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Second Edition

MUSCULOSKELETAL INTERVENTIONS

TECHNIQUES FOR THERAPEUTIC EXERCISE

Barbara J. Hoogenboom

Michael L. Voight • William E. Prentice

Musculoskeletal Interventions

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Third Edition

Musculoskeletal Interventions

Techniques for Therapeutic Exercise

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Preface

Movement is an integral part of human experience. Functional movement is necessary for participation in all aspects of life, including activities of daily living, work, occupation, avocation, and sport. This philosophy is evident in the new Vision Statement that was adopted by the American Physical Therapy Association House of Delegates in June 2013:

"Transforming society by optimizing movement to improve the human experience."

In the 7 years since the last edition of the textbook, the focus of rehabilitation has become increasingly related to human movement. The editors and authors who have contributed to this textbook have been on this path for years. Together, we offer decades of highly variant experience in order to produce a textbook that offers a movement-based, functional perspective to the treatment of musculoskeletal dysfunction and injury. The art and science of caring for a patient or client is rooted in evidence-based practice, but requires knowledge of foundational sciences, application of theory, as well as skill, creativity, and innovation; however, above all we believe, it relates to movement. Several areas within the current 31-chapter edition have been expanded to best reflect the contemporary practice of physical therapy including clinical decision-making, algorithmic thinking, the neuromuscular scanning examination, functional movement screening, and the essentials of functional exercise.

The purpose of this text is to provide a comprehensive guide to assist practitioners in the design, implementation, and progression of rehabilitation programs for patients with musculoskeletal dysfunction. This includes dysfunction that occurs due to imbalance, overuse, injury, as well as postoperatively. It is intended for use in musculoskeletal intervention courses that teach students the application of theory, decision-making in therapeutic interventions, and rehabilitation progressions. However, it is equally well-suited for the practicing physical therapist looking for novel ideas for therapeutic interventions. The contributing authors have attempted to use our collective expertise, creativity, and knowledge to produce a textbook that encompasses many aspects of musculoskeletal rehabilitation and positively affects approaches to intervention, with a focus on function!

Organization

The text is divided into the same five parts as the previous edition. In Part 1: The Foundations of the Rehabilitation Process a revised chapter has been provided (Chapter 1) that summarizes *The Guide to Physical Therapist Practice*, as well as the important skill of clinical decision-making, highlighted by the use of algorithmic thinking. The other two chapters on tissue healing (Chapter 2) and the Neuromuscular Scan Examination (Chapter 3) complete the foundational concepts portion of the text that provides the basis for each of the upcoming sections. Very little time is spent on the process of examination in musculoskeletal practice, as the focus of this text is intervention.

Part 2: Treating Physiologic Impairments During Rehabilitation provides in-depth information about the general impairments that may need to be addressed throughout all phases of rehabilitation. These chapters include information about the management of pain (Chapter 4); an updated chapter on posture and function (Chapter 5); muscle performance

(Chapter 6); endurance and aerobic capacity (Chapter 7); mobility and range of motion (Chapter 8); and neuromuscular function (Chapter 9). Each of these introductory chapters highlights both methods for managing impairments described in the subsequent chapters, as well as new "clinical pearl" boxes to highlight the authors experience with regard to interventions.

Part 3: The Tools of Rehabilitation provides the reader with an overview of rehabilitation "tools" that can be used during the rehabilitation of many types of patients or clients. It provides the reader with detailed information on how each tool can be applied throughout the rehabilitation process in order to achieve high-level outcomes that are functionally relevant. The tools of rehabilitation covered in this part include: plyometric exercise (Chapter 10); open- and closed-kinetic chain interventions (Chapter 11); proprioceptive neuromuscular facilitation techniques (Chapter 12); joint mobilization (Chapter 13); postural stability and balance interventions (Chapter 14); core stabilization training (Chapter 15); aquatic therapy (Chapter 16); functional movement screening (Chapter 17); functional exercise and progressions (Chapter 18); and the essentials of functional exercise interventions, including a novel exercise prescription and progression matrix (Chapter 19). Of note are the updated chapters on functional movement screening and functional intervention, reflecting paradigm shifts in practice.

