient experiences, and they should be addressed by a clinician.

Maximum uncertainty is often extremely stressful for an individual experiencing a health condition such as an acute musculoskeletal injury or a chronic musculoskeletal disorder. Uncertainty is particularly common with persistent pain conditions that cannot be explained within the traditional biomedical framework or when patients encounter conflicting explanations and advice from different health professionals. The uncertainty can have immobilizing effects on anticipatory and actual coping processes and can cause mental confusion in the individual. Helping patients recognize the many personal and situational factors that may contribute to the stressors or improve coping behaviours can assist in reducing some of the uncertainty that comes with musculoskeletal disorders. Overall, it is important to assess both situational factors and personal factors in order for clinicians and patients to understand and recognize factors that ultimately influence the level of stress related to pain and disability in musculoskeletal disorders.

Different Appraisals

Although differences between individuals under similar circumstances are inevitable due to various personal and situational factors, the stress and coping model emphasizes that all individuals evaluating a stressor undergo a cognitive appraisal process involving primary appraisal, secondary appraisal and/or reappraisal ([Lazarus and Folkman, 1984a](#)). Primary appraisals involve assessment of the magnitude and significance of a stressor or traumatic event. During primary appraisal, the individual will assess the actual harm, loss, threat or challenge that must be encountered with a stressful health condition. When an individual first experiences a musculoskeletal condition or a reoccurrence of a musculoskeletal condition, primary appraisal takes place. Individuals with musculoskeletal conditions are often in the process of primary appraisal when they seek out medical care and treatment.

Secondary appraisal refers to an individual's assessment of the degree to which the stressor or traumatic event can be controlled and the available coping resources ([Lazarus and Folkman, 1984a, 1984b](#)). Secondary appraisals are a judgment about what might and can be done in the situation ([Lazarus and Folkman, 1984b](#)). Secondary appraisals include an evaluation about whether a coping option (e.g. rest, medication, therapy) will accomplish what it is supposed to do as well as the consequences in the context of other internal and/or external demands and constraints. Appraisals of controllability of a health condition can be stress-reducing if one believes that the outcome is controllable or that one has the coping resources to manage the outcomes. However, appraisals of controllability can also heighten threat and give rise to negative emotions and beliefs about coping if perceptions of control and resources are diminished. For example, individuals with low back pain (LBP) will use secondary appraisals when their chronic LBP has reoccurred and their activities have been limited. This in turn motivates some to seek treatment to control their pain and disability as part of the coping process if they have the necessary access and resources. For others, their LBP reoccurrence may heighten negative emotions and beliefs about the seriousness of their condition and its underlying cause and diminish their ability to manage the condition.

Reappraisal is the final feature of the appraisal process and entails an altered or revised version of a previous appraisal. Reappraisals can occur multiple times for reasons such as changes in the environment or the health condition ([Lazarus and Folkman, 1984a, 1984b](#)). Reappraisals can also occur when an individual has gone through the cognitive coping process and has altered his or her assessment of the available coping resources. Because the complete process of appraisal is dynamic, a patient with a chronic disease or persistent pain state, such as with many musculoskeletal conditions, is likely to appraise and reappraise

the stressors of pain and disability and respective coping resources before, during and after treatment multiple times and with each successive episode. Ultimately, reappraisal of previous unhelpful appraisals is the aim of educative, behavioural and activity/exercise management for patients with persistent musculoskeletal pain and disability associated with a nociplastic dominant pain type and unhelpful cognitions and coping behaviours.

Coping

Coping is intimately related to the concept of cognitive appraisal and the person–environment relationship. Coping involves the cognitive and behavioural efforts to address external and internal demands on the person experiencing a stressful encounter. Coping can either be focused on changing the person–environment problem behind the stress or be directed toward changing the appraisal of the situation. Moreover, coping can be focused toward trying to reduce a negative emotional state of the situation. Early identification of patients who have reduced coping behaviours could help target certain factors and resources needed to improve coping behaviours. For example, in patients with a musculoskeletal disorder, early identification of individuals who have negative appraisals and reduced coping resources can help direct clinicians to increase cognitive-behavioural management to improve patient beliefs, motivation and participation in treatment. Ultimately, understanding coping behaviours in relationship to health outcomes can be important in the big picture to identify and prioritize healthcare resources for individuals with a musculoskeletal condition.

Key Points

Most musculoskeletal health conditions require an individual to make changes, either short or long term, to their activities and expectations. Patients will evaluate the situation (called appraisal) and interpret the magnitude of the effect this condition will have on their lives. Patients will respond to the situation differently, depending on how manageable they perceive the situation to be. Patients with stronger coping skills tend to feel more positive about being able to manage their health condition. A clinician who can identify which patients feel negative about their condition can work to provide extra support and/or refer patients to appropriate caregivers to assist in improving coping skills and behaviours to manage their condition.

Managing Stressors: Coping With the Stressor of Pain

The experience of pain is often described as stressful by an individual and identified as a source of stress for individuals (Jensen and Karoly, 1991). In recognizing the role of pain as a stressor, it is necessary to explore and expand upon an understanding of the factors contributing to an individual's experience of pain. The traditional biomedical model of pain dates back hundreds of years to an era when pain was understood to be a primarily sensory experience resulting from the stimulation of noxious sensory receptors, usually from physical damage or injury (Descartes, 1985). This theory of pain describes primarily nociceptive pain, defined as pain elicited when sensory receptors specialized to sense mechanical, thermal or chemical pain react when stimulated past a sensory threshold. This simplistic view suggests that pain only comes from specific physical pathology and is often called the biomedical model of pain. It does not take into account how pain is experienced by the individual, involving additional psychological, social and behavioural mechanisms of injury and illness. Chapter 2 goes into further depth about our current understanding of pain and its effects on the individual. In this chapter, a broader understanding of pain and its influences beyond the individual level that ultimately impact the individual's pain experience during a health condition will be explored. There are many potential avenues that can heighten or alter the pain experience. In the musculoskeletal condition of LBP, for example, patients with LBP often experience pain that is unrelated or only partly related

to their radiographic severity or lumbar pathology (Boden, 1996; Pahl et al., 2006), illustrating that their pain experience is greater than the pure pathophysiological processes involved. Due to the narrow scope of the biomedical model of pain, it is often criticized for being reductionist and exclusionary, and broader concepts need to be explored (Turk and Flor, 1999).

Biopsychosocial Models of Pain

To encompass a broader view of pain, Turk and Flor (1999) described a biopsychosocial approach to pain which addresses many of the shortfalls found in traditional biomedical models. In this approach, it is recognized that the experience of pain is the reciprocal and dynamic interaction of biological, psychological and social factors. It is based on the concept that the experience of pain arises from illness behaviour, although it is typically initiated by and/or has contributions from nociceptive and/or neuropathic pain. Illness behaviour is a term used to describe the ways in which given symptoms may be differently perceived, evaluated and acted or not acted upon by different individuals (Mechanic, 1962). Illness behaviour is believed to be a dynamic process that allows for the role of the biological, psychological and social factors to change in health conditions and as the condition evolves (Engel, 1980).

In the 1980s, Waddell (1987) applied the construct of illness behaviour to LBP (see Fig. 3.2). Their view was that persons with chronic LBP experienced illness behaviours and not just nociceptive pain. This view represented a broader biopsychosocial model of pain stemming from physiological impairment but with broader cognition, affective and social factors resulting in the experience of pain perceived and reported by individuals with chronic LBP (Waddell, 1987). Since this work, the construct of illness behaviour has been recognized as an important construct in many health conditions but continues to be absent in evaluative and management strategies for most musculoskeletal conditions other than LBP.

Stress-Diathesis Model of Pain

Asmundson and Wright (2004) expanded on the biopsychosocial framework by describing pain behaviours and the additional factors that contribute to disability in patients with chronic pain. In their stress-diathesis model (see Fig. 3.3), the impact (stress) of a painful

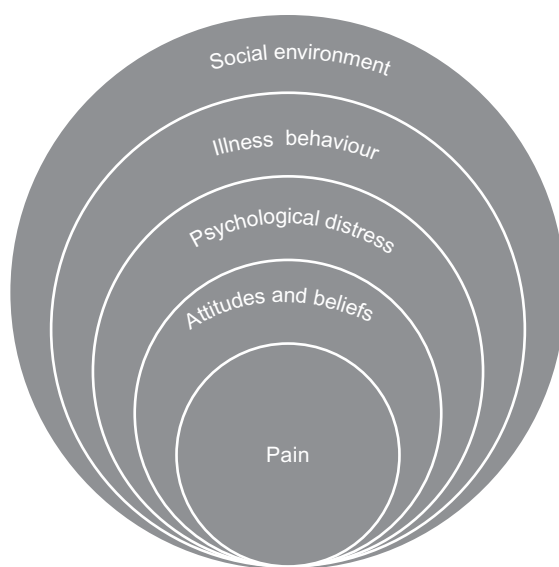


Fig. 3.2 Biopsychosocial model of pain. Cross-sectional representation of the Glasgow model representing the role of fear-avoidance beliefs in chronic low back pain and disability (Adapted with permission from Waddell et al. [1987, 1993].)

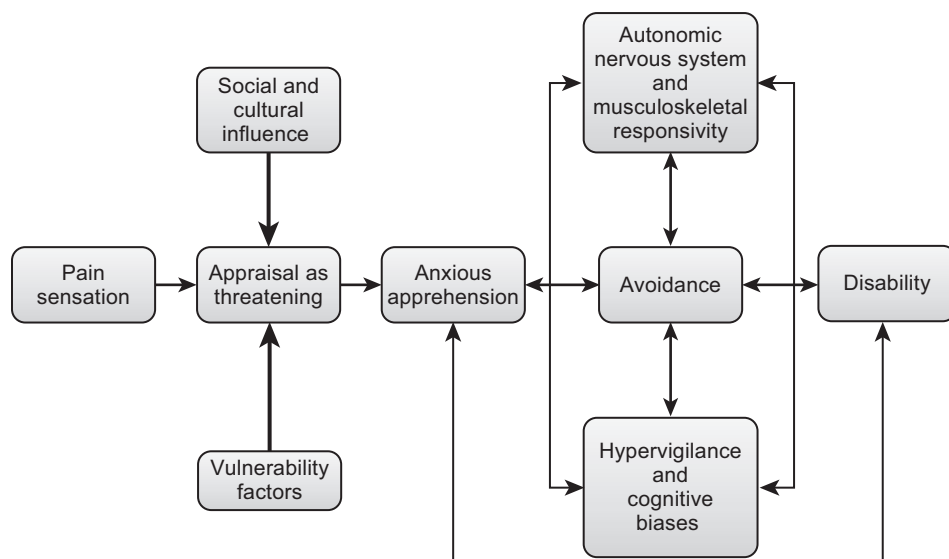


Fig. 3.3 The stress-diathesis model of pain and disability. An integrated stress-diathesis model of chronic pain (Adapted with permission from [Asmundson and Wright \[2004\]](#).)

condition is described in terms of the effects on the person and his or her social activities, and the model considers if the individual is vulnerable (diathesis) to additional comorbidities. A key part of the stress-diathesis model is the issue of pain appraisal. Pain appraisal refers to the meaning ascribed to pain by an individual ([Sharp and Harvey, 2001](#)). As already discussed with the stress and coping model ([Lazarus and Folkman, 1984c](#)), a distinction can be made between primary appraisal of pain in terms of it being threatening, benign or irrelevant and secondary appraisal, which evaluates the controllability of pain and one's coping resources. Primary appraisal of a threat or harm/loss is an indication of a stressor. Therefore, pain described as threatening by the stress-diathesis model is inherently stressful. The degree of the stress depends on the other factors of vulnerability, social and cultural influence and assessment of coping resources.

Let's use an example of a middle-aged male patient with sciatica. He rates his pain as 8/10 when sitting and 4/10 when walking or standing. He has tried multiple interventions, including physical therapy and injections, following surgery several years ago, with modest results. Although this is distressing to him, he has found ways to manage his pain and continue in activities that are important to him, including his spending time with his grandchildren and working. His work environment is flexible in that he is able to choose when he needs to move around and can control his schedule and activities. He has cut back on his activities with the grandchildren but enjoys his family time. By all accounts, this gentleman has low fear and avoidance behaviours and a good narrative in the aspects of the biopsychosocial model described by Waddell.

