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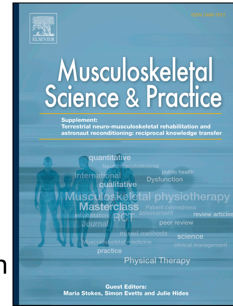

Prognosis in Entry-Level Physiotherapy Programs: An Australian and New Zealand Framework for Developing Knowledge and Skills for Musculoskeletal Practice.

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Title: Prognosis in Entry-Level Physiotherapy Programs: An Australian and New Zealand Framework for Developing Knowledge and Skills for Musculoskeletal Practice.

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Abstract

Question: How should prognosis in relation to musculoskeletal disorders be incorporated into the curriculum of entry-level physiotherapy programs within Australia and New Zealand?

Design: Consensus group methodology using the nominal group technique.

Participants: Twelve members considered experts in the fields of musculoskeletal physiotherapy and entry-level education in Australia and New Zealand were invited to participate.

Method: The nominal group technique method implemented involved three specific stages. In stage one members were provided with pre-reading material related to the topic of prognosis. They were instructed to generate ideas and feedback related to this material. Stage two involved an online consensus group meeting to discuss the ideas and feedback generated from the pre-reading material. Consensus statements were also generated within this meeting. Stage three involved rounds of iterative feedback and refinement of the consensus statements.

Results: Four consensus statements were generated including the definition of prognosis; the purpose of learning about prognosis; recommendations for incorporating prognosis into entry-level curriculum; and what elements of prognosis should be taught and assessed.

Conclusion: Prognosis is a complex but essential concept to incorporate within entry-level physiotherapy curriculum. Entry-level physiotherapy programs should be explicit in the teaching and assessment of the knowledge and skills relating to prognosis. This framework may assist educators in incorporating prognostic content throughout their curriculum.

Key Words: Clinical Reasoning, Education, Musculoskeletal Diseases, Physical Therapy, Prognosis

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Title: Prognosis in Entry-Level Physiotherapy Programs: An Australian and New Zealand Framework to Develop Knowledge and Skills, and Guide Curriculum Design for Musculoskeletal Practice.

Introduction

The World Health Organisation (WHO) defines a musculoskeletal disorder (MSD) as a condition characterized by pain and associated impairments of the neuromusculoskeletal system leading to temporary or lifelong limitations in functioning and participation[1]. There are a range of reasons that an individual with a MSD may engage the services of a physiotherapist. Historically, physiotherapists have primarily targeted pain and dysfunction as treatment goals. In more recent years the International Classification of Function (ICF) biopsychosocial framework, which includes a person-centred approach, has provided a framework for expanding physiotherapy management to include individual education regarding the interaction of biological, psychological, and social factors that may contribute to the individual's pain experience[2]. Education facilitates informed decision making in the management of MSDs and the alleviation of distress or concern regarding the injury or pain[3]. However, no matter the reason, the common theme is that individuals with a MSD desire a positive outcome for their condition. Therefore, the overarching purpose and essence of physiotherapy is to optimise an individual's outcome following an episode of care.

The Australian and New Zealand Prognosis Framework Document (ANZPFD) has been developed as a resource for academic educators involved in teaching a musculoskeletal subject in an entry-level physiotherapy program. A more detailed rationale for the development of this framework is outlined below. The scope of this document relates to entry-level physiotherapy programs within Australia and New Zealand.

Prognosis can be defined as the likely course or future health outcomes in individuals with a given disease or health condition[4]. In relation to MSDs, prognosis is invariably related to outcomes, trajectories, or course of the condition. Openly discussing prognosis with individuals with a MSD is central to evidence-based management and optimising outcomes[5]. Furthermore, discussing prognosis is aligned with the ICF framework as individuals with a MSD wish to discuss outcomes in relation to impairments, pain, and/or activity and participation[6]. Therefore, for physiotherapists to remain true to their purpose, it is essential for them to first understand the concept of prognosis and continually develop the knowledge and skills required for prognostication. The role of entry-level education is to equip aspiring physiotherapists with foundational knowledge and skills to ensure that

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they practice safely and competently upon graduation. Therefore, entry-level programs play a pivotal role in introducing and developing the concept of prognosis.

The International Federation of Manual and Musculoskeletal Physical Therapists (IFOMPT) is an international group of member organisations with a vision for the promotion of excellence in manual therapy/musculoskeletal physiotherapy/physical therapy to meet the musculoskeletal health needs of society. Member organisations of IFOMPT have a set of internationally agreed standards that all postgraduate programs must achieve to maintain memberhip[7]. The determination and consideration of prognosis is an explicit part of these standards at postgraduate level. In the absence of a structured framework for teaching prognosis, other member countries have extended this so that prognosis features explicitly in their entry-level standards including Canada[8], Ireland[9], and the United States of America[10]. However, no such standard for prognosis explicitly features in entry-level physiotherapy standards for Australia or New Zealand[11]. This document and framework may assist entry-level programs to incorporate prognosis into their curriculum in a consistent and explicit manner.