The fourth part of the text uses a regional approach to address specific application of intervention throughout the body. Part 4: Interventions for Specific Injuries builds upon the varied information presented in Part 3, by offering applications of techniques and interventions related to common overuse, traumatic, and postoperative musculoskeletal dysfunction. Included are detailed rehabilitation suggestions for conditions common to the shoulder complex (Chapter 20); the elbow (Chapter 21); the wrist, hand, and digits (Chapter 22); the groin, hip, and thigh (Chapter 23); the knee (Chapter 24), the lower leg (Chapter 25); the ankle and foot (Chapter 26); the cervical and thoracic spines (Chapter 27); and the lumbar spine (Chapter 28). Of note is the addition of the comprehensive chapter on the cervical and thoracic region. Each of these regionally based chapters provides in-depth discussion of pathomechanics and injury mechanisms while focusing on rehabilitation strategies and concerns for specific injuries and providing example protocols. As the title indicates, this is a textbook dedicated to intervention. Thus, it should be noted that detailed examination strategies and special test procedures are not a part of these regional chapters; therefore, it is likely that this text will accompany a text on examination, differential diagnosis, evaluation, and prognosis.

The fifth part of the text, Part 5: Special Considerations for Specific Populations, provides application of all the previous intervention strategies and how these may need to be selected, adapted, and utilized in three unique groups of patients: the geriatric patient (Chapter 29), the pediatric patient (Chapter 30), and the physically active female (Chapter 31). The editors and authors believe that these groups of patients deserve special consideration and attention during the rehabilitation process.

Updated, Evidence-based Intervention Strategies

Musculoskeletal Interventions: Techniques for Therapeutic Exercise, 3rd ed, offers a state-of-the art comprehensive collection of rehabilitation techniques and strategies for the physical therapist who intervenes with patients of all ages, abilities, and functional levels. The contributing authors have made every attempt to provide the reader with updated, evidence-based strategies for patient management, while reflecting our unique experience and creativity. The editors have assembled a group of experienced and well-respected clinicians, researchers, and academics/educators in order to cover all aspects of musculoskeletal rehabilitation. All updates were submitted to critical editorial review to ensure accuracy and relevancy.

Learning Aids

T e learning aids provided in this text include:

Objectives—provided at the beginning of each chapter presented to identify critical concepts presented within each chapter.
Tables—for presentation of concepts and organization of complex information.
Figures—updated full-color illustrations and figures are a feature of the third edition!
"Clinical Pearls," new to this edition to assist the reader in application of concepts and of er insights or connections between information, as provided by the authors of chapters.
Summary points provided at the end of each chapter outlining major points within, for the reader to determine their level of comprehension.
End of Chapter Treatment Guidelines—present in the regionally organized chapters to illustrate a possible sequence of interventions or a postoperative protocol.
References—a comprehensive, updated list of references is provided with each chapter.

Instructor Resources

Power Points—Tables and photographs in the text will be available as PowerPoints to professors who adopt the text
Videos—Videos of critical skills in the text will be available to professors who adopt the text and a larger selection of the video library will be available to AccessPhysiotherapy subscribers
Enhanced Ebook—T is third edition will also be of ered as an enhanced ebook, which will incorporate videos and include interactive quizzes.

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Acknowledgments

T is textbook is all about movement: movement within the profession of physical therapy, movement as a part of human function, and movement in personal goals, dreams, and career paths that occur during a lifetime. T e process of preparing and editing the 31 chapter manuscripts for this textbook was daunting in the face of all of the other activities and demands of life. T e collaborative dedication of three editors with a common goal of producing a unique, relevant, and current textbook on musculoskeletal intervention made this revision possible. T e three editors of this text each bring a unique perspective regarding writing, therapeutic exercise, clinical interventions, and the process of rehabilitation. Even amid our dif erences we were able to work together, achieve a common vision, and have this updated textbook to show for it!

We would like to personally thank each of the amazing contributing authors. T ey were asked to contribute to this text because we have tremendous respect for them personally and professionally. T ese individuals have distinguished themselves as educators, clinicians, and researchers, dedicated to the rehabilitation of a wide variety of individuals of all abilities, ages, and walks of life. We are exceedingly grateful for their input and willingness to share their ideas in writing and pictures.

Finally, we would collectively like to thank people important to us throughout our careers and the process of revising and editing this textbook. To our many friends and colleagues who have contributed to "who we are today" with creative thinking, intellectual challenges, and mentorship; you have shaped and influenced us, for that we are grateful. You have instilled in each of us the desire to continue learning, to challenge others to learn, grow, be change agents, and to seek continued improvement in the practice of physical therapy. T ese same friends and colleagues constantly keep us growing (older), laughing, loving life, and enjoying the many blessings of careers in rehabilitation.