In the stress-diathesis framework, this gentleman does not perceive (appraise) his pain as a significant distress and has a social-cultural context which accommodates his level of pain, thus contributing to a low level of disability. But the stress-diathesis framework can help explain situations that are more complex. Let's take another patient, also male and middle-aged, with low back pain of the same intensity. This patient, too, has tried many interventions, including physiotherapy, injections and surgery. This patient works in an office which requires him to spend most of the time at the computer or phone, with few breaks. His home/active life is focused on his wife's recovery from breast cancer surgery and his son, who wants to hike and bike in the mountainous environment. He perceives his pain to interfere with his ability to focus at work, his relationship with his wife and the activities with his son. He feels limited and frustrated that he cannot be the person he wants to be. These are examples of how the social and cultural contexts influence the patient's perception of pain and contribute to disability. In addition, this patient has experienced feelings of helplessness before – after his first back surgery 15 years ago, after

his discharge from the military and after his father had a heart attack. These experiences make him vulnerable to perceiving his LBP as very disabling and likely contribute to maintaining his persistent pain condition. This vulnerability is the 'diathesis' portion of the model.

In the stress-diathesis model, we can expect that patients with high vulnerability, psychological distress, low self-efficacy and/or complex social/cultural situations will have increased pain and higher levels of disability. In order to minimize disability (and pain), it is important for clinicians to understand and recognize the influences of social/cultural experiences and vulnerability as they impact outcomes.

Key Points

Pain is one of the key stressors of patients with both acute and chronic musculoskeletal conditions. In patients who have other psychological stressors, such as depression, or with complex social and cultural situations, a pain condition can lead to a significant level of disability. In order to improve patients' outcomes and quality of life, clinicians need to understand the patient's story, including psychological, social and cultural factors, along with their interpretation and appraisal of the situation.

Managing Stressors: Coping With the Stressor of Disability

As we see in the stress-diathesis model, pain is only one factor in a more complex set of factors contributing to disability. Coping behaviours can therefore ultimately differ when addressing the stressor of pain as compared with the stressor of disability. Understanding disability has been an evolving process in health and the healthcare literature. It is the role of musculoskeletal clinicians to reduce or limit the level of disability and improve function in patients, which requires the complex understanding we have today about disability and the factors that contribute to function.

Disability and Functioning

Over the years, multiple frameworks have been developed to explain a broader concept of disability. One of the earliest frameworks for disability, proposed in the 1960s by sociologist Saad Nagi, is the 'disablement model' that illustrates a disease pathway that is still used by healthcare professionals. The disablement model describes a pathway comprised of four inter-related but separate constructs that contribute in a linear fashion to disability (Nagi, 1965). The model starts with pathology as the underlying disease condition that eventually leads to impairments, functional limitations and disability. Much of current practice continues to describe the links between these constructs with the underlying implication that treating impairments will improve function and limit disability.

ICF Framework

In many ways, the disablement model describes a simplistic approach to treatment that does not address factors seen in other biopsychosocial models. Chapter 1 introduced the ICF model developed by the World Health Organization (WHO) and the Committee on a US National Agenda for the Prevention of Disabilities that combines previous research contributions to the concept of disability into a universal classification system to define and measure health and function by means of two domains: functioning and contextual factors. The domains characterize different factors that interact with the individual to facilitate or hinder functioning and/or disability (Bickenbach et al., 1999). Changes to different factors often result in a decrement of health and thereby can be used to describe disability in the individual.

Functioning

Similar to the original disablement model, the ICF has components that encompass pathology, impairment and functioning. Problems in both body function and structure are together usually termed impairments by health professionals and defined as deviations or loss of structure or function. The other two components of activity and participation encompass a larger concept of functioning. Activity and participation are similar concepts, although each has a slightly different definition. Activity is defined as the action or task performance by an individual. Participation represents the involvement in life activities. Problems in an individual's ability to participate in activities will result in participation restrictions and limit actual activity. For example, individuals with LBP or knee pain may be limited in activities such as walking, climbing steps, or lifting objects. When a person with knee pain cannot perform activities such as walking or climbing stairs, it often precludes his or her participation in many social, recreational and daily chores that require both the functional ability and the psychological confidence to execute these activities, as well as the social supports to navigate these activities in a modified or assisted manner.

Contextual Factors

Contextual factors in the ICF are classified as either personal or environmental factors that influence disability. Contextual factors are similar to the two types of factors that influence the cognitive appraisal process during stress and coping: personal factors and situational factors (Lazarus and Folkman, 1984b). Environmental factors, similar to situational factors, refer to all aspects of the external or extrinsic world that form the context of an individual's personal life that have an impact on a person's functioning. Environmental factors can be both facilitators that can assist a person's functioning or barriers that hinder or limit a person's functioning. Our understanding of disability as a function of the interaction of individuals with the influence of social and physical environments has grown over the years. As a result, the environment has been seen to influence disability via the natural environment, the built environment, culture, the economic system, the political system and social systems. Previous literature has added increased emphasis that persons with disabilities have reduced access in the environment that restricts full participation in life and society (Oliver, 1996). Ultimately, the less supportive the environment is to an individual from both a physical and social perspective, the greater the resulting disability.

The other type of contextual factor, personal factors, can include anything that is an internal influence on a person's functioning and disability. Personal factors include individual markers such as age, sex and social status (Stucki and Ewert, 2005) and personal characteristics such as coping styles, lifestyle, habits, social background, past experiences, self-efficacy, self-advocacy and other psychosocial assets that, at least initially, are not directly related to the health condition. This overlaps with the concepts in the stress and coping model where personal factors consist of the personal values that motivate individuals to make certain decisions and beliefs that give the individual a personal sense of control (Lazarus and Folkman, 1984a, 1984b). These personality traits can influence how a person responds to possible limitations secondary to disability. Some individuals may have difficulty with assertiveness or have a negative outlook, regardless of the health condition and corresponding disability. Others may have a sense of positive optimism or self-determination that persists regardless of the disability. The individual's outlook or sense of self can be directly influenced by his or her larger social context. Overall, personal factors are attributes within the person that influence an individual's level of disability and in turn can be positively or negatively influenced by the pain or disability experienced. The recognition of personal factors in the ICF framework illustrates that a person is more than simply the sum of his or her physical functioning. The ICF framework and its components are displayed in Fig. 3.4.

Application of Functioning and Disability in LBP

The ICF model of function illustrates the complex and multifactorial nature of disability as currently understood by clinicians, researchers and the public health community. One

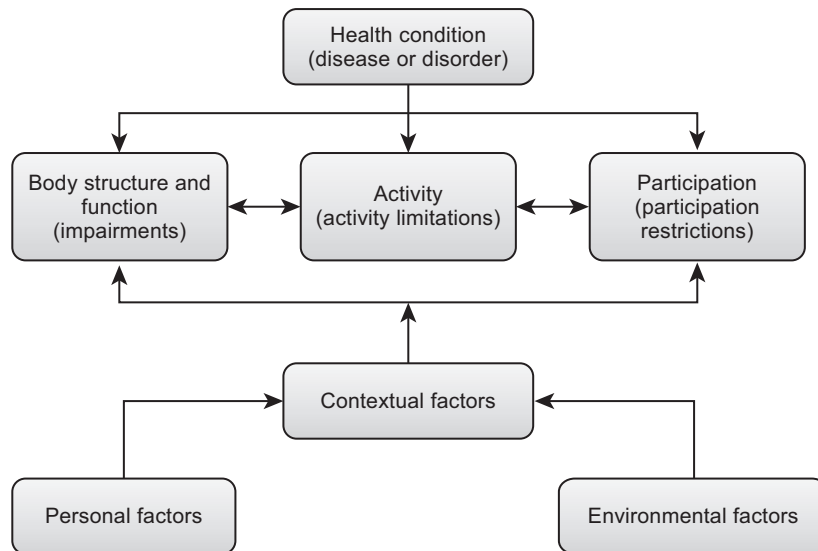


Fig. 3.4 International Classification of Functioning, Disability and Health framework. Representation of the different factors that interact and contribute to disruption of function and increase overall disablement (Adapted with permission from the WHO ICF framework [WHO, 2001].)

musculoskeletal area, LBP, has received a lot of attention by all of these groups because it is recognized as a significant cause of musculoskeletal-related disability in our society. In 1980, Waddell revolutionized the clinical perspective of LBP by illustrating that there were many nonorganic and behavioural components to an individual's experience of LBP (Waddell et al., 1980, 1989). The work to revise the concept of disablement along with continued research in LBP has resulted in a more complex understanding of the typical spectrum of musculoskeletal problems of functioning in patients with LBP. Various studies have used the ICF framework to assist in understanding the complexity of LBP (Krismer and Van Tulder, 2007; Sigl et al., 2006; Cieza et al., 2004). Psychosocial and environmental risk factors have been identified in the development and management of LBP (Gatchel et al., 1995; Waddell, 1987, 1991; Waddell et al., 1989, 1993). These studies show the complexity of LBP beyond somatic symptoms and support the multifactorial disablement models in musculoskeletal disorders such as LBP. Using the stress and coping model in combination with the ICF framework and the stress-diathesis model, respective coping processes and resources can be better identified that describe the experience of pain and disablement in patients with musculoskeletal disorders. Ultimately, these theoretical contributions serve to support the larger goal of improving clinicians' understanding of psychosocial factors contributing to musculoskeletal disorders and improving the allocation of resources to reduce the consequences of disability.

Resource Theories of Stress and Coping

To further understand how personal and environmental factors contribute to disablement in musculoskeletal disorders, theoretical constructs have been identified in a number of resource theories of stress and coping. In some health conditions, such as diabetes mellitus and cancer, social and personal constructs have been proposed to serve as coping resources that address stressful person–environmental transactions. More needs to be known about what personal and social constructs are important in coping by patients with musculoskeletal disorders. Specific constructs are explored in this chapter, including the constructs of self-rated health, self-efficacy and social support. Each construct reflects both the individual-level coping behaviours and the interpersonal role of society on influencing health and health behaviours.

Self-Rated Health as a Psychosocial Construct

Self-rated health is a commonly used measurement that identifies a patient's perspective of his or her health condition. It is believed that self-rated health may contribute to both poor coping behaviours as well as improvement in health outcomes. Self-ratings of health are used frequently in the health literature and have been shown to be predictors of morbidity and mortality (Ware and Sherbourne, 1992). Self-rated health has also been proven sensitive to improvements and declines in many health-related outcomes (Garritty et al., 1978; Rodin and McAvay, 1992). A 5-year study by Gold et al. (1996) of health outcomes in the community determined that both functional ability and self-rated health were independent predictors of health outcomes.

Self-rated health measures assess subjective well-being related to physical and mental domains of health. These measures are used extensively in clinical trials and in health services research, where they have shown evidence of reliability, validity and responsiveness (Stewart et al., 1988). These studies support the use of a health status measure as part of an initial intake for patients in musculoskeletal clinics. Even though most medical treatment still focuses on a person's actual physical state as it relates to pain and illness, perceived health may largely contribute to a person's well-being and function.

Appraisal of Health

Self-rated health, both physical and mental health, is likely to be part of a larger appraisal process when faced with a stressful health condition. The perception of health status during a negative health experience is believed to be just as relevant to health outcomes as the actual somatic state of the individual. When an individual has a better perception of his or her overall health, there is a greater potential for these health beliefs to bolster positive coping behaviours during illness experiences. For example, it has been shown that older adults' overall perception of health can be predictive of their use of active coping strategies to deal with age-related health challenges (Menec et al., 1999). Research has also shown that those who don't have a positive health perception may engage in sick-role behaviours that can lead to self-destructive behaviours during illness (Mechanic, 1962). One reason for this is that self-rated health is believed to be a reflection of an enduring self-concept of a healthy or unhealthy person (Bailis et al., 2003). There are many factors at and beyond the individual level that may influence and contribute to an individual's self-health concept. Therefore, this self-concept of health may act as a moderator when engaging in positive or negative illness behaviours.

Variance in physical measures and outcomes have also been shown to be related to respondents' previous self-rated health (Bailis et al., 2003). Longitudinal studies have illustrated that those with initial lower self-rated health predict poor functional ability and increased healthcare utilization over time (Rodin and McAvay, 1992; Ferraro et al., 1997). Negative self-rated health has been found to predict long-term disability and health decline in the general population (Ferraro et al., 1997). Change in self-rated health has been shown to coincide with long-term changes in physical health, mental health, perceived social support and performance-related behaviours (Bailis et al., 2003). Moreover, self-rated health has been shown to vary according to whether respondents intended to improve specific health-related behaviours in the future (Bailis et al., 2003). These findings suggest that self-rated health is both a current assessment of one's health status, similar to a self-concept, and a reflection of efforts to achieve relatively important health-related goals.