Prognosis of MSDs is a complex concept shrouded in uncertainty[12]. There are several different outcomes that can be associated with MSDs, innumerable factors that can impact these outcomes, and a high degree of variation in the outcome which requires constant re-evaluation and reflection. For example, if prognosis is predominantly considered from a biological perspective, the degree of uncertainty is likely to be less as literature regarding tissue healing and management can assist in determining a prognosis or typical timeframe. However, individual factors would still need to be considered in how they may positively or negatively impact upon that typical tissue healing timeframe. In contrast, there is likely to be a greater degree of uncertainty in the absence of a definitive tissue injury. In this instance, greater consideration for prognostic factors that positively or negatively impact prognosis is required. The multifactorial nature of most health problems underpins the complexity of prognosis, making it difficult to understand, consider, and determine, particularly for entry-level physiotherapy students. One mission in developing the ANZPFD was to provide a framework to assist educators in teaching and developing students' knowledge and skills regarding provision of a prognosis. Such a framework may help prepare students to be better equipped to consider and determine prognosis within their clinical practice.

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The ANZPFD has been developed through a rigorous consensus methodology and based upon the best available evidence. Whilst consensus methodology does not establish validity or credibility, the ANZPFD can be used as a starting point to assist academic educators in incorporating prognostic content and teaching throughout their curriculum. A key feature of this framework is the clinical reasoning required for prognostication. It is not the intention for this framework to be a set of rigid teaching principles. The intention is that the framework should guide educators in embedding prognostic content throughout their curriculum in an explicit manner. To ensure students understand key components of prognosis, the curriculum needs to be continually reflected upon and re-evaluated.

METHOD

Participants, recruitment, and sampling strategies

This study implemented a purposive sampling strategy to allow for the identification and selection of potential participants that will yield appropriate information[13]. Specifically, experts in the field of musculoskeletal physiotherapy education in Australia and New Zealand were chosen. In the context of this study, an expert was defined as a senior physiotherapy academic with experience overseeing musculoskeletal curriculum development and teaching and/or an experienced physiotherapy educator who had published in the areas of musculoskeletal education, clinical reasoning or clinical framework development. To ensure representativeness, potential participants were invited across a spectrum of entry-level physiotherapy programs from Australia and New Zealand. Potential participants were identified using publicly available domains and professional networks.

Potential participants were initially sent an email containing the participant information statement and a survey to express their interest. A sample size of 12 participants from 10 different entry-level physiotherapy programs was chosen, as 12 has previously been accepted as an ideal number of participants to achieve consensus when implementing the nominal group technique (NGT)[14].

Consensus Method

A consensus method was chosen to develop the ANZPFD due to the scarcity of available empirical evidence regarding teaching prognosis and prognostic reasoning within entry-level physiotherapy

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programs. Therefore, it is appropriate and reasonable to rely on the assessment of a panel of experts when a lack of evidence exists[15]. To achieve consensus for this framework the NGT was implemented[14]. There are four key stages of the NGT including silent idea generation, round robin feedback, clarification and discussion, and voting[16]. The NGT approach was chosen as it has been demonstrated to be a cost effective and time efficient method in generating information through group discussion in response to an issue[17]. Our process was undertaken in three distinct phases that incorporated the methodology of the NGT:

Stage 1: Group members were provided with pre-reading material related to prognosis, MSDs, and entry-level education. Members were instructed to generate ideas and feedback related to this material and email it to the convenor.

Stage 2: A consensus group meeting was conducted over the videoconferencing platform Zoom (Zoom Video Communication Inc, San Jose CA, USA). Key ideas and feedback from the pre-reading were presented to facilitate discussion amongst group members. This meeting was used to generate consensus group statements that would then inform the development of this framework.

Stage 3: Consensus group statements were developed based upon the consensus group meeting. These were distributed amongst group members for review and feedback. This process implemented an iterative consultative process to develop drafts and the final version of the statements. These statements have been used to form the basis of this framework.