Barb would like thank her great family; Dave, Lindsay, and Matthew—who continually support her during her crazy adventures; which often equate to time away from home. Barb would also like to thank her parents for their guidance, encouragement, and love of education and writing. T eir examples have shaped a lifetime of goals and dreams. Finally, thanks to her sports physical therapy colleagues and the DPT students at Grand Valley State University who keep her moving, learning, and growing every day.

Mike would like to give special thanks to several individuals. First to his co-editors/authors, Barb and Bill who put up with countless rewrites and missed deadlines while at the same time constantly changing things—thanks, I owe both of them an extreme debt of gratitude; secondly, to John Halle and his colleagues at Belmont University. T ey have provided him the academic freedom and time to pursue this project. T ey challenge him every day to seek excellence. And lastly, to his close family; his parents who started him down the right path and gave him educational freedom; to his mentor Tab Blackburn, who has continued to give him professional direction; and finally to his wife Cissy, who has had to pay the price for his passion for excellence while at the same time providing inspiring wisdom and endless support to help sustain his passion for being an educator.

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Thank-you to all—we enjoyed the ride and hope you enjoy the outcome!

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1

Introduction to the Therapeutic Interventions

The Guide to Physical Therapist Practice, Clinical Reasoning, and an Algorithmic-Approach to Intervention

Barbara J. Hoogenboom and Michael L. Voight

OBJECTIVES

After completion of this chapter, the physical therapist should be able to do the following:

- Describe components of The Guide to Physical Therapist Practice, and its relationship to the 4 elements of the disablement model as described by Saad Nagi.
- Compare and contrast the disablement model, the medical model, and a functional movement model of dealing with the effects of injury and dysfunction.
- Identify the components of the examination process as defined by The Guide.
- Describe the components of and sequence of steps in the clinical decision-making process related to evaluation, diagnosis, prognosis, and intervention.
- Contrast novice and expert clinical reasoning and decision making in physical therapist practice.
- Relate clinical reasoning to quality provision of physical therapy, in terms of both diagnosis and selection of interventions.

(continued)

OBJECTIVES (continued)

- Relate evidence-based practice to clinical reasoning.
- Describe the algorithmic approach to clinical reasoning for intervention selection.
- Use sample basic algorithms to examine clinical reasoning for each of the 4 phases of rehabilitation (acute, intermediate, advanced, and return to function).
- Describe a basic algorithmic decision-making process based upon results of the examination.
- Articulate a movement-based philosophy upon which to construct plans for intervention in physical therapy practice.

Physical therapists play an exciting and vital role in the provision of health care. As a profession, physical therapists contribute in a variety of ways to the health care system. No longer are physical therapists seen only as providers of rehabilitation, but also as participants in the processes of patient education, disease prevention, and promotion of health and wellness. Physical therapists of the 21st century must have a united voice with regard to our scope of practice, our models of health care delivery, and the types of patients and clients we serve, as well as the types of examination measures and interventions we use to remedy or prevent impairments, functional limitations, and disabilities in our patients and clients. We must be active, knowledgeable educators of the public, other health care providers, third-party payers, and health policy makers as we advocate for the profession of physical therapy.

The Guide to Physical Therapist Practice

The Guide to Physical Therapist Practice (*The Guide*) was first published in the November 1997 issue of *Physical Therapy* as a document to describe the practice of physical therapy.[1] It was developed by consensus of an expert clinician panel, whose members were chosen from across the United States and who represented perspectives from a variety of practice settings. Prior to its publication, the document underwent extensive clinician review and repeated edits. *The Guide* is not a static document, rather it is a "living" document that is intended to grow and change with the profession of physical therapy. A revision to the original *The Guide* was published in 2001.[2] This revision represented the culmination of input from the panels, educators, and clinicians, and attempted to improve the utility of *The Guide*. Subsequently, in 2003, *The Interactive Guide to Physical Therapist Practice* was released on CD-ROM, allowing access to a digital version of *The Guide*, search capabilities, and cross-referencing, as well as an index of tests and measures with hyperlinks to reliability and validity studies and citations.[3] Next, *The Guide* is anticipated to be updated to include the World Health Organization International Classification of Functioning, Disability, and Health (ICF) model.