Application of Self-Rated Health

Measurement of perceived physical and mental health has been performed routinely in the health literature by several standardized tools (Brooks et al., 1990; Gold et al., 1996; Hicks and Manal, 2009; Ware and Sherbourne, 1992). A common tool used in the health literature is the Medical Outcomes Survey Short Form 36 Questionnaire or the SF-36. Other tools include the General Psychological Well Being Inventory (Dupuy, 1984), Health Perceptions Questionnaire (Davies and Ware, 1981), EuroQol (Group, 1990) and various

other measures that assess physical and role functioning (Reynolds et al., 1974). General health surveys have been designed to measure overall self-rated health with a broad range of questions covering a variety of aspects of physical and mental health. It is commonly felt that the usefulness of general measures is in their ability to allow comparisons among patients with the same condition as well as between patients with different conditions. In some cases, general health measures may be able to identify unsuspected issues from a diagnostic group that would be highlighted as scores deviating from population- or disease-specific norms. These self-rated indicators likely take into account the patient's physical sensations (e.g. bodily pain), the patient's comparison of what he or she can perform in his or her daily life as compared with previously or as compared with his or her peers, his or her psychological status and his or her social perception of functioning and social role. Overall, understanding how an individual with a musculoskeletal disorder perceives his or her general physical and mental health may add to the larger role of personal and environmental-level influences on outcomes of pain and disability.

Looking closer at the SF-36 as an example, it is a general health survey which yields psychometrically based physical and mental health summary measures. In numerous previous studies, the SF-36 has been used for general and specific populations in evaluating health outcomes, comparing the relative burden of diseases and differentiating the perceived health benefits produced by a wide range of different treatments. The content validity of the SF-36 has been compared with that of other widely used generic health surveys (McHorney et al., 1993; Ware et al., 1995). The SF-36 was judged to be the most widely evaluated generic patient assessed health outcome measure in a study published in the *British Medical Journal* (Garratt et al., 2002). The SF-36 has proven useful in estimating disease burden and comparing disease-specific benchmarks with general population norms in more than 200 diseases and conditions. Among the most frequently studied diseases and conditions, with 50 or more SF-36 publications, are the following: arthritis, cancer, cardiovascular disease, chronic obstructive pulmonary disease, depression, diabetes, gastrointestinal disease, migraine headache, HIV/AIDS, hypertension, irritable bowel syndrome, kidney disease, LBP, multiple sclerosis, various musculoskeletal conditions, neuromuscular conditions, osteoarthritis, psychiatric diagnoses, rheumatoid arthritis, sleep disorders, spinal injuries, stroke, substance abuse, surgical procedures, transplantation and trauma (Turner-Bowker et al., 2008).

The SF-36 is 36-item, generic self-report measure of general health status covering eight domains: physical functioning, role limitations as a result of physical health problems, role limitations as a result of emotional health problems, energy/fatigue, emotional well-being, social functioning, pain and general health perceptions (McHorney et al., 1993; Ware and Sherbourne, 1992). LBP is a key area of musculoskeletal practice where the evidence for self-rated health and health behaviours has been explored. Psychosocial factors and emotional distress have been found to be stronger predictors of LBP outcomes compared with physical examination findings or severity of pain alone (Pincus et al., 2002). Psychosocial factors that predict poorer LBP outcomes include the presence of depression, passive coping strategies, higher disability levels or somatization (Fayad et al., 2004; Pincus et al., 2002). Chapter 4 discusses issues related to psychological factors in greater detail. However, it is important to remember that a general health status measure can give insight into which aspects of the patient's life are most affected, including the ability to participate in social activities or social roles.

In the general LBP literature, Fanuele et al. (2000) investigated the Medical Outcomes Survey SF-36 physical component scores (PCSs) in a prospective sample of 17,774 patients with spinal disorders. They found that individuals with LBP had a mean PCS of 30.4 ± 9.95 (standard deviation [SD]) compared with 50.0 ± 10.00 for the general U.S. population. This indicates that the PCS is greatly reduced in individuals with spinal disorders in general and is similar to the PCS in other patient populations, such as chronic heart failure (31.0), chronic obstructive pulmonary disorder (33.9), systemic lupus erythematosus (37.1), cancer (38.4) and other musculoskeletal disorders such as primary total hip arthroplasty (29.0), primary total knee arthroplasty (32.6) and glenohumeral degenerative joint disease (35.2) (Fanuele et al., 2000). Because LBP and other musculoskeletal disorders greatly impact an individual's perceived self-health, it is important to include a health status measure to guide further questioning and assessment, collaborative goal setting and outcome

reassessment. Beyond the total score, clinicians can determine which of the domains are most influenced by the patient's condition and can target interventions or identify referrals to address these issues.

Key Points

Self-rated health is an indicator of how patients perceive their health. Patients with both acute and chronic musculoskeletal conditions may still rate their overall health as good; this can indicate that the patient also has good coping skills in dealing with health conditions. The converse is also true: patients who rate their overall health as poor may have lower abilities to manage their condition(s). Therefore, we recommend that an examination of patients with either acute or chronic pain condition(s) include a measure of health status. This measure can be used for patient outcomes as well as guidance for selecting interventions and as an indicator for adding and/or augmenting additional coping resources.

Social Cognitive Theory and the Psychosocial Construct of Self-Efficacy

Health status measures attempt to make a link between personal characteristics and social factors that together lead to the ability to function in both physical and social environments. Some frequently cited work by Bandura (1977a) views individuals both as products and as producers of their own environments and social systems. In this view, called social cognitive theory (SCT) (Bandura, 1977a, 1986), individuals possess a self-system that enables them to exert control over their thoughts, feelings, motivations and actions (Bandura, 2001). SCT hypothesizes that people's beliefs in their capabilities mediate how they behave in situations such as participating in treatment for a musculoskeletal disorder. Treatment provides an environment in which there are opportunities for physical and psychosocial support by health professionals, family or friends which can in turn affect beliefs about their capabilities. Both external social supports and individual physical actions during treatment may help to improve an individual's beliefs about his or her capacity to perform functional tasks.

Self-Efficacy

The construct of self-efficacy is a key concept within the SCT framework. Perceived self-efficacy is defined as a person's belief in his or her capacity to both organize and execute the necessary actions and behaviors needed to produce specific performance attainments (Bandura, 1997). It is a context-specific assessment of one's competence to perform a specific task or range of tasks in a given domain. Bandura (1997) describes self-efficacy as influencing four areas: (1) the choices that are made, (2) the effort put forth in task-specific roles, (3) the time one persists when there are obstacles and (4) one's feelings of confidence in performing specific tasks in specific situations.

Depending on what is being managed, the tasks over which personal influence is exercised may entail regulation of one's motivation, thought processes, affective states and actions, or changing environmental conditions. Self-efficacy beliefs are sensitive to these contextual factors. Therefore, they differ from other expectancy beliefs in that self-efficacy judgments are more task and situation specific, and individuals make use of these judgments in reference to the type of goal (Bandura, 1986; Bandura et al., 1989; Pintrich and Schunk, 1996). Self-efficacy can refer to sub-skills required to organize actions that are governed by broader self-regulatory skills, such as perceiving the practical needs for certain task demands or constructing and evaluating alternative strategies. Possessing these self-regulatory sub-skills can permit individuals to improve their performance across varied activities. This is particularly relevant to the patient who is experiencing a musculoskeletal or other health disorder. Individuals who have self-regulatory skills could theoretically participate in treatments and develop alternative strategies for task performance even when faced with sensations of pain during activities. Self-efficacy can also generalize across skills when

commonalities are cognitively structured across activities. For example, confidence in physical exercises and motor skills practiced in musculoskeletal treatments may transfer to confidence in other activities performed in daily living if the tasks have generalizable features.

Theoretically, people make and shape self-efficacy beliefs in the context of performing a specific goal or task. Self-efficacy beliefs might influence a patient's experiences of pain, functional limitations and disability with a musculoskeletal disorder. Self-efficacy beliefs have the potential to be modifiable with the right support and reinforcement. A patient practicing functional activities like walking could increase his or her task-specific self-efficacy for walking through successful practice with a reconstructed understanding of pain provocation and pacing to avoid flare-up and, as a result, increase his or her confidence and activity participation outside of the clinic. Moreover, a patient who enters treatment with high self-efficacy for functional tasks might have even greater belief that he or she can organize and execute all of the actions needed to successfully complete tasks required in treatment. Theoretically, a patient with higher self-efficacy could have heightened beliefs about accomplishing tasks, including positive health behaviours such as attending regularly scheduled clinical appointments, following medical instructions, executing a series of home and clinic exercises and performing adaptive avoidance behaviours to minimize pain and discomfort. Overall, high self-efficacy beliefs can lead to setting challenging individual goals and maintaining a strong commitment to these goals, which ultimately could affect outcomes related to a musculoskeletal disorder.

Researchers think self-efficacy beliefs not only influence behaviours but in part determine outcome expectations (Bandura, 1997; Davis and Yates, 1982). Individuals who expect success in a particular task often produce successful outcomes in that task. The opposite is also true of those who lack such confidence in task performance; those who doubt their success will produce failed outcomes. Patients undertaking tasks such as those found in musculoskeletal treatment would have similar anticipatory outcome expectations about performing the specific tasks required for the process of treatment and transfer these beliefs to similar skills outside of treatment.

Issues of self-efficacy found in those with chronic conditions and in older adults often center on reappraisals and misappraisals of their capabilities. Because physical conceptions in chronicity and aging focus extensively on declining abilities, many physical functions can decrease as people regularly avoid activity due to chronic pain or general aging concerns. This process requires reappraisal of self-efficacy for activities in which physical functions have been significantly affected. However, evidence has shown that when older adults are taught to use their intellectual and physical capabilities, their improvement in cognitive and physical functioning more than offsets the average decrement in performance over two decades (Bandura, 1997). Similar situations arise from chronic health conditions. As a health condition becomes chronic, individuals can often reappraise their ability to perform tasks at much lower levels. However, intervention that targets both cognitive and physical capabilities can often mitigate some of this decline. Therefore, it is possible that perceived self-efficacy may affect the level of involvement in activities and theoretically mitigate the decline from musculoskeletal disorders seen in older adults or those with chronic conditions.

Application of Self-Efficacy

In many musculoskeletal disorders, it is unknown if self-efficacy for specific tasks can maintain or improve in the presence of the pain and disability perceived by many patients. It is known that pain can impede or prevent patients from participating in an activity because of the actual experience of pain, the fear and/or avoidance behaviours that pre-empt participation and the cognitive appraisals or reappraisals that are made after activities have repeatedly resulted in painful experiences. Reductions in function can also lower an individual's self-confidence and, as a result, continue to lower the levels of activity in which an individual participates in daily life.

In laboratory experiments, self-efficacy beliefs were found to predict tolerance levels to pain (Keefe et al., 2005). From a biological perspective of pain, perceived self-efficacy has been shown to affect the body's opioid and immune systems (Weisenberg et al., 1998). In

patients with pain disorders related to LBP, self-efficacy positively affects physical and psychological functioning (Woby et al., 2007). Evidence shows that self-efficacy influences pain and function after acute physical interventions like surgery (Bastone and Kerns, 1995; Allen et al., 1990). Prospective studies in patients who underwent orthopedic surgery demonstrated that high self-efficacy before the start of treatment and larger increases over the course of treatment speed recovery and predict better long-term outcomes (Waldrop et al., 2001; Dohnke et al., 2005; Orbell et al., 2001). It is possible that individuals with high self-efficacy may be more motivated to engage in health-promoting behaviours and adhere better to treatment recommendations because they have higher performance success expectancies. In addition, it is believed that people with high self-efficacy are less likely to give up an activity when faced with barriers such as pain or weakness and are therefore less likely to become trapped in the negative spiral of activity avoidance, physical deconditioning, loss of social supports and depression.

Application of Self-Efficacy During Treatment

In rehabilitation literature, self-efficacy is measured by using task-specific constructs relevant to the chronic disease process and specific rehabilitation treatments being studied. Research indicates that task-specific self-efficacy can improve during the treatment process. Scherer and Schmieder (1997) demonstrated improved task-specific self-efficacy with patients who participated in treatment for dyspnoea due to chronic obstructive pulmonary disease. Patients who completed educational and exercise training had significant increases in their self-efficacy scores to manage or avoid breathing difficulty. In addition, patients increased their self-efficacy expectations for exercise endurance (Scherer and Schmieder, 1997). Carlson et al. (2001) showed that cardiac rehabilitation treatment involving physical exercise improved patients' post-treatment self-efficacy beliefs for independent exercise. Another study by Jeng and Braun (1997) found that greater success in functional outcomes from cardiac rehabilitation treatment correlated with higher exercise-specific self-efficacy scores. Finally, Rejeski et al. (1998) found that when patients engaged in aerobic and strength-training exercises for knee osteoarthritis (OA), those who actively engaged in physical exercises had increased self-efficacy outcomes for stair climbing, a task-specific limitation for patients with knee OA, compared with controls.