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<u>Framework Structure</u>

The ANZPFD has been developed to be used in conjunction with current accreditation standards, available literature on the concept of prognosis, and educator experience. The framework is divided into the following sections:

1. Aim and scope of the framework
2. The definition of prognosis
3. The purpose of learning about prognosis
4. How it is recommended to incorporate prognosis within Australian and New Zealand entry-level physiotherapy curriculum and assessment
5. What elements of prognosis should be taught and assessed
6. Conclusion

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RESULTS

The results of this study are separated into five sections. Section one outlines the aims and scope of the ANZPFD. Section two discusses how prognosis should be defined in relation to MSDs. Section three outlines the purpose of learning about prognosis. Section four provides recommendations regarding how to incorporate prognostic content within entry-level physiotherapy curriculum. Finally, section five provides recommendations regarding the elements of prognosis that should be taught and assessed within entry-level physiotherapy education.

Section One: Aim and scope of the ANZPFD

This framework has been developed to provide guidance for incorporating prognosis into the curriculum of entry-level physiotherapy programs in Australia and New Zealand. Specifically, it relates to the teaching of musculoskeletal subjects or courses, or in relation to MSDs. This framework does not extend to other fields of physiotherapy that are taught in entry-level programs where prognosis may also feature, although the concepts and principles of this framework may be common to other fields of study, for example, neurological or cardiorespiratory fields.

Within clinical practice, physiotherapists are encouraged to implement a clinically reasoned approach to minimize errors associated with cognitive bias and lack of analytical thinking[18]. Specifically, regarding MSDs, clinical reasoning frameworks have been developed to assist physiotherapists[19,20] of which prognosis is one clinical judgement. Therefore, this framework is reflective of current best practice in the management of MSDs. However, this framework solely focuses on prognosis and prognostic reasoning.

One principle that underpins this framework is that prognosis is not a fixed state. Prognosis is grounded in subjectivist probability and likelihood and therefore is subject to change and impacted upon by an extensive number of variables[21]. Therefore, our prognostic estimates are dynamic in that they are updated when new or better information becomes available and thus require a constant state of reflection and re-evaluation. This framework has been developed to provide a starting point to better understanding and developing prognostic reasoning knowledge and skills within entry-level education.

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The intention of this framework is to be informative rather than prescriptive. It aims to facilitate how prognosis and prognostic reasoning are incorporated into an entry-level physiotherapy curriculum. Therefore, it aims to enhance how prognosis and prognostic reasoning are understood, considered, and developed by physiotherapy students.

Section Two: The definition of prognosis

Table 1. Statement One: Definition
1. Prognosis can be defined as the likely course or future outcome of a musculoskeletal disorder. a. Outcomes may be related to tissue health, pain, and/or activities and participation. b. Timeframes for expected outcomes should be considered. For example, timeframes associated with tissue healing or length of time for returning to a particular activity or participation. c. Prognostic factors are those that influence prognosis. These factors can be biological or contextual. Contextual factors include personal attributes (e.g. education, culture, beliefs, expectations, self-efficacy, and lifestyle); and environmental factors (e.g. physical and social environment). d. Prognosis and prognostic factors should be considered within a person-centred framework.

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The definition used in this framework, the likely course or future health outcomes in individuals with a given disease or health conditions, is explicitly related to the outcome of a MSD, which is aligned with the scope of the framework. Evidence has demonstrated a dissonance in how physiotherapists define and understand the concept of prognosis in relation to MSDs[22]. It appears that prognosis may often be understood as the timeframe to an outcome[22]. However, providing a timeframe has also been identified as a barrier towards considering and discussing prognosis[23]. Whilst timeframes are important to consider in relation to prognosis, it is first important to understand that prognosis is defined as the likely course or future outcome of a MSD.

If the first step is to understand that prognosis is the likely course or future outcome of a MSD, the second step is to understand what the outcome may relate to. The outcomes associated with a MSD may be related to impairments (i.e. tissue health, pain, stiffness, weakness), and/or activities and participation. Emerging evidence supports the uncertain and/or variable correlation between tissue health, pain, and function in relation to MSDs[24]. Therefore, for students to develop a more complete understanding of prognosis they must understand that the outcome or trajectory can relate to these

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three components. Low back pain may be considered an example where the prognosis for tissue health can be different than the prognosis for pain and function[25]. Furthermore, discussing prognosis in this way may have benefits in the management of individuals with a MSD including education, reduced fear avoidance, and meeting their expectations[6].

Whilst, prognosis should not be understood as a timeframe, it is still essential that timeframes be considered in relation to the outcome. Different timeframes will be appropriate depending upon what the prognosis is in relation to. If the outcome is related to tissue health, timeframes can be considered based on the tissue healing model[26]. However, timeframes for tissue healing may be uncertain for many MSDs and provide little assistance in formulating a prognosis. In these conditions, timeframes for improvements in pain or return to activity or participation may be more appropriate. For example, a timeframe for return to sport participation after anterior cruciate ligament reconstruction may be more appropriate in this instance.