The Guide is not a cookbook. It provides a framework for physical therapy practice, but does not provide clinical guidelines or protocols for intervention. Clinical guidelines must be developed based upon evidence, whereas the preferred practice

patterns contained in *The Guide* are merely patterns considered by *The Guide* developers as most commonly used or most appropriate patterns of patient and client intervention.[7] Likewise, there is neither a recommended fee structure in *The Guide* nor any direct connection to current procedural terminology codes. Although some (International Classification of Diseases) ICD-9 codes are listed and referred to in Part 2, they should not be used to code for billing purposes. *The Guide* does not specify the site of care; rather, it uses the *episode of care* concept that crosses all rehabilitation settings related to each episode. *The Guide* also does not address the state-to-state variances in the scope of practice.

Disablement Model

The Guide was developed based upon the disablement model developed by Saad Nagi in 1969.[22] It was designed to describe the effects of disease and injury at both the personal and societal levels as well as their functional consequences. The disablement model emphasizes the functional and health status of individuals, with intervention based on improving these aspects of the patient's condition.[1-3] The model has 4 elements:

Pathology ↔ *Impairment* ↔ *Functional limitation* ↔ *Disability*

Pathology is the interruption of the normal cellular processes from a biomechanical, physiologic, or anatomic perspective.[1-3] The body often responds to an injury or pathology with a defensive reaction in order to restore the normal state. Examples of this include hemarthrosis in the case of ligament rupture, or the inflammatory process in response to connective tissue damage (tear/stretch). Intervention at this level is generally handled by physicians and is often pharmacologic and/or surgical in nature.

Impairment is any loss or abnormality of physiologic, psychological, or anatomic structure or function at the level of organs and body systems.[1-3] Physical therapists typically measure the signs and symptoms that present in conjunction with an injury, illness, or pathology, and identify the subsequent impairments. Physical therapists often intervene trying to attempt correctly identified impairments. Examples of physiologic impairments include muscle weakness, range-of-motion loss, pain, and abnormal joint play. Anatomic impairments include structural conditions such as genu recurvatum, scoliosis, femoral anteversion, and alterations in foot alignment.

Functional limitation is a deviation from the normal behavior in performing tasks and activities from that which would be considered traditional or expected for an individual.[1-3] Functional limitations are tasks or activities that are not performed in the usual efficient or skilled fashion. Problems with transfers, standing, walking, running, and climbing stairs are all examples of functional limitations.

Disability is the incapacity in performing a broad range of tasks and activities that are usually expected in specific social roles.[1-3] Inability to function as a spouse, student, parent, or worker (in the home or outside of the home) constitutes a disability.

The scope of physical therapist practice overlaps with many portions of the disablement model, as shown in Figure 1-1.

The disablement process is a 2-way continuum affected by intraindividual and extraindividual risk factors (Figure 1-2). Intraindividual factors include habits, lifestyle, behavior, psychosocial characteristics, age and sex, educational level and income, weight, and family history. Extraindividual factors comprise the medical care received, the pharmacologic and other therapies available, the physical environment, and any external supports. The relationship between these aspects will vary between individuals and will ultimately determine the impact of the disease or injury.

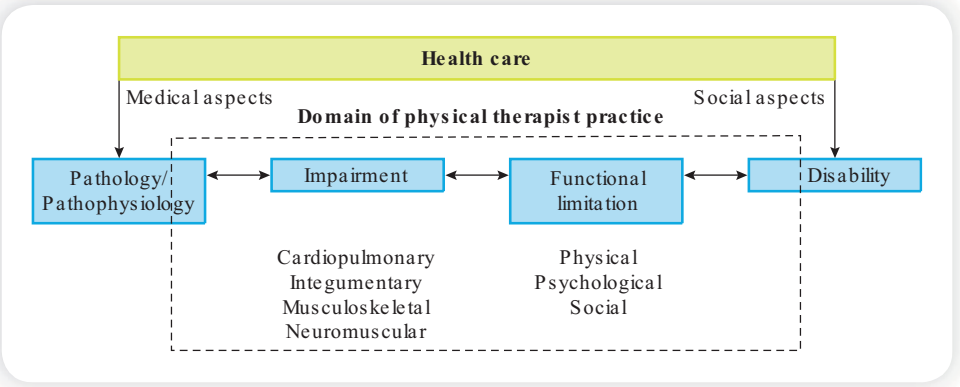

Figure 1-1

The scope of physical therapist practice within the continuum of health care services and the context of the disablement model. (Reproduced, with permission, from the American Physical Therapy Association [APTA]. The guide to physical therapist practice. 2nd ed. Phys Ther. 2001;81(1):9-738.)