Research has demonstrated that self-efficacy is also an important factor in improved coping and psychological outcomes (Tinetti et al., 1994; Salbach et al., 2006; Lackner and Carosella, 1999b). Taal et al. (1993) surveyed patients with rheumatoid arthritis (RA) to determine their level of self-efficacy in relation to function, pain and disability when coping with RA. Higher self-efficacy scores correlated with improved coping abilities independent of pain, disease status and functional abilities. Moreover, Strahl et al. (2000) found that higher self-efficacy levels in patients with arthritis were predictive of better outcomes related to psychological functioning.

An investigation of self-efficacy for patients with chronic LBP found that initial self-efficacy beliefs predicted functional abilities. In a study by Lackner and Carosella (1999a) that included patients with chronic LBP, 100 patients rated their confidence to perform load-lifting tasks before any examination or treatment. Next, these patients underwent a subsequent physical examination and physical performance test for lifting loads. The results indicated a significant association between self-efficacy beliefs and lifting higher loads and higher physical performance. Lackner and Carosella did not find an association between pain perceptions or measures of psychological distress and the physical performance measures.

Overall, these studies indicate that self-efficacy is an important construct in healthcare management and should be recognized in musculoskeletal-related disorders. Two of the studies (Jeng and Braun, 1997; Lackner and Carosella, 1999a) found significant relationships demonstrating that self-efficacy beliefs have an impact on the outcomes of pain and disability for patients with chronic disease processes. Although the role of self-efficacy in the treatment process warrants more investigation, these studies indicate that heightened patient beliefs regarding the ability to perform specific tasks might also raise the functional, psychological and overall coping behaviours of patients during and post-treatment and therefore help to decrease overall perceptions of pain and disability. Although the role of self-efficacy is

unknown in many musculoskeletal disorders, it is important for clinicians and researchers to appreciate the possible impact of self-efficacy in the appraisal of the pain, disability and coping behaviours of patients with musculoskeletal disorders.

Key Points

Self-efficacy plays a significant role in positive patient outcomes. Self-efficacy should be assessed as part of an initial examination as well as ongoing progression in rehabilitation for any musculoskeletal health condition. Clinicians can select interventions that lead to patient success and improve self-efficacy or note that additional efforts to increase confidence using graded exposures may be warranted to reduce fears resulting in poor self-efficacy and avoidance of certain tasks. This may involve the treating clinician and/or may necessitate additional referral to other care providers.

Social Relationships and Health

Although many of the models we have described in this chapter support the complex role of biology and physiology, personal characteristics and social factors (e.g. biopsychosocial model), less is known about the direct role of social factors in the health and management of patients with musculoskeletal disorders. In general, researchers have determined that people with social support and social ties, regardless of their source, live longer than people who are isolated (Putnam, 2000). People with a close network of ties with other people maintain better health, resist disease and deal more successfully with problems they encounter (Putnam, 2000; Guidi et al., 1998). People who are socially isolated and have fewer social relationships have been found to have mortality rates two to five times higher than those with good social relationships, regardless of gender, race, ethnic background and socioeconomic status (Berkman, 1985; Cohen et al., 2000).

As it relates to health and outcomes, assessment of a patient's social contacts and resources could lead to newer treatments and improved outcomes. Social integration and social networks are terms used to describe the existence and quantity of social connections that an individual has available as resources. Social integration is used to establish the existence of social ties (Berkman, 1985) and refers to having open and honest relationships with others. Families or work colleagues who engage in open communication about current and personal issues would be seen as having social integration. Social network is another social construct that describes the interconnectedness of social relationships that surround an individual (Cohen et al., 2000). Researchers investigating social networks describe the types and numbers of other individuals that someone interacts with. People who engage with neighbours, attend church, or participate in interest or civic engagement groups are examples of individuals who have strong and varied social networks. Together, social integration and social networks describe the existence and quantity of social connections that an individual has available.

Social support is another social-level concept that illustrates not only the existence of a social relationship but also the positive function of that social connection and its potential to play a supportive role specifically in an individual's health (Heaney and Israel, 2002; Schwarzer and Leppin, 1991). Social support is defined as the degree to which a person's basic social needs are met through interaction with other people (Cohen, 1992). It includes tangible and intangible resources, emotional support and informational and instructional support, as well as a person's perception of assistance in times of need. When assessing supportive social influences in health, assessment should include what support is available if needed (i.e. patient's perceived support availability) and functions that are currently being supported (i.e. patient's received support) (Schwarzer and Leppin, 1991; Cohen et al., 2000).

Social Support

The role of social support has evolved in health research and is believed to be a social construct that protects and preserves the well-being of an individual in the face of a

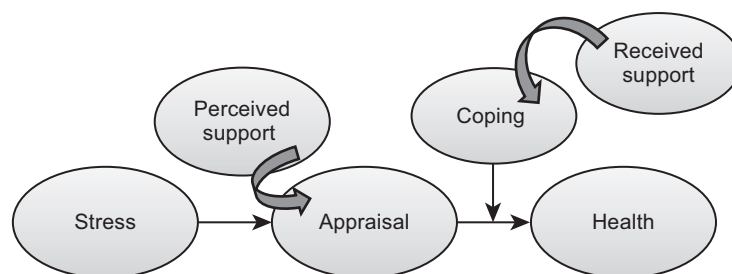


Fig. 3.5 Social support interactions with the stress and coping model. Interactions between perceived support with appraisals as well as received support with coping to modify the effect of a stressor on health.

stressful encounter such as a negative health condition (Cohen et al., 2000). Social support is believed to contribute to global self-evaluations of health (Krause and Borawski-Clark, 1994). In addition, social support serves as a social resource that can assist an individual in his or her capability to cope with stress (Lazarus and Folkman, 1984b). Even though social support comes from an external source, this external support is believed to be able to help protect people from the adverse effects of stress (Fig. 3.5). In the stress and coping literature, social support is a coping resource that can alter beliefs and commitments that can in turn alter how one appraises a stressful situation (Lazarus and Folkman, 1984b).

When considering the role of social support, stressors are believed to act on two different pathways. One pathway is through appraisals of available social support (see Fig. 3.5). The perception that social support is available may protect people from the adverse effects of stressors by leading them to appraise or interpret stressful situations less negatively. For example, a patient with a musculoskeletal disorder with high perceived social support might interpret his or her pain and disability less negatively than a person with low perceived social support and therefore approach the process of treatment and self-management more proactively. Patients' interpretations and reinterpretations of support may moderate their experience of pain and disability before, during and after the treatment process.

The other pathway social support is believed to assist in coping is by actual supportive actions, or received support. Received social support is the actual assistance of others during stress (Cohen and Lichtenstein, 1990; Coriell and Cohen, 1995). Received support is believed to interact with and alter a person's coping abilities in times of stress. This improved coping due to increased received support is theorized to reduce the impact of stress on a person's health (Cohen et al., 2000). When a person can reduce the impact of stress on his or her health, it is theorized that this could be measured through improved health outcomes such as reduced pain and/or disability. Therefore, social support can indirectly influence routine physical measures of pain and disability that are evaluated in patients with musculoskeletal disorders.

Social support can be measured in several ways. One way clinicians and researchers have measured social support is by quantifying the frequency or number of supportive actions a person reports as well as his or her perception of the quality of that received support (Masters et al., 2007). Retrospectively identifying the patient-reported frequency and quality of support received during a specific time period of treatment is an easy way to evaluate the social support beliefs of a patient. In addition, more information can be gained if the patient is asked to identify and report the actual supportive actions that were experienced. Finally, a further step is to investigate how the patient perceived the supportive action and how it interacted with his or her health by rating how the support was helpful or unhelpful. This brings up the key point that not all supportive actions are perceived by patients as helpful. In fact, some supportive actions performed by a healthcare professional, friend or family member may actually hinder the coping process by the individual with the health disorder. It is important to remember that the existence of social supports does not always result in positive coping behaviours by individuals with health conditions. Careful consideration and direct interpretation by a patient are always important to determine if social support plays a positive or negative role in managing stressors related to health.

Application of Social Support in Treatment

Evidence exists on the importance of overall social support in the treatment of chronic diseases, particularly in the treatment of cardiovascular disease (André-Petersson et al., 2007; Amick and Ockene, 1994) and stroke (Glass et al., 1993; Evans et al., 1987; Friedland and McColl, 1987; McLeroy et al., 1984). These studies have shown that improvements in physical functioning and psychological adjustment in cardiovascular and stroke recovery were greater among those with higher sources of social support (Amick and Ockene, 1994; Evans et al., 1987; Friedland and McColl, 1987; Glass et al., 1993; McLeroy et al., 1984; Morris et al., 1991; Stephens et al., 1987). Other studies have shown that social support from all sources positively correlated with increased perceived general health and quality of life after stroke (Angeleri et al., 1993; King, 1996; Handen, 1991). Researchers have also shown lack of social support in general to be associated with negative health consequences, including suicidal thoughts (Kishi et al., 2001), depression (Andersen, 2002), length of hospital stay (Rao et al., 2001), discharge to rehabilitation and nursing home facilities (Marottoli, 1994) and reduced physical functioning (Kawachi et al., 1996; LaCasse et al., 2001).

There is additional evidence that patients with a variety of disease processes benefit from social support from all sources. In one study, Littlefield et al. (1990) found that patients with type II diabetes mellitus had improved function associated with higher total social support scores but worse function associated with higher depression scores. In another study, Yates (1995) surveyed patients with cardiovascular disease who reported that both emotional support and tangible aid from healthcare providers and the patients' spouses were important sources of support for coping with their disease process and improving overall physical recovery. Additionally, Gulick (2001) conducted research involving patients with multiple sclerosis and found that higher total social support scores correlated positively with ADL function scores and inversely with depression scores.

Research investigating arthritis found that social support does mediate the response to the treatment process and function of the patient. In patients with rheumatoid arthritis (RA), Taal et al. (1993) found that tangible or instrumental support by caregivers corresponded positively with improved patient-reported health status and participation in daily physical activities. However, emotional support did not relate to patients' reported health status for this sub-group of patients with RA. Weinberger et al. (1990) illustrated that in research involving patients with osteoarthritis (OA) with concurrent functional limitations, both older age and lower levels of tangible support from caregivers, friends or family were directly associated with greater physical disability. Moreover, in patients with OA, greater psychological disability was associated with lower levels of emotional support from all sources.

Little research has directly examined the association between treatment for many musculoskeletal disorders and the quality or benefit of social support. Masters et al. (2007) investigated whether patients received social support in the treatment process for LBP. Retrospectively, the researchers asked patients who participated in treatment for LBP to indicate which sources of social support they received and whether this support was helpful or unhelpful. Out of the 50 patients surveyed, 43% indicated that they received tangible support from a physiotherapist and physician that was helpful. Thirty-three percent of the patients indicated they received helpful emotional support from physiotherapists, family and friends. Twenty-three percent of the patients additionally reported that they received helpful informational support from physiotherapists. However, 50% of the patients also reported that they received unhelpful emotional support from their family and friends during the treatment process. Additionally, 37% reported receiving unhelpful informational support, and 10% reported receiving unhelpful tangible support from their physicians during the treatment process. Unfortunately, the researchers did not evaluate the relationship of support to other general health, physical function or psychosocial measures. In addition, the researchers did not evaluate the relationship of social support to the outcomes of pain and disability in treatment for LBP. Overall, this study illustrates that social support sources are available and are identified as both helpful and unhelpful in treatment for LBP. Additional research needs to be conducted to understand how social support and

other social factors can impact the experience of pain and disability in LBP and other musculoskeletal disorders and identify ways to best intervene to assist our patients to achieve more optimal outcomes.

Key Points

The presence or lack of social support can influence the experience of pain and disability and affect coping behaviours. Although we don't know enough about which social support interventions are more likely to improve outcomes, clinicians should address the social situation of patients with musculoskeletal conditions. Clinicians should attempt to identify those social supports that play a positive role in the patient's life in order to identify additional resources for management strategies. Additionally, clinicians should attempt to identify support that is interpreted as negative and determine if alternative sources of support could improve coping behaviors. Minimally, positive support from the patient's family, friends and other caregivers can be involved in therapeutic activities, or related social activities could be included in the plan of care for rehabilitation.

Conclusion

A theoretical framework can assist clinicians in understanding psychosocial contributions to musculoskeletal conditions. Table 3.1 summarizes the theoretical framework described in this chapter. It is important for clinicians to understand the complex personal, social and environmental factors that influence health and functioning. Often, coping beliefs and behaviours due to health-related stressors are multifactorial. Early identification and assessment of these complex issues can assist clinicians in identifying resources and treatment approaches that enhance function and outcomes.