Prognostic factors are those that influence prognosis either positively or negatively. There are numerous prognostic factors that can be biological or contextual (personal attributes and environmental factors) in nature. This aligns with the biopsychosocial model of health, which is routinely recommended in the management of MSDs[27]. For students to develop their prognostic reasoning skills it is essential for them to understand the different factors that may impact prognosis. Preference may be given to identifying those factors that have a negative impact to avoid a poorer prognosis or need for onward referral to a medical professional. However, factors that have a positive impact should also be considered. Examples of different prognostic factors can be found in Table 1.

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Historically, diagnosis has often being used to predominantly inform the determination of prognosis[28]. However, variable outcomes can exist for the same diagnosis. Additionally, individuals are as unique as prognosis itself. Therefore, it is essential for students to consider prognosis and prognostic factors within a person-centred framework. They need to consider the unique features that the individual brings to their MSD and how that may impact upon their likely outcome or trajectory. For example, cigarette smoking has been found to have a negative impact upon MSDs[29]. However, not every individual smokes and therefore smoking will not have a negative impact on every MSD. Furthermore, even for those individuals that do smoke, their degree of exposure would need to be considered.

Section Three: The purpose of learning about prognosis

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Table 2. Statement Two: Why
2. The overarching purpose of learning and applying prognostic reasoning is to improve or optimise an individual's outcome. Additionally, understanding prognosis is important because: a. It enhances person-centred care through meeting individual expectations, facilitating shared decision-making, promoting the therapeutic alliance, and education. b. Prognosis is a complex concept that requires critical thinking, reflection and communication skills. These skills need to be taught and refined within a clinical reasoning framework. c. It is essential to understand and identify individuals who are at risk of a poor prognosis or when an individual's own perceived prognosis differs from the expected prognosis. This may be in relation to an individual's overall prognosis and/or expected timeframes for a specific outcome.

One of the roles of the physiotherapist is to improve or optimise the prognosis of an individual with a MSD. Therefore, it is essential that students first learn and develop skills in relation to prognosis and prognostic reasoning. This knowledge and associated skills may be related to understanding the concept of prognosis, identification and consideration of prognostic factors, and determination and communication of prognosis. This framework is proposed to assist with introducing and developing the early knowledge and skills of students regarding prognosis and prognostic reasoning.

It is well understood that individuals with a MSD want to receive an accurate prognosis[5,30,31]. Therefore, it is essential that prognosis is discussed with these individuals. Doing so will enhance person-centred care through meeting individual expectations[32], facilitate shared-decision making[33], promoting therapeutic alliance[34], and improving health literacy[35] through education. All of these factors have an impact upon prognosis.

In the management of MSDs, physiotherapists are encouraged to implement a clinically reasoned approach[36]. This approach helps reduce errors associated with cognitive bias, premature conclusions, and lack of analytical thinking[18]. Prognosis and prognostic reasoning are complex concepts associated with high levels of uncertainty and therefore require strong analytical and reasoning skills[12]. Therefore, it is important to introduce knowledge and skills relating to prognosis to students so they can begin to develop prognostic reasoning skills. These skills may include how students consider, determine, discuss and review prognosis[23].

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Finally, learning about prognosis is essential for students so that they can understand and identify those individuals who are at risk of a poor prognosis. There are several prognostic tools that students could learn about that may be useful at identifying these individuals, such as the Orebro Musculoskeletal Pain Questionnaire[37] which helps to identify psychosocial factors that might influence outcomes. Identifying individuals at risk of a poor prognosis is important as it may change management decisions. Furthermore, it may be important to identify those individuals who are not appropriate for physiotherapy management or need onward referral to a medical specialist. For example, using the red flag framework for serious spinal pathologies[38].

Section Four: Recommendations to incorporate prognosis within entry-level physiotherapy curriculum

Table 3. Statement Three: How

3. It is recommended that entry-level curriculum include explicit learning outcomes and course objectives relating to prognosis.
    a. Prognosis should be introduced and developed within a clinical reasoning framework or model.
    b. Knowledge and skills relating to prognosis should be explicitly assessed within entry-level physiotherapy programs.
    c. An example of a learning outcome may be *'By the end of this course, students will be able to formulate, evaluate, and communicate evidence-informed prognoses for common musculoskeletal conditions by analysing clinical findings and contextual factors.'*

4. Learning opportunities related to prognosis should be embedded throughout the curriculum (case-based learning, lectures, practical classes etc). However, educators should still be explicit when introducing and referencing content regarding prognosis.
    a. This responsibility is shared by all educators teaching entry-level physiotherapy students in either an on-campus or clinical placement context.
    b. During clinical placements, students should have opportunities to practice and demonstrate prognostic reasoning.