Most physical therapists have treated patients who had significant impairments but remained extremely functional. Most have also treated patients who were disabled by what seemed to be minor impairments or functional limitations. Unfortunately, there are few studies in the literature to show a direct cause-and-effect relationship between impairments, functional limitations, and disability. In addition to the Nagi model, *The Guide* is also strongly influenced by 2 additional conceptual frameworks: the integration of prevention and wellness strategies and the patient/client management model. These influential frameworks are discussed further in subsequent sections.

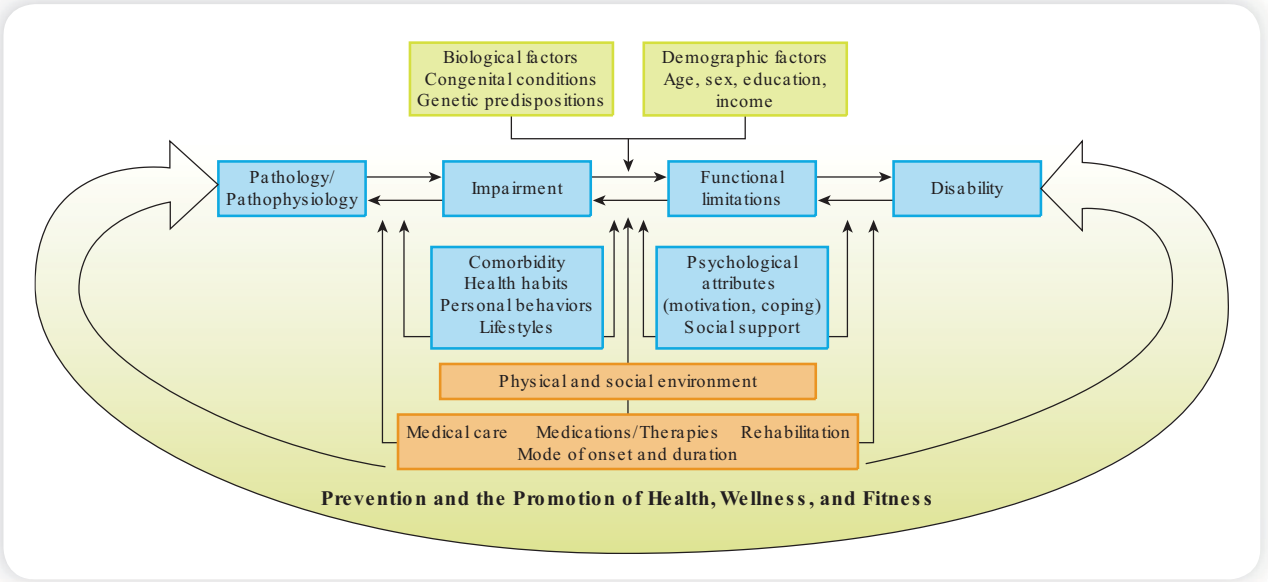

Figure 1-2

An expanded disablement model showing interactions among individual and environmental factors, prevention, and the promotion of health, wellness, and fitness. (Reproduced, with permission, from the APTA. The guide to physical therapist practice. 2nd ed. Phys Ther. 2001;81(1):9-738.)

Other Models of Patient Management

The classic medical model of patient management is distinctly different from the disablement model. Many medical providers address a wide variety of disease processes, illnesses, or injuries that patients present with, using the medical patient management model. This is typically begins with the history and physical examination (not unlike that which occurs during the disablement model), which is typically followed by some type of additional invasive tests or measures such as lab work or diagnostic imaging. The combination of the history and physical and additional tests allow the practitioner to arrive at a cellular, structural, or systems level diagnosis. Typically, pharmacologic or other medical management is utilized, or the patient or client is referred to surgery, with the ultimate goal being cure or repair of the tissue, system, or structure. In this model, referral to other practitioners may also accompany treatment, with the goal remaining cure or repair of the errant tissue, system, or structure.

Finally, a new functional movement model is emerging in physical therapist practice. This model uses the analysis of basic functional movements in order to determine if a movement dysfunction is present, as compared to attempting to describe dysfunction at the impairment level. The strength of using this model is that the practitioner can work algorithmically "backward" in order to determine the actual cause of the movement impairment. Through the use of systematic examination procedures and algorithmic thinking, the clinician is able to arrive at the specific impairment and then begin functionally based interventions that assist the patient or client in return to optimal function. Algorithms are discussed in the Introduction to Algorithm section of this chapter, while functional movement assessment and intervention is covered thoroughly in Chapters 19 and 20.