TABLE 3.1

FACTORS TO INCLUDE IN ASSESSMENT OF PATIENTS WITH MUSCULOSKELETAL CONDITIONS

Stressors

1. Pain and disability
 - a. Biopsychosocial model
 - b. Stress-diathesis model
 - c. ICF framework

Coping

1. Perception/appraisal of the condition and how much control the patient feels
2. External/environmental factors influencing activity participation (contextual)
3. Personal factors influencing activity participation (contextual)
4. Coping beliefs and behaviours
 - a. Self-rated health
 - b. Self-efficacy
 - c. Positive application of social support

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Assessment, Reasoning and Management of Psychological Factors in Musculoskeletal Practice

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Pain and associated disability are an overall experience and not simply isolated sensory, emotional or physiological responses ([Institute of Medicine, 2011](#); [Sim and Smith, 2004](#)). Pain and disability occur in both a psychological and sociocultural context. As reflected in the International Classification of Functioning, Disability and Health (ICF) of the [World Health Organization \(2001\)](#) biopsychosocial framework depicted in [Chapters 1](#) and [3](#), biological and psychosocial factors interact reciprocally in determining patients' pain and disability experiences that are both individual and complex ([Borrell-Carrio et al., 2004](#)). Within the literature, the term 'psychosocial' is commonly used as a single construct capturing both psychological and social influences. However, although psychological and social factors are intimately associated with each other, and in turn with pain and disability, they are individually comprised of specific characteristics that need to be understood and considered in musculoskeletal clinicians' patient assessment and management. Although the 'psychosocial' construct is used within this chapter because it is more broadly linked to the literature, this chapter focuses on psychological factors, with [Chapter 3](#) focussing more explicitly on the influences of stress, coping and the interaction of social factors.

An important point to establish at the outset of this chapter is that psychological factors should not all be construed as negative. As an example, as discussed in [Chapter 3](#), high self-efficacy related to pain-provoking tasks has been identified as a positive prognostic indicator for musculoskeletal pain clinical outcomes ([Foster et al., 2010](#); [Sarda et al., 2009](#)). Building on the clinical reasoning theory in [Chapter 1](#) and the theoretical foundations for the interaction between psychological and social factors covered in [Chapter 3](#), this chapter discusses clinical reasoning associated with the identification and management of psychological factors that have been described as complications associated with recovery because they provide modifiable treatment targets.

There is increasing evidence that negative psychosocial factors are adversely influential in the transition from acute to chronic pain conditions ([Burton et al., 1995](#); [Linton, 2000](#); [Linton, 2005](#); [Nicholas et al., 2011](#); [Chou et al., 2007](#); [Chou and Shekelle, 2010](#)). For example, a systematic review involving psychological factors as prognostic indicators for persistent pain and disability suggests there can be consistent relationships between depression, pain catastrophizing, pain intensity and beliefs about pain with future clinical or occupational outcomes in patients with acute or subacute low back pain (LBP) ([Nicholas et al., 2011](#)). A similar, yet separate systematic review involving predictors of poor clinical outcomes indicated that nonorganic signs, elevated maladaptive pain coping behaviors, elevated baseline LBP-related disability, the presence of psychiatric comorbidities and low general health status were the strongest predictors of poor clinical outcomes at 1-year follow-up ([Chou and Shekelle, 2010](#)). The theoretical foundations of coping beliefs and behaviours, pain, disability and general health status are covered in [Chapter 3](#). Although most of the previous research in this area has explored the influence negative psychological factors have on LBP outcomes, it seems plausible (from a theoretical perspective) that

similar relationships may be relevant for musculoskeletal pain complaints in other body regions (Nicholas et al., 2008; Hunt et al., 2013; Sullivan et al., 2006, 2009; George et al., 2007, 2011; Hartigan et al., 2013). Similarly, although not the focus of research, psychological factors can impact positively and negatively on any patient, and negative factors can contribute to attitudes, beliefs and behaviours that underpin the slow recovery and recurrence of any problem, thus supporting their screening in all patients.

Key Points

- Pain and associated disability occur in both a psychological and sociocultural context which creates an overall experience and not simply isolated sensory, emotional or physiological responses.
- Psychological factors are an important component within the biopsychosocial framework.
- Considering the wide spectrum of psychological factors, their influence on musculoskeletal pain clinical outcomes can be either positive or negative.
- There is increasing evidence that negative psychosocial factors are adversely influential in the transition from acute to chronic pain conditions.

Musculoskeletal Clinicians' Lack of Knowledge and Ability to Assess and Manage Psychological Factors

Although musculoskeletal clinicians are generally well educated to assess and manage the physical and many environmental dimensions of the patient's health condition, formal education and experience assessing, evaluating and managing psychological and social factors contributing to both acute and chronic pain are often less developed and less structured (Barlow, 2012; Bishop and Foster, 2005; Foster and Delitto, 2011; Main and George, 2011; Overmeer et al., 2005; Sanders et al., 2013; Singla et al., 2015). This was evident in survey responses from Australian primary care clinicians ($n = 651$), including musculoskeletal specialists ($n = 255$; 39.2%), that indicated formal psychosocial screening is not common (Kent et al., 2009). These results are alarming when one considers that formal screening has been shown to be more accurate than informal judgement (Spitzer et al., 1994; Haggman et al., 2004). Therefore, it seems apparent that embedding attention to psychological factors into musculoskeletal clinicians' management strategies is faced with several challenges, including inconsistency in breadth and depth of psychosocial education during entry-level study, competency in application of theory to practice (which is difficult to measure) and clinician culture (Foster and Delitto, 2011; Main and George, 2011). Most notably, biomedical or impairment-based perspectives are predominantly emphasized during the formal education and ongoing professional development of many musculoskeletal clinicians, with little, if any, content being provided from a biopsychosocial perspective (Foster and Delitto, 2011; Main and George, 2011; Smart and Doody, 2007; Daykin and Richardson, 2004; Bishop and Foster, 2005; Simmonds et al., 2012). Further complicating this issue is that collectively and traditionally, there has been a lack of clear knowledge regarding musculoskeletal clinicians' psychosocial assessment, reasoning and management best practice (Linton and Shaw, 2011; Nicholas et al., 2011; Foster and Delitto, 2011). However, suggestions have been put forward (Jones and Edwards, 2008), and a growing body of literature is now available informing musculoskeletal clinicians' psychosocial assessment and management, as well as underpinning reasoning (French and Sim, 2004; Hasenbring et al., 2012; Jones and Edwards, 2008; Keefe et al., 2006; Main et al., 2008).

Key Points

- Traditionally, musculoskeletal clinicians do not receive adequate training in biopsychosocial perspectives of patient management.
- Clinical reasoning has strong potential to be enhanced through standardized screening of psychological factors.

The 'Flag' System of Screening for Psychosocial-Related Risk Factors

The 'flag' system has been suggested as a framework to classify patients and assist in clinical decision-making processes based on colours representing different types of risk factors (Nicholas et al., 2011; Main and George, 2011):

- Red flags – serious pathology (e.g. fracture)
- Orange flags – psychopathology (e.g. clinical depression)
- Yellow flags – psychological reactions to symptoms (e.g. fear-avoidance beliefs about physical activity)
- Blue flags – perceptions about work and health relationships (e.g. belief that increased work will lead to further injury)
- Black flags – healthcare system influence on clinical decisions and contextual factors (e.g. insurance restrictions, socioeconomic status)

Although sociocultural influences outside the workplace and healthcare system (e.g. family, community, government, etc.) are not represented in the flag classifications, they are equally important to consider, as discussed in Chapter 3.

An important component to incorporating the flag system into musculoskeletal practice is the ability to distinguish between different types of clinical decisions (Nicholas et al., 2011). 'Psychologically informed practice' has been presented as a secondary prevention approach for chronic musculoskeletal pain that integrates both biomedical (focused on pathology or physical impairments) and cognitive-behavioural (focused on psychological distress or behaviour) principles (Main and George, 2011). Psychologically informed practice also underpins cognitive-behavioural approaches used for patients who may be experiencing recurrent symptoms or have already progressed to chronicity. The primary goal of psychologically informed musculoskeletal practice is minimization of current and future disability related to musculoskeletal pain by emphasizing (1) identification of individuals who are at high risk for developing chronic or recurrent symptoms based on the presence of psychological factors and (2) targeted treatment aimed at psychological factors in conjunction with traditional, impairment-based therapy (Main and George, 2011). Therefore, although screening for 'red flags' as indicators of serious pathology is an important component of routine clinical practice, psychologically informed practice is predominantly characterized by screening for elevated and functionally maladaptive 'yellow flags' to identify patients at risk for poor outcomes primarily based on psychological factors that potentially can be targeted through direct therapeutic intervention.

It is also important to distinguish between modifiable and non-modifiable psychosocial risk factors from a musculoskeletal intervention perspective because both may be strong predictors of future outcomes and can be identified through screening. Some psychosocial risk factors are non-modifiable through musculoskeletal clinical intervention. For example, social class has been identified as a predictor of poor outcome in patients with neck pain treated by physical therapists (Hill et al., 2007); however, it is non-modifiable through musculoskeletal clinical intervention. From a psychological perspective, Main and George (2011) have suggested that the ability to distinguish between modifiable and non-modifiable risk factors based on the flag system is a critical component of psychologically informed practice because musculoskeletal clinicians are not trained to address all psychological risk factors. For instance, properly trained musculoskeletal clinicians are equipped to identify and provide interventions tailored to addressing yellow flags (e.g. maladaptive pain coping), which are considered modifiable psychological risk factors. However, it is not within the scope of musculoskeletal practice to provide direct treatment interventions that target orange flags (e.g. clinical depression), which are considered non-modifiable psychological risk factors, through direct musculoskeletal treatment interventions alone. Therefore, orange flag screening combined with frequent and early re-assessment is a vitally important role for musculoskeletal clinicians during the ongoing clinical reasoning process to determine if referral to other healthcare professionals (e.g. clinical psychologist) is warranted. Similar to screening for visceral disease masquerading as a musculoskeletal disorder, the appropriately trained musculoskeletal clinician's role in orange flag screening is, for example, to screen for symptoms of clinical depression and other psychological disorders (e.g. anxiety) and

not to diagnose psychological or psychiatric disorders. Just as every clinical feature listed as a potential red flag does not necessitate immediate referral, not every patient with elevated depressive symptoms will need to be referred to a psychologist or back to the referring practitioner. This is an area requiring more attention in musculoskeletal education to assist clinicians to be able to recognize indicators warranting immediate referral or consultation (e.g. suicidal tendencies, features of post-traumatic stress syndrome). Musculoskeletal clinicians are advised to add this screening to their current patient assessment, to monitor any overt symptoms linked to orange flags and to consult with the referring practitioner or a psychologist when uncertain about the significance of such symptoms.

Psychosocial yellow flags are probably the most manageable from a musculoskeletal clinical perspective; therefore, increased emphasis should be placed on clinical reasoning associated with information obtained from yellow flag assessments to identify individuals who may benefit from psychologically based interventions (Nicholas and George, 2011). Expert musculoskeletal clinicians have been shown to employ a range of 'clinical reasoning strategies' incorporating different foci of reasoning, including psychosocially oriented reasoning (i.e. 'narrative reasoning') (Edwards et al., 2004) as discussed in Chapter 1. Expanding your knowledge of theoretical constructs that characterize pain coping behaviours, as covered in Chapter 3, combined with an understanding of narrative reasoning, will facilitate clinical assessment, analysis and management of yellow flags for patients experiencing musculoskeletal pain.

Key Points

- The flag system is a framework to classify different types of risk factors by colour to assist clinicians' recognition, reasoning and management of such factors in their patients.
- Psychologically informed practice is a secondary prevention approach for chronic musculoskeletal pain that integrates both biomedical and cognitive-behavioural principles.
- Psychologically informed practice is also used for patients who are experiencing recurrent symptoms or have already progressed to chronicity. Psychologically informed practice emphasizes (1) identification of individuals who may be at high risk for poor clinical outcomes and (2) targeted treatment aimed at psychological factors in conjunction with traditional, impairment-based therapy.
- Clinical reasoning can be enhanced when clinicians are able to distinguish between modifiable and non-modifiable psychosocial risk factors.

Psychosocial 'Yellow Flag' Screening and Assessment Process

The intent of primary prevention is the protection of health by personal and community-wide efforts. As a potential component of primary prevention, screening can provide valuable information regarding risk factors for future disease among healthy individuals in the general population (e.g. demographics or lifestyle) (Straus et al., 2005). However, screening is also commonly associated with secondary prevention processes where the intent is early identification of individuals with the potential for poor future outcomes (e.g. disability related to musculoskeletal pain). Early risk factor screening has been advocated as one strategy to identify patients who may be at risk of poor clinical outcomes and as a potential method to improve the efficiency and effectiveness of care (Pransky et al., 2011; Hill and Fritz, 2011; Chou et al., 2007). Risk factor screening can be achieved by questionnaire and by patient interview. Validated questionnaires provide quantitative measurement of psychological factors while also opening the door to important areas of assessment patients may not spontaneously volunteer. Information provided via questionnaire can then be explored further through the patient interview for a fuller understanding of the patient and psychological factors that may be contributing to the patient's pain and disability.