In Australia and New Zealand, prognosis is currently not explicitly a part of practice thresholds or accreditation standards[11,39]. As a result, it is left to the discretion of entry-level physiotherapy programs as to whether they explicitly incorporate prognosis into their curriculum. If prognosis is not explicitly incorporated into curriculums there is risk that prognostic content is either not taught, or only taught in parts, students may not recognise when content relating to prognosis is taught, or students may not develop the required skills for prognostication. Therefore, to ensure that knowledge and skills related to prognosis are introduced and developed, it is recommended that entry-level physiotherapy programs include explicit learning outcomes and course objectives relating to prognosis.

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It is not the intention of this framework to misconstrue that learning about prognosis is simply a by-product of curriculum structure. Rather, this framework is intended to be a guide for how prognosis content can be embedded within curricula as a component of the explicit pedagogical design. Within the design learning about prognosis should involve structured development of skills and knowledge, engagement with uncertainty, and iterative sense-making. This should further extend to the teaching of the clinical reasoning associated with prognosis as discussed in Section Five. Due to the complex nature of prognosis, it is likely best taught through a combination of different teaching methods[41,42]. For example, providing students with theoretical knowledge in lectures and then allowing them to practice prognostic reasoning and communicating prognosis in practical classes and whilst on clinical placement. Furthermore, embedding prognostic content throughout the curriculum in conjunction with other concepts such as diagnosis is reasonable. However, the complexity of prognosis should also dictate that academic educators be explicit when teaching it. Students are unlikely to comprehend the different outcomes that prognosis can relate to or the innumerable number of prognostic factors that can influence the outcome if educators are not explicit in regard to prognosis. Furthermore, because of the complexity and uncertainty, it is essential that prognostication be based on robust clinical reasoning where the interaction of prognostic factors for each individual is considered and prognostic judgments re-evaluated throughout the ongoing management. Therefore, it is recommended that prognostic content be embedded throughout the curriculum using several teaching methods, but educators should always be explicit when prognostic content is introduced.

<u>Section Five: What elements of prognosis should be taught</u>

Section five relates to the content about prognosis that should be included and embedded throughout the curriculum to aid in developing students' knowledge and skills relating to prognosis. A summary can be found in Table 4. This section combines the content outlined in the previous sections and statements. For complex concepts, such as prognosis, implementing teaching strategies that embed content throughout the curriculum aids in developing skills and knowledge through both surface and deep learning[42]. Students should first understand the concept of prognosis. They then should develop skills relating to what may impact prognosis, how to determine prognosis, and then how the prognosis developed may be effectively utilised within clinical practice. The prognostic factors listed in Table 4 are only examples and are not meant to be taken as an exhaustive list.

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Table 4. What about prognosis should be taught for musculoskeletal disorders

Prognosis: the likelihood of future health outcomes associated with musculoskeletal disorders		
Tissue health outcomes	Pain outcomes	Activity and participation outcomes
Examples of prognostic factors:		
Biological Factors • Tissue damage and/or expected tissue healing and repair timeframes • Pain type (e.g. nociceptive, neuropathic, nociplastic) • Muscle strength and flexibility • Motor control (e.g. posture, movement, muscle activation) • Smoking status • Comorbidities	**Contextual Personal Attributes** • Psychological distress (e.g. anxiety, frustration, fear, depression) • Individual beliefs and expectations • Individual coping strategies • Education • Self-efficacy	**Contextual Environmental Factors** • Social, work and familial supports • Socioeconomic status • Physical environmental factors • Social environmental factors
Determination of prognosis: • Made within a clinical reasoning framework (Figure 3.) • With consideration of the diagnosis • With relation to specific timeframes as appropriate • With consideration of the individual's specific goals		

The importance of clinical reasoning within physiotherapy practice in relation to MSDs has previously been discussed in Section 3. To facilitate the clinical reasoning associated with prognosis, or prognostic reasoning, this framework provides a prognostic reasoning model (Figure 1.). This model highlights the complexity of prognosis and the analytical thinking required for prognostication. It further emphasises that prognosis is not a fixed state but requires constant reflection and evaluation as it changes.

In teaching prognosis, student concern about 'being wrong' needs to be mitigated. This is why ongoing reflection and iteration of the prognosis is important. Reviewing progress against initial prognostic judgments facilitates reflection on factors that may have been over- or under-weighted,

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not considered at all, and consideration of new information that has come to light, facilitating the learning of prognostic patterns for use with future patients. This process of iteration may reduce student concern about making a mistake. Additionally, given the potential complexity involved in making a prognosis for an individual, direction on managing uncertainty may be beneficial. A framework for the consideration of uncertainty in clinical practice has been described elsewhere[43]. Furthermore, safety netting is a strategy that can assist in managing uncertainty that involves prognostic reasoning, specifically, communicating the likely time course of the MSD[44]. Understanding there is uncertainty in the prognostic process may also reduce the threat associated with making an error during prognostication for students.