Overview of The Guide: Part 1

The original purpose of *The Guide* was to improve the quality of physical therapy, promote appropriate use of services, enhance customer satisfaction, and reduce unwarranted variations in physical therapy management. Prevention and wellness initiatives are also stressed and will help decrease the need for services.[1-3]

Chapter 1 provides a description of "who" physical therapists are and "what" they do. This description includes the various practice settings in which a physical therapist may practice, including some less traditional ones like corporate or industrial health centers and fitness centers. In this chapter, the terms "patients" and "clients" are defined as

- **Patients** are "individuals who are the recipients of physical therapy examination, evaluation, diagnosis, prognosis, and intervention and who have a disease, disorder, condition impairment, functional limitation, or disability" (Ref. 2, p. 689)
- **Clients** are "individuals who engage the services of a physical therapist and who can benefit from the physical therapist's consultation, interventions, professional advice, health promotion, fitness, wellness, or prevention services" (Ref. 2, p. 685). Clients are also businesses, school systems, and others to whom physical therapists provide services.[1-3]

The chapter continues with a general discussion of the scope of practice for physical therapists, acknowledging that this varies by state. Physical therapists provide direct services to patients as well as interact with other professionals, provide prevention and wellness services, consult, engage in critical inquiry (research), educate, administrate, and supervise support personnel.

Physical therapy is an integral part of secondary and tertiary rehabilitative care. Chapter 1 of *The Guide* expands on this model with a discussion of the physical therapist's role in primary care and in wellness. The concepts of primary care and wellness involve restoring health, alleviating pain, and preventing the onset of impairments, functional limitations, disabilities, or changes in physical function and health status resulting from injury, disease, or other causes.[1,2] Physical therapists play major roles in secondary and tertiary care of those with conditions of the musculoskeletal, neuromuscular, cardiovascular/pulmonary, and integumentary systems that may have been treated primarily by another practitioner. Often, secondary care is provided in acute care and rehabilitation hospitals as well as outpatient clinics, home health settings, and within school systems.[2,3] Tertiary care is often provided by physical therapists in more specialized, comprehensive, technologically advanced settings in response to another health care practitioners' request for consultation and specialized services offered by the therapist.[1-3]

The clinical decision-making process presented in *The Guide* comprises the 5 elements of the patient/client management model (Figure 1-3): examination, evaluation, diagnosis, prognosis, and intervention. This clinical decision-making model is explored in greater depth later in this chapter in the section titled Clinical Reasoning and Decision Making.

The physical therapist begins with a thorough *examination*. Because the focus of this text is intervention, the examination process will not be described in detail.

The next 3 steps in the process involve decision making. Using the information gathered through the examination, the physical therapist formulates an *evaluation*. This is the clinical judgement that results from assessing the situation in its entirety from multiple points of view. Factors such as loss of function or presence of dysfunctional movement patterns, social considerations, and health status are taken into consideration when developing a *diagnosis* (cluster of signs and symptoms) and *prognosis* (optimal level of improvement and time to get there), which guides the interventions that are chosen and performed during comprehensive management of the patient.[1]

Intervention describes the skilled interaction of the physical therapist when performing the therapeutic techniques and/or delegating and overseeing services. The goal is to produce a positive change in the condition or functional performance of the patient. Intervention strategies should be constantly evaluated and reevaluated for their effectiveness with goals of remediation of impairments, improvement in functional outcomes, as well as secondary and tertiary prevention and the goal of long-term wellness. Continued care is based on the patient's response and progress toward the determined goals.[1-3]

There are 3 important components to the intervention: (a) coordination, communication, and documentation; (b) patient/client-related instruction (education); and (c) procedural interventions. Management of every patient will include some aspect of the first 2 intervention components and often 1 or more procedural interventions. There are 9 procedural interventions, listed by level of importance and utilization in the practice of physical therapy:

- Therapeutic exercise (the focus of this textbook)
- Functional training in self-care and home management
- Functional training in work, community, and leisure integration or reintegration
- Manual therapy techniques, including mobilization/manipulation
- Prescription, application, and, as appropriate, fabrication of devices and equipment