Although psychosocial factor screening to inform psychologically informed management has mostly been investigated and discussed in the area of LBP, the overarching premise of routine screening may have applicability to many if not all musculoskeletal conditions (Nicholas et al., 2008, 2011).

Psychological Factor Screening by Questionnaire

Self-report psychological factor screening questionnaires are commonly used by clinicians as a component of the assessment process. The design of these questionnaires can range from unidimensional measures that provide an assessment of a specific psychological construct to multidimensional measures that provide an assessment of overall psychological distress. Each of these approaches is associated with strengths and weaknesses. For example, a potential weakness in using unidimensional questionnaires is that they do not provide information beyond the targeted psychological factor(s) of interest. In addition, it has been suggested that many commonly used unidimensional psychological screening instruments (e.g. Tampa Scale of Kinesiophobia) may be better suited for patients with persistent pain, rather than acute or sub-acute pain (Nicholas et al., 2011). On the other hand, there are potential benefits of using multidimensional instruments with a small number of items (e.g. STarT Back screening tool) for estimating patient risk of a poor outcome (based on assessment of modifiable risk factors), for example, with respect to disability, return to work and, to a lesser extent, pain (Nicholas et al., 2011; Hill and Fritz, 2011; Chou et al., 2007; Chou and Shekelle, 2010; Karran et al. 2017). Considering time is commonly indicated as a barrier to administering and interpreting questionnaires with patients in clinical settings, the use of brief multidimensional measures that have prognostic value while also highlighting for the clinician areas to explore further through the patient interview is potentially advantageous. However, although a potential strength of multidimensional questionnaires is their broader screening of psychological distress, they do not provide detailed information on specific psychological factors that may serve as behavioural treatment targets. Therefore, in later sections of this chapter, we describe a two-step screening approach that consists of using multidimensional measures to identify those patients at high risk for poor outcomes and then further screening those high-risk patients using unidimensional measures and the patient interview.

Disability and health screening questionnaires are often completed as part of an intake process. We suggest these include an initial multidimensional psychosocial screening tool. Although unidimensional psychosocial screening questionnaires can also be completed at that time, this would require prior review of the multidimensional screening scores and a judgment on which unidimensional measures to use. Also, the administering of excessive questionnaires at the one time can be overwhelming to patients. Therefore, completion of a multidimensional screening measure followed by the patient interview may be more feasible for clinical practice, and together both will assist in identifying the need for and selection of the more focused unidimensional psychosocial questionnaires to subsequently administer.

Key Points

- Multidimensional measures are capable of providing a general assessment of overall psychological distress.
- Unidimensional measures are capable of providing a more comprehensive assessment of a specific psychological construct.
- Both multidimensional and unidimensional measures are associated with individual strengths and limitations.
- We suggest clinicians attempt to incorporate both multidimensional and unidimensional measures (if appropriate), in conjunction with a thorough patient interview, to enhance the assessment of psychological distress and associated clinical reasoning.

Examples of Multidimensional Measures

STaRT Back Screening Tool (SBT)

The SBT is a nine-item measure used to identify subgroups of patients associated with different levels of risk for persistent LBP-related disability based on the presence of modifiable prognostic factors which may be useful in matching patients with targeted interventions (Hill et al., 2008). The SBT contains items related to physical and psychosocial factors that have been identified as strong independent predictors for persistent, disabling LBP. The SBT overall score (ranging from 0 to 9) is determined by summing all positive responses, and the SBT psychosocial subscale score (ranging from 0 to 5) is determined by summing items related to bothersomeness, fear, catastrophizing, anxiety and depression. Based on the patient's responses, the SBT categorizes the patient as either 'high risk' (psychosocial subscale score ≥ 4), in which high levels of psychosocial prognostic factors are present with or without physical factors being present; 'medium risk' (overall score >3 , psychosocial subscale score <4), in which physical and psychosocial factors are present, but not a high level of psychosocial factors; or 'low risk' (overall score 0–3), in which few prognostic factors are present (Hill et al., 2008). Other studies on the horizon should (and will) further evaluate the capabilities of these multidimensional tools and do so in different capacities (i.e. purely prognostic capabilities versus treatment that is provided based on stratification strategies) while also evaluating different screening instruments' prognostic accuracy for specific outcome parameters. For example, Karran et al. (2016) demonstrated that the accuracy of the risk assessment classification via a range of prognostic screening instruments administered within the first 3 months of an episode of LBP is best for predicting return to work ($>80\%$ probability), somewhat less accurate for predicting persistent disability (70%–80% probability), and least accurate for predicting persistent pain (60%–70% probability), highlighting the importance of considering different outcome dimensions when seeking prognostic information. As with any new and evolving area of research, clinicians need caution in relying on a single measure, and hence the three-dimensional approach to psychosocial factor assessment recommended in this chapter incorporates multidimensional questionnaires, unidimensional questionnaires and the patient interview.

Örebro Musculoskeletal Pain Screening Questionnaire (OMPSQ)

The OMPSQ was originally developed to assist primary care practitioners in identifying psychosocial 'yellow flags' and patients at risk for future work disability due to pain. The OMPSQ is a 25-item screening questionnaire (of which 21 are scored) that consists of items involving pain location (item 4), work absence due to pain (item 5), pain duration (item 6), pain intensity (items 8 and 9), control over pain (item 11), frequency of pain episodes (item 10), functional ability (items 20–24), mood (items 12 and 13), perceptions of work (items 7 and 16), patient's estimate of prognosis (items 14 and 15) and fear avoidance (items 17–19) (Linton and Hallden, 1997). The scored items are summed to provide a total score potentially ranging from 0 to 210, with higher scores indicating a higher risk of poor outcome. The ability of the OMPSQ to predict long-term pain, disability and sick leave has been supported in previous studies (Maher and Grotle, 2009), including a notable systematic review (Hockings et al., 2008). Karran et al. (2016) similarly found the OMPSQ was 'excellent' for discriminating workers at risk of prolonged absenteeism, and they reported that this was regardless of country and across varied clinical settings, supporting its wider utility for return-to-work risk assessment. A 10-item short-form OMPSQ (Linton et al., 2012) has been shown to have similar properties to the long version.

Examples of Unidimensional Measures

Fear Avoidance Beliefs Questionnaire (FABQ)

The FABQ assesses the degree of fear-avoidance beliefs specific to LBP (Waddell et al., 1993); however, modified versions have been used for other body regions (Piva et al., 2009; Hart et al., 2009; Cleland et al., 2008; Simon et al., 2011). The FABQ consists of a 4-item FABQ physical activity scale (FABQ-PA; score potentially ranging from 0 to 24) and a 7-item FABQ work scale (FABQ-W; score potentially ranging from 0 to 42), with higher scores indicating higher levels of fear avoidance for both FABQ scales.

Pain Catastrophizing Scale (PCS)

The PCS assesses the degree of exaggerated negative orientation toward actual or anticipated pain experiences and catastrophic cognitions due to musculoskeletal pain (Sullivan et al., 1995). The PCS consists of 13 items with a potential score range from 0 to 52, with higher scores indicating higher levels of pain catastrophizing (Sullivan et al., 1995).

Tampa Scale of Kinesiophobia (TSK-11)

The TSK-11 assesses the degree of fear of movement and injury or re-injury (Woby et al., 2005). The TSK-11 consists of 11 items with a potential score range from 11 to 44, with higher scores indicating greater fear of movement and increased injury or re-injury due to painful symptoms.

Pain Anxiety Symptoms Scale (PASS-20)

The PASS-20 assesses the degree of pain-related anxiety symptoms for individuals with pain disorders (McCracken and Dhingra, 2002). The PASS-20 consists of 20 items with a potential score range from 0 to 100, with higher scores indicating elevated symptoms of pain-related anxiety.

Patient Health Questionnaire (PHQ-9)

The PHQ-9 assesses the degree of depressive symptoms (Kroenke et al., 2001). The PHQ-9 consists of nine items with a potential score range from 0 to 27, with higher scores indicating elevated depressive symptoms.

Pain Self-Efficacy Questionnaire (PSEQ)

The PSEQ assesses the degree of self-efficacy beliefs in the context of pain that can be either low or high (Nicholas, 2007). The PSEQ consists of 10 items with a potential score range from 0 to 60, with higher scores indicating elevated levels of pain-related self-efficacy, which is a positive prognostic indicator.

Chronic Pain Acceptance Questionnaire (CPAQ)

The CPAQ assesses the degree of pain acceptance from a functional perspective by focusing on behavioural aspects (McCracken et al., 2004). The CPAQ consists of 20 items with a potential score range from 0 to 120, with higher scores indicating an increased level of pain acceptance, also a positive prognostic indicator.

Brief Illness Perception Questionnaire (Brief IPQ)

The Brief IPQ assesses cognitive and emotional representations of illness (Broadbent et al., 2006). The Brief IPQ consists of nine items rated using a 0–10 scale, except for the causal question. Five of the items assess cognitive illness representations: consequences (item 1), timeline (item 2), personal control (item 3), treatment control (item 4) and identity (item 5). Two of the items assess emotional representations: concern (item 6) and emotions (item 8). One item assesses illness comprehensibility (item 7). An open-ended response is provided so that patients are able to list the three most important causal factors of their illness (item 9).

Psychological Factor Screening by Patient Interview

The patient interview is an essential component of a musculoskeletal clinical examination, with respect to both information gathering and associated clinical reasoning and establishment of the patient–therapist therapeutic alliance. It provides the framework for psychological factor screening by questionnaire in an iterative process, with questionnaires providing standardized, measurable assessments supplemented by more in-depth exploration and qualification through the initial patient interview and ongoing discussions. Assessing for psychological factors by interview and questionnaire interconnects to the ‘patient’s perspective on his or her experience’ hypothesis category discussed in Chapter 1. Formulation of unique patient perspectives associated with pain and disability experiences was discussed

in greater detail in [Chapter 3](#). Assessment of patient perspectives incorporates aspects such as the following:

- Patients' understanding of their problem (including attributions about the cause, beliefs about pain and associated cognitions)
- Patients' responses to stressors in their lives and any relationship these have with their clinical presentation
- Effects the problem and any stressors appear to have on patients' thoughts, feelings, coping, motivation and self-efficacy to actively participate in management and the recovery process
- Effects the problem and any stressors appear to have on patients' work or social participation
- Patients' goals and expectations for management

When assessing patients' perceptions of their problem (e.g. diagnosis, pain), it is important to question sufficiently to discover their unique perspectives with respect to the potential nature of cause, management and likely recovery trajectory – that is, their 'illness (problem) schema' ([Leventhal et al., 1980](#)). As [Chapter 3](#) describes, research into patients' health and disability perspectives highlights important components that make up patients' understanding/beliefs and concerns about their problem. Greater understanding of the components that comprise patients' perceptions of their problems assists in knowing what to listen for and what to more overtly screen for, as psychosocially oriented information often emerges spontaneously during patient and clinician interactions. The 'self-regulation model' proposes that internal (e.g. experience of symptoms) and external (e.g. medical, family, media warnings) experiences that patients perceive as threats (e.g. to body/health, self, life, etc.) lead patients to develop individual illness perceptions or schemas that determine how they respond to those threats ([Leventhal et al., 1998](#)). Illness perceptions represent individuals' implicit theories of their health problem(s) that they use in order to interpret and respond to health threats (see also the discussion of the stress and coping model in [Chapter 3](#)). Illness perceptions across different musculoskeletal pain conditions have been shown to be related to the severity of pain, affective distress, muscle and joint tenderness, pain-related disability and poor treatment outcome ([van Wilgen et al., 2014](#)). These schemas are learned (consciously or unconsciously) through social and personal experiences and are comprised of the following elements:

- A label that identifies the problem (e.g. 'disc prolapse')
- Beliefs regarding how long they expect the problem to last
- Beliefs regarding what caused the problem
- Beliefs regarding the problem's likely effects (immediate and long-term consequences or prognosis)
- Beliefs regarding management and potential for change or coping strategies

There are also a range of dimensions that people use in evaluating their health problem, including their perception of its seriousness (e.g. self-limiting versus can't be helped), extent of impact on their life (work, family, sport, social), self-concept and self-worth (e.g. embarrassed, shame, guilt) and changeability or controllability. Therefore, it is not only patients' existing beliefs and assumptions that make up their illness perceptions and contribute to determining their coping strategies, but, as discussed in [Chapter 3](#), it is also their 'primary appraisal' of the threat their health condition/problem poses and their 'secondary appraisal' of its controllability. This highlights the importance of assessing, and if necessary addressing through education and cognition-targeted activities and exercise ([Nijs et al., 2011, 2014](#)), the patient's threat appraisal ([Jones and Edwards, 2006](#); [Louw and Puentedura, 2018](#); [Moseley, 2004](#); [Moseley and Butler, 2017](#)).