Figure 1. Prognostic reasoning model for musculoskeletal disorders requiring reflective and iterative reasoning

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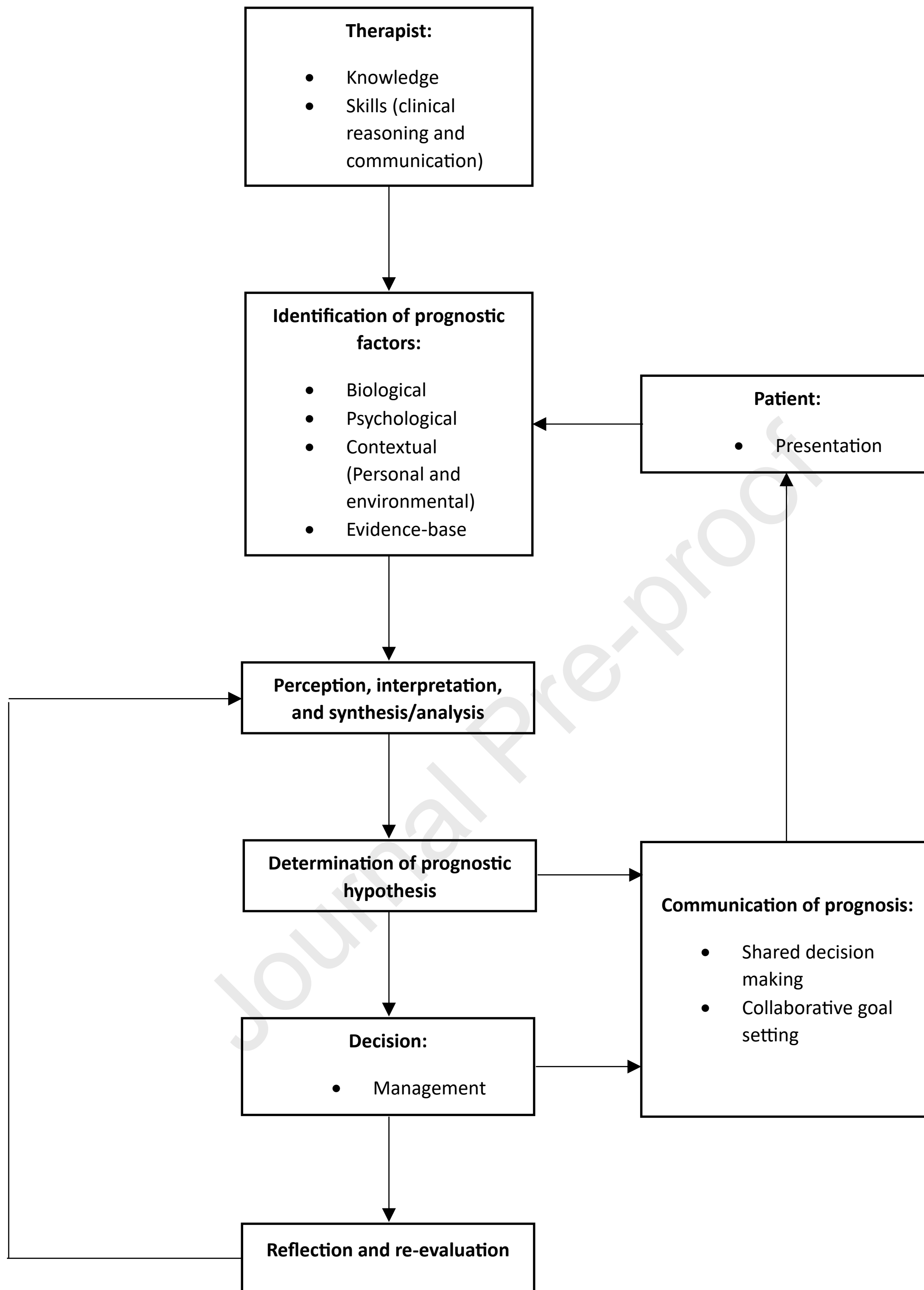

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CONCLUSION

The purpose of physiotherapy is to enhance or optimise an individual's health outcomes. Therefore, prognosis is an essential component of physiotherapy practice in optimising an individual's health outcomes associated with a MSD. Prognosis and the clinical reasoning associated with prognosis is complex and requires strong analytical and reflection skills. Because of this, teaching prognosis within entry-level physiotherapy programs is essential. Prognosis should feature explicitly within entry-level curriculum to ensure that the knowledge and skills associated with prognosis are introduced, developed, and later refined through clinical practice. Currently, there is no requirement or framework to assist in the teaching of prognosis within entry-level physiotherapy programs in Australia or New Zealand. The ANZPFD is designed to be a resource to assist educators incorporate prognostic content throughout their teaching within entry-level physiotherapy programs.

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References

1. The World HO. Musculoskeletal Health. 2022; https://www.who.int/news-room/fact-sheets/detail/musculoskeletal-conditions, 2025.
2. Sykes C. The International Classification of Functioning, Disability and Health: relevance and applicability to physiotherapy. *Adv Physiother.* 2008;10(3):110-118.
3. Louw A, Zimney K, Puentedura EJ, Diener I. The efficacy of pain neuroscience education on musculoskeletal pain: a systematic review of the literature. *Physiother Theory Pract.* 2016;32(5):332-355.
4. Hemingway H, Croft P, Perel P, et al. Prognosis research strategy (PROGRESS) 1: A framework for researching clinical outcomes. *BMJ : British Medical Journal.* 2013;346:e5595.
5. Mullen N, Ashby S, Haskins R, Osmotherly P. The experiences and preferences of individuals living with a musculoskeletal disorder regarding prognosis: A qualitative study. *Musculoskeletal Care.* 2023;21(4):987-996.
6. Mullen N, Ashby S, Haskins R, Osmotherly P. The perceptions of individuals with musculoskeletal disorders towards prognosis: An exploratory qualitative study. *Musculoskeletal care.* 2023;21(2):527-536.
7. Rushton A, Beeton K, Jordaan R, et al. Educational standards in orthopaedic manipulative therapy. *PART A: EDUCATIONAL STANDARDS.* 2016;2016:91.
8. Canada PEA. Accreditation Standards for Canadian Entry-to-Practice Physiotherapy Education Programs 2020.
9. Coru. Standards of Proficiency for Physiotherapists 2019.
10. Education CoAiPT. Standards and Required Elements for Accreditation of Physical Therapist Education Programs 2023.
11. Australian Physiotherapy Council. Accreditation Standard for entry-level physiotherapy practitioner programs December 2016. *Australia: Australian Physiotherapy Council Limited.* 2017.
12. Chiffi D, Zanotti R. Fear of knowledge: Clinical hypotheses in diagnostic and prognostic reasoning. *J Eval Clin Pract.* 2017;23(5):928-934.
13. Campbell S, Greenwood M, Prior S, et al. Purposive sampling: complex or simple? Research case examples. *J Res Nurs.* 2020;25(8):652-661.
14. Harvey N, Holmes CA. Nominal group technique: an effective method for obtaining group consensus. *Int J Nurs Pract.* 2012;18(2):188-194.
15. Humphrey-Murto S, Varpio L, Wood TJ, et al. The use of the Delphi and other consensus group methods in medical education research: a review. *Acad Med.* 2017;92(10):1491-1498.
16. McMillan SS, King M, Tully MP. How to use the nominal group and Delphi techniques. *Int J Clin Pharm.* 2016;38:655-662.
17. Potter M, Gordon S, Hamer P. The nominal group technique: a useful consensus methodology in physiotherapy research. *NZ Journal of Physiotherapy.* 2004;32(3):126-130.
18. Kahneman D. Fast and slow thinking. *Allen Lane and Penguin Books, New York.* 2011.
19. Jones MA, Rivett D. *Clinical Reasoning for Manual Therapists E-Book.* Elsevier Health Sciences; 2003.
20. Mitchell T, Beales D, Slater H, O'Sullivan P. Musculoskeletal Clinical Translation Framework. From Knowing to Doing. . In:2017.
21. Tousignant-Laflamme Y, Houle C, Cook C, Naye F, LeBlanc A, Décary S. Mastering Prognostic Tools: an Opportunity to Enhance Personalized Care and to Optimize Clinical Outcomes in Physical Therapy. *Physical Therapy.* 2022.
22. Mullen N, Ashby S, Haskins R, Osmotherly P. The perceptions and knowledge of prognosis of physiotherapists in musculoskeletal practice: an exploratory qualitative study. *Musculoskeletal Science and Practice.* 2024:103142.