While questioning to understand the patient's activity and participation restrictions and capabilities, areas to listen for and explicitly screen as part of a psychological factor assessment by clinical interview can include the following:

- What are the patient's perspectives of his or her pain/disability experience with respect to the following:
 - Their understanding of the diagnosis/problem?
 - Their understanding of pain (e.g. acute versus chronic)?
 - Excessively negative cognitions (e.g. catastrophizing) associated with the problem?

- Their emotions (e.g. depressive symptoms, feelings of vulnerability) associated with the problem?
- Their goals and future predictions?
- Their expectations and beliefs about management and their role in management?
- What is the basis of the patient's beliefs and expectations?
- How does the patient think he or she is perceived by partner, workmates and employer, and how does this affect how the patient feels about him- or herself with respect to:
 - What they can and cannot do?
 - Their perceptions of their contributions?
 - Their self-concept and conception of self-worth?
- Does the patient perceive they have social support from family, friends, work mates, employers?
- How is the patient coping, emotionally (e.g., anger, depressive symptoms, feelings of vulnerability, etc.) and behaviorally? Do they have any specific coping strategies (e.g. medication, rest, alcohol, medication, exercise, avoidance), and if so, are they effective?
- Is change important to the patient? If so, to what extent and in regard to what domain? Does the patient display self-efficacy to positively contribute to change? What tasks does the patient currently believe he or she can perform? What tasks does the patient believe he or she will be able to return to following management?
- What is the patient's threat appraisal with respect to:
 - Seriousness?
 - Vulnerability?
 - Extent of impact on their life, on activity and participation (work, home, sport, social), and on their relationships?
 - Changeability and controllability?

These areas should be considered as a suggested framework only, and not as a prescribed list or set sequence of questions that must be followed. Realistically, there will be some degree of overlap in regard to patient perspectives and threat appraisal because they are both capable of influencing one another to a certain extent, particularly for individuals experiencing chronic musculoskeletal pain. Whereas patient interview questions directed at understanding the patient's problem(s) and associated musculoskeletal 'diagnostic reasoning' typically follow a routine structure, question timing and structure to assess psychosocial status will vary according to a patient's readiness for this line of enquiry and the rapport established. Although some patients will spontaneously offer much of this information (hence the importance of knowing what to listen for), for others, it will take longer for them to feel comfortable discussing non-physical issues related to their problem. This point emphasizes the importance of establishing a therapeutic alliance with an effective collaborative relationship between the patient and clinician very early during an episode of care. When assessing patient perspectives by interview, commencing with a question regarding the patient's understanding of the problem followed by clarification of why the patient has that understanding is less intrusive and hence generally accepted. Moreover, acknowledging patient efforts to change (i.e. improve) whenever possible is recommended because this strategy will potentially help foster a collaborative relationship and enhance patient motivation. If clues in the patient interview regarding, for example, patient fears, repeated negative statements, stress, adverse coping or depression do emerge, then further assessment through the use of unidimensional questionnaires can still be conducted.

Three Avenues for Psychological Factor Screening and Monitoring

Thus, as the reader might have gleaned, three avenues exist for psychological factor screening: direct communication with the patient in the form of formal interview and ongoing discussions, and both multidimensional and unidimensional questionnaires (Beneciuk et al., 2014; Mirkhil and Kent, 2009; Nicholas et al., 2011; Bergbom et al., 2014). Traditionally, screening for pathological disease (e.g. cardiovascular disease) should occur prior to the onset of symptoms, with one rationale being that the risk of poor outcome is decreased if certain diseases are detected early and managed accordingly. This rationale for early screening can also be applied to psychological factors which have the potential to adversely

influence musculoskeletal pain outcomes (e.g. transition to chronicity) if not identified and addressed early during the episode of care.

A concrete example of the three-avenue screening process would consist of (1) the patient interview to understand, in conjunction with diagnostically oriented inquiries, the patient's context (e.g. living, work, social and economic circumstances, activity/fitness/exercise behaviours) and the patient's 'perspectives on the pain/disability experience'; (2) a multidimensional measure (e.g. STarT Back screening tool for patients with LBP) to identify those at high risk of persistent disability primarily based on the influence of psychological factors; and (3) unidimensional measures to specifically identify psychological factors to target with treatment (e.g. pain-related fear) that should be administered close to initiating treatment and can be used to monitor responses to psychologically informed interventions. Although we are suggesting that unidimensional measures be used specifically for patients identified as being at high risk for persistent disability, we also acknowledge that they may similarly enhance clinical reasoning for other patients when, in certain cases, the adverse influence of a particular psychological construct may become apparent during the patient interview, thus requiring more objective assessment. Ongoing discussions with the patient are then iteratively used to clarify select responses from multidimensional and unidimensional screening questionnaires and to provide further depth of understanding regarding the patient's perspectives on his or her experiences (Fig. 4.1).

Utilization of multidimensional and unidimensional (if appropriate) questionnaires will ensure a standardized screening and assessment process for all patients that will provide information to enhance clinical reasoning regarding psychological (yellow flag) factors. On the other hand, lack of a standardized assessment process can lead to self-selecting which patients are best suited for psychological factor screening, which has the potential to bias clinical decision-making. The patient interview provides further screening and allows for open-ended responses which may provide additional insight related to the patient's perspective. Ongoing follow-up communication to clarify responses from unidimensional measures and continued exploration of the patient's pain and disability experiences that often emerge as the therapeutic relationship develops are both important and should continue during the entire episode of care. That is, understanding a patient's psychosocial status takes time, and clinicians should be cognisant that initial findings may change rapidly for better or worse following communication with a healthcare provider and initiation of treatment. Facilitation of self-disclosure is a specific strategy that can be used to encourage patients to discuss their concerns about their problems and may serve as a method to collaboratively engage patients in clinical decision-making. For example, item responses on unidimensional

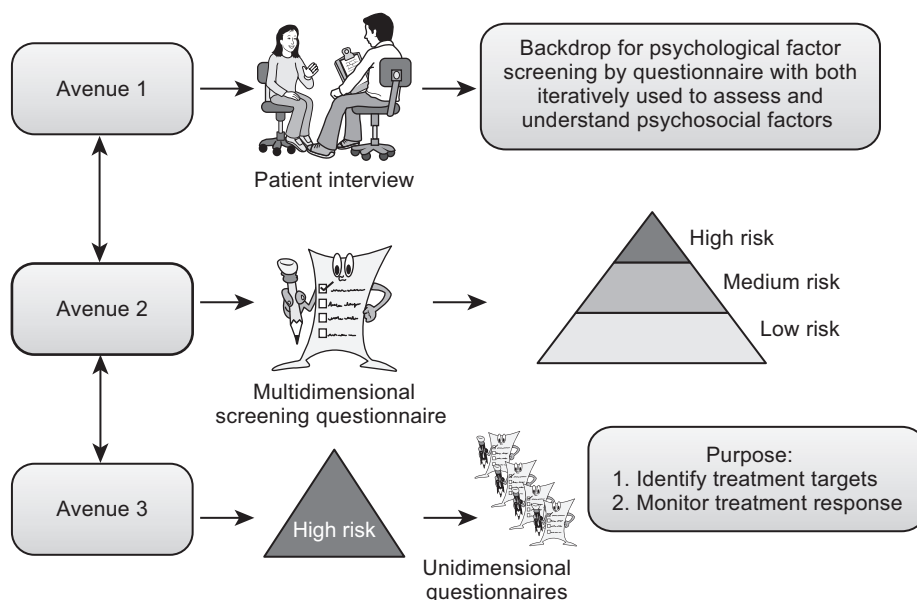


Fig. 4.1 Iterative three-avenue psychological factor screening.

questionnaires (e.g. TSK-11) can be more fully understood by having patients elaborate as to why they feel they may become injured with exercise (as a specific example). It is essential that patients understand that the purpose of discussion regarding the completed questionnaire is to better understand their perspectives on their responses. Following this explanation, it is best to employ open questions regarding completed questionnaires, such as, 'After reviewing your responses, I realize that you may be fearful of certain activities because you think they will make your problem worse – can you tell me more about that?'

Collectively, responses from multidimensional measures and information gathered during the patient interview can guide whether unidimensional psychosocial measures need to be administered, and if so, which constructs require further exploration that can subsequently be targeted with psychologically informed interventions and monitored accordingly. In the event that the patient is not identified as being at high risk for a poor outcome using multidimensional measures, and the interview also does not suggest further screening is necessary, then the administration of unidimensional measures is arguably not required. However, as previously discussed, further questioning regarding the patient's perspectives on his or her experiences is still warranted to fully understand the 'person behind the problem'.

An additional consideration is that information obtained during psychological assessment has the potential to vary based on the timing (e.g. pre-treatment, over an episode of care, post-treatment) and number of repeated assessments (Wand et al., 2009; Dunn and Croft, 2006; Sieben et al., 2002; Turner et al., 2007; Hart et al., 2011; Werneke et al., 2011), with some studies indicating that changes in psychological risk factors may improve the prediction of clinical outcomes when compared with pre-treatment assessments (Sieben et al., 2002; Turner et al., 2007; Hart et al., 2011; Werneke et al., 2011). The clinical relevance of these findings is that changes in psychological risk factors have potential not only for use as prognostic indicators administered at the initial patient encounter but also for treatment monitoring (i.e. re-assessment) during a patient encounter, particularly for psychologically oriented interventions (van der Windt et al., 2008; Nicholas et al., 2011; Bergbom et al., 2014). Although potentially appealing, using a single measure for multiple purposes (e.g. prognostic screening and treatment monitoring) is not always appropriate because many screening measures were developed to be used only as brief triage instruments and are not capable of providing specific information or being responsive to change. Nevertheless, if, for example, a patient's beliefs regarding the problem were judged to be unhelpful and possibly contributing to the patient's pain and disability, those beliefs would not only be targeted within both the education and physical activity or exercise management provided, they would also need to be reassessed to determine if those negative beliefs had changed for better or worse throughout the course of management (see the research on social support and LBP discussed in Chapter 3 for a further perspective). Therefore, we advocate for early re-assessments during an episode of care so that the clinician is provided with important clinical decision-making information that can be used to determine whether treatment modifications are required, sooner as opposed to later.

Key Points

- The patient interview provides an avenue to understand the patient's context and perspectives on his or her pain and disability experience, and related categories of information regarding patient perspectives to listen for and screen are proposed.
- A multidimensional measure provides an avenue to identify patients at high risk for poor clinical outcomes primarily based on the influence of psychological factors.
- Utilization of unidimensional measures (if appropriate) provides an avenue to enhance clinical reasoning regarding psychological (yellow flag) factors.

Psychological Factor Management

Several opportunities exist for musculoskeletal clinicians to provide interventions that target psychological factors that may influence the development and maintenance of chronic musculoskeletal pain and therefore enhance musculoskeletal management generally. We

fully acknowledge that in extreme cases, psychological distress could require referral to another provider. However, more commonly, psychological distress is a precursor of delayed recovery or an indication for psychologically informed interventions that could provide better outcomes than standard treatment approaches alone (Nicholas and George, 2011; Nicholas et al., 2011).

It is important to appreciate that stress in a person's life can be minor or more significant; that is, it occurs along a continuum. Similarly, the psychological response to stress (distress) also occurs along a continuum. Pincus and colleagues (Pincus and Morley, 2001; Pincus, 2004; Rusu and Pincus, 2012) discuss continuums of stress and distress associated with pain and disability. Some patients present with selective attention to sensory information, low levels of fear avoidance of movement perceived as dangerous and frustration with their activity and participation restrictions. Many of these patients will either adjust to this themselves over time or will respond well to education and activation strategies, such as graded activity. Generally, the greater the pain- and disability-associated stress, the greater the distress, with the emergence of catastrophizing cognitions, hypervigilance and broader fear avoidance being common in chronic pain presentations. Higher levels of distress where the person's negative cognitions and emotions regarding his or her pain and disability become integrated with the person's self-concept and self-worth (see schema enmeshment theory [Pincus and Morley, 2001]) can lead to emotions of helplessness, hopelessness, guilt and despair associated with depression. Musculoskeletal clinicians with training in the provision of pain education and cognitive-behavioural application of activity promotion and exercise are well placed to manage patients' unhelpful/maladaptive cognitions and behaviours at the lower end of these continuums. However, at the higher end, as with clinical depression, and when stressors include issues outside of clinicians' scope of practice, such as a relationship breakdown, clinicians need to facilitate referral to other, more qualified mental health professionals. Importantly, referral to a psychologist (for example) does not necessarily equate to discharge from musculoskeletal therapy, as pain education, activity promotion and exercise are still important, and optimal management will likely involve the integration of musculoskeletal therapy and psychology (Johnson and Moores, 2006).