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23. Mullen N, Ashby S, Haskins R, Osmotherly P. The prognostic reasoning by physiotherapists of musculoskeletal disorders: A phenomenological exploratory study. *Musculoskeletal Science and Practice.* 2025;75:103241.
24. Brinjikji W, Luetmer PH, Comstock B, et al. Systematic literature review of imaging features of spinal degeneration in asymptomatic populations. *American journal of neuroradiology.* 2015;36(4):811-816.
25. Maher C, Underwood M, Buchbinder R. Non-specific low back pain. *The Lancet.* 2017;389(10070):736-747.
26. Hildebrand KA, Gallant-Behm CL, Kydd AS, Hart DA. The basics of soft tissue healing and general factors that influence such healing. *Sports Med Arthrosc.* 2005;13(3):136-144.
27. Caneiro J, Roos EM, Barton CJ, et al. It is time to move beyond 'body region silos' to manage musculoskeletal pain: five actions to change clinical practice. In. Vol 54: BMJ Publishing Group Ltd and British Association of Sport and Exercise Medicine; 2020:438-439.
28. Croft P, Altman DG, Deeks JJ, et al. The science of clinical practice: disease diagnosis or patient prognosis? Evidence about "what is likely to happen" should shape clinical practice. *BMC medicine.* 2015;13(1):20-20.
29. Al-Bashaireh AM, Haddad LG, Weaver M, Kelly DL, Chengguo X, Yoon S. The effect of tobacco smoking on musculoskeletal health: a systematic review. *J Environ Public Health.* 2018;2018(1):4184190.
30. Lim YZ, Chou L, Au RT, et al. People with low back pain want clear, consistent and personalised information on prognosis, treatment options and self-management strategies: a systematic review. *J Physiother.* 2019;65(3):124-135.
31. Mallen CD, Peat G. Discussing prognosis with older people with musculoskeletal pain: a cross-sectional study in general practice. *BMC Family Practice.* 2009;10(1):50.
32. Bialosky JE, Bishop MD, Cleland JA. Individual expectation: an overlooked, but pertinent, factor in the treatment of individuals experiencing musculoskeletal pain. *Physical therapy.* 2010;90(9):1345-1355.
33. Hoffmann T, Lewis J, Maher CG. Shared decision making should be an integral part of physiotherapy practice. *Physiotherapy.* 2020;107:43-49.
34. Moore AJ, Holden MA, Foster NE, Jinks C. Therapeutic alliance facilitates adherence to physiotherapy-led exercise and physical activity for older adults with knee pain: a longitudinal qualitative study. *Journal of physiotherapy.* 2020;66(1):45-53.
35. Buchbinder R, Batterham R, Ciciriello S, et al. Health literacy: what is it and why is it important to measure? *The Journal of rheumatology.* 2011;38(8):1791-1797.
36. Jones MA. 1 - Clinical Reasoning: Fast and Slow Thinking in Musculoskeletal Practice. In: Jones MA, Rivett DA, eds. *Clinical Reasoning in Musculoskeletal Practice (Second Edition).* Oxford: Elsevier; 2019:2-31.
37. Linton SJ, Boersma K. Early identification of patients at risk of developing a persistent back problem: the predictive validity of the Örebro Musculoskeletal Pain Questionnaire. *Clin J Pain.* 2003;19(2):80-86.
38. Finucane LM, Downie A, Mercer C, et al. International framework for red flags for potential serious spinal pathologies. *journal of orthopaedic & sports physical therapy.* 2020;50(7):350-372.
39. Physiotherapy Board of Australia PBoNZ. Physiotherapy practice thresholds in Australia and Aotearoa New Zealand. *The Physiotherapy Board of Australia and the Physiotherapy Board of New Zealand.* 2015.
40. Reubenson A, Ng L, Gucciardi DF. The Assessment of Physiotherapy Practice tool provides informative assessments of clinical and professional dimensions of student performance in undergraduate placements: a longitudinal validity and reliability study. *Journal of physiotherapy.* 2020;66(2):113-119.

41. Ajjawi R, Smith M. Clinical reasoning capability: Current understanding and implications for physiotherapy educators. *Focus on Health Professional Education: A Multi-disciplinary Journal.* 2010;12(1):60-73.
42. Hattie JA, Donoghue GM. Learning strategies: A synthesis and conceptual model. *npj Science of Learning.* 2016;1(1):1-13.
43. Scott IA, Doust JA, Keijzers GB, Wallis KA. Coping with uncertainty in clinical practice: a narrative review. *Med J Aust.* 2023;218(9).
44. Jones D, Dunn L, Watt I, Macleod U. Safety netting for primary care: evidence from a literature review. *British Journal of General Practice.* 2018.

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HIGHLIGHTS

- Prognosis is complex to incorporate into entry-level physiotherapy curriculum
- A framework is provided to assist in incorporating prognosis into curriculum
- Prognostic reasoning is an essential component in teaching prognostic content

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Declaration of Interest Statement

☐ The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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