As previously described, psychologically informed musculoskeletal practice emphasizes (1) identification of individuals who are at high risk of developing chronic pain based on the presence of psychological distress and (2) targeted treatment aimed at psychological factors in conjunction with traditional, impairment-based musculoskeletal therapy (Main and George, 2011). From a clinical reasoning perspective and specifically related to musculoskeletal pain, this approach to management is consistent with prognostic stratified care that has been investigated for LBP and which has been described as targeting treatment to subgroups of patients based on key characteristics (e.g. psychological factors) (Foster et al., 2013).

What follows is an example of the three-avenue psychological factor screening and assessment process and one particular yellow flag management approach for LBP that consists of a sensitive initial screening using a multidimensional measure followed by the patient interview, then a more comprehensive third-order assessment using a battery of unidimensional measures. Realistically, administering a multidimensional measure prior to the patient interview may not always be feasible in the clinical setting; however, we strongly suggest that both are incorporated early during an episode of care. The STarT Back screening tool is being used to illustrate a patient scenario related to LBP. We acknowledge that further research is needed to establish the clinical utility of the STarT Back screening tool (and other screening tools) to determine if similar targeted treatment approaches based on responses to these tools are generalizable to other musculoskeletal conditions. Nonetheless, we support the general principle of the three-avenue screening and assessment process as described here as a strategy to further enhance clinical reasoning.

The STarT Back screening tool (SBT) is used as the first-order screening to categorize patients into one of three subgroups (low, medium or high risk) for persistent LBP-related disability. For patients categorized as high risk on the SBT, clinical reasoning can be enhanced by the patient interview to both clarify issues highlighted in the SBT screening and to gain further understanding of the patient, including the context of the patient's problems and his or her perspectives on the experience. Together, the SBT and the patient

interview can guide the selection of appropriate unidimensional psychological measures. Information obtained through the unidimensional measure screening can then be used to identify specific psychological factors that may be negatively impacting the patient's pain and disability experience (and can potentially be targeted by musculoskeletal clinicians through direct treatment). Because two patients can provide the same response for quite different reasons, clarification of select interview and unidimensional measure responses is used to better understand the meaning and basis of those responses (refer to the previous discussion of facilitation of self-disclosure), thus providing explicit targets for psychosocially oriented treatment strategies such as pain belief education and cognition-targeted exercise.

Brief Case Example

A 38-year-old female presents with LBP following an afternoon of gardening at home 2 weeks prior. The patient was administered the SBT, and based on her responses, she was categorized as 'high risk' for persistent disability. During the patient interview, she was asked to elaborate on her perception of the current pain experience and indicated she felt hopeless and was very concerned that her condition would never improve because a friend experienced similar symptoms several years ago and ultimately received surgical intervention. Additional information collectively obtained during the patient interview and supported by careful clarification of responses to the SBT also indicated that (1) she was avoiding any physical activity due to concerns her symptoms would become worse, and (2) this was the worst experience she had ever had.

Based on the information obtained, the patient was subsequently administered the Fear-Avoidance Beliefs Questionnaire (FABQ) and Pain Catastrophizing Scale (PCS) to enhance clinical reasoning regarding fear of physical activity (via the FABQ – physical activity scale) and catastrophic cognitions (via the PCS). Over the course of treatment, the clinician was then able to compare these early scores to later scores (e.g. 1–2 weeks) to monitor for change and progress (or lack thereof). This information was then used to determine if modification of the treatment plan was necessary.

It is beyond the scope of this chapter to present the details of the psychologically informed management for this patient. Instead, key principles and general strategies for psychologically informed musculoskeletal therapy management are presented. Examples of specific strategies for psychologically informed musculoskeletal therapy management through education and activity are covered in several chronic pain case studies later in this book.

Management

In the case of LBP, suggested targeted treatment pathways are matched to each SBT subgroup such that patients categorized as low risk receive minimal care, primarily consisting of reassurance, education and self-management, with the potential to benefit from minimal therapy based on physical examination findings. Patients categorized as

medium risk also receive reassurance and education, but their treatment is supplemented with therapy focused on restoring function and targeting physical signs identified from the physical examination. For patients categorized as high risk, therapy is focused on restoring function using a combination of physical and psychological approaches (described in greater detail later in this case study).

Prior to providing descriptions of how communication style, education and activity-based interventions can be implemented to target previously identified psychological factors, it is important to acknowledge that skilled communication strategies can (and should) be used to enhance other interventions. Importantly, skilled communication can enhance clinical reasoning by providing clinicians with information that otherwise may not be detected.

Communication Style

Musculoskeletal clinicians should incorporate effective communication skills, including active listening, facilitation of self-disclosure, empathy and collaborative decision-making, in order to optimize the patient–clinician therapeutic alliance (as discussed in [Chapter 1](#)). Active listening skills are important for picking up potentially relevant information spontaneously offered by patients, for example, regarding their expectations, beliefs and behaviours related to pain and physical activity (as discussed in [Chapter 3](#)). Previous studies have indicated relationships between patient expectations and musculoskeletal therapy outcomes ([Bishop et al., 2011, 2013](#)), with findings from an experimental study suggesting the potential role that clinicians may have in influencing patient expectations ([Bialosky et al., 2008](#)). Facilitation of self-disclosure is enhanced when rapport is good and when the patient perceives genuine interest from their clinician. Skilled communication through the psychosocial screening not only elicits more relevant information important to making a judgment regarding the patient's perspectives on his or her experiences and in identifying negative psychological factors to address in management, but it also enriches the therapeutic relationship and is

Continued on following page

Brief Case Example (Continued)

important for optimizing outcomes (Ferreira et al., 2013; Hall et al., 2010).

Education-Based Approaches

Musculoskeletal clinicians should consider incorporating a combination of educational approaches where psychosocial factors are judged to be contributing to patients' pain and disability. Education-based approaches commonly include 'pain neuroscience' and 'activation philosophy' as two broad components. A systematic review of available randomized controlled trials supports the use of pain neuroscience education for changing pain beliefs and improving health status in patients with chronic musculoskeletal pain (Louw et al., 2011), and guidelines for application of pain neuroscience education are readily available (Nijs et al., 2011; van Wilgen and Keizer, 2012). Content related to pain neuroscience can be used to provide a general overview about the nature of pain, neurophysiological processes associated with pain perception, mechanisms of pain associated with the development of disability, and the role of psychosocial factors in transitioning from acute to chronic pain. Ideally, information is contextualized to the patient's unique presentation, for example, by referring to specific unhelpful beliefs, behaviours and social factors uncovered in the overall psychosocial factor screening when discussing different pain neuroscience constructs. Importantly, pain neuroscience education should not unduly focus on biomedical constructs such as pathology, biomechanics and anatomical structures. Although we acknowledge that there is the potential for a direct link between musculoskeletal pain symptoms, anatomical structures, pathology (e.g. disc bulge) and biomechanics, when the intent is to target psychological obstacles, the language of physical impairments (mobility, control/strength, fitness, etc.) rather than that of pathology is advised, particularly for those patients who already overly focus on pathology and demonstrate maladaptive fears, hypervigilance and catastrophization. When pathology is raised, skill is needed to acknowledge confirmed pathology, explain that pathology can be asymptomatic and reassure the patient that any exercises and graded activity recommended will not cause them harm. Two excellent resources to assist clinicians understanding and application of pain neuroscience education are the texts *Explain Pain Supercharged* by Moseley and Butler (2017) and *Pain Neuroscience Education. Vol 2.* by Louw, Puentedura, Schmidt & Zimney (2018).

In general, activation philosophies involve encouraging patients to be active participants in the recovery process (Nicholas and George, 2011). Activation philosophy strategies can be used to provide patients with reassurance (e.g. there is no permanent damage) and encouragement to resume

normal activities (if appropriate), as well as to emphasize positive attitudes and coping styles. However, providing passive reassurance in the form of pamphlets or booklets alone is not sufficient. Previous review studies (Nicholas and George, 2011; Linton et al., 2008) have indicated the vital importance of addressing specific patient concerns or misapprehensions during educational approaches that incorporate an activation philosophy component. Moreover, the importance of incorporating an education-based approach involving activation philosophy content within an activity-based approach (described later in this case study) has been previously highlighted (Nicholas and George, 2011). This requires clinical judgments (i.e. 'reasoning about teaching'; see Chapter 1) regarding when to address patient concerns and misapprehensions, how best to challenge existing beliefs and present alternatives, when to initiate activation philosophy discussions, how much to cover at a single time, and re-assessment to determine understanding, acceptance and integration of new perspectives. Pain neuroscience education and activation philosophy are important precursors to promote adaptive pain and activity beliefs prior to commencing activity-based interventions, and education needs to continue throughout any cognition-targeted activities and prescribed exercise (Nijs et al., 2011, 2014). Equally, education and interventions specifically tailored to address pain coping strategies are vitally important for successful management, as discussed in some of this book's patient cases (for example, see Chapters 9, 13, 14, 24 and 25).

Activity-Based Approaches

Information obtained through psychological (and social) factor screening assessments can also be utilized to enhance clinical reasoning during the planning of activity-based interventions. Two common activity-based approaches are graded exercise or activity and graded exposure, which are described in greater detail elsewhere (Nicholas and George, 2011). Graded exercise or activity encourages continued activity despite the presence of pain and utilizes a quota-based system (Nicholas and George, 2011). For example, baseline levels (i.e. initial quotas) are first determined by having the patient perform an activity (e.g. treadmill walking) until limited by pain tolerance. Initial quotas serve as the basis for subsequent treatment sessions and should be set relatively low (e.g. 60%) to optimize success because successful completion of prescribed exercise and activity is in itself usually reinforcing. An important component of this treatment strategy is patient participation in goal setting because this contributes to guiding subsequent quota increases. The activities and exercises utilized should not only be

Brief Case Example (Continued)

time-contingent, but they should also be 'cognition targeted', that is, reinforcing of previous pain education by addressing the patient's unhelpful cognitions regarding the problem during the activity and exercise instruction, and they should be practiced with progression from more simple (including motor imagery) to more complex activities and exercise (Nijs et al., 2014).

Alternatively, graded exposure is primarily for patients presenting with high levels of fear and avoidance behaviours and utilizes a hierarchical exposure approach (Nicholas and George, 2011). For example, fearful activities (e.g. forward bending to retrieve objects from ground level) are specifically identified, and low levels of those activities are initially incorporated into the treatment plan. As the level of fear decreases, the level of activity subsequently increases. The Fear of Daily Activities Questionnaire (FDAQ) provides an example of a self-report measure that can be utilized to specifically

identify fearful activities and levels of fear associated with those activities that can then be used to monitor treatment responses (George et al., 2009). George and Zeppieri (2009) have previously described how the FDAQ can be used to positively impact clinical reasoning during the management of patients with LBP. The principle underpinning both graded activity/exercise and graded exposure is 'exposure without danger' to reduce maladaptive pain memories associated with maintained pain and pain behaviours (Zusman, 2004, 2008). The combination of pain neuroscience education assisting patients to reconceptualize their perceptions of danger followed by cognition-targeted graded activity/exercise or graded exposure (as required) facilitates increased activity and participation capability. More specific details for implementation of cognition-targeted interventions are provided elsewhere (Nijs et al., 2014, 2015), with examples also presented in some case studies in this book.

Key Points

- Skilled communication (including active listening, facilitation of self-disclosure, empathy and collaborative decision-making) is essential to optimize the patient–clinician therapeutic alliance, the extent to which the patient shares his or her full story (i.e. the patient's perspectives), the clinician's reasoning and, ultimately, the success of management.
- Education-based interventions, including 'pain neuroscience' and 'activation philosophy', are important in the management of psychosocial factors and should be supplemented with pain coping strategies.
- Activity-based interventions (e.g. graded exercise/activity and graded exposure), along with ongoing education, should be implemented collaboratively with the patient to help facilitate increased activity and participation capabilities.

Summary

Musculoskeletal pain experiences are unique to each individual patient and can be strongly influenced by psychological factors. An increased understanding of these relationships will enhance clinical reasoning, which in turn has strong potential to improve patient outcomes. In this chapter we have described a three-avenue psychological factor screening and assessment process consisting of (1) direct communication with the patient in the form of formal interview and ongoing discussions, (2) a multidimensional screening measure to identify those patients at risk of persistent disability and (3) unidimensional measures (where appropriate) to identify specific psychological factors to target and monitor through psychologically informed interventions. The overall intent of this chapter is to provide musculoskeletal clinicians with strategies and understandings to enhance their clinical reasoning by embracing a biopsychosocial framework with special emphasis placed on psychological factors.

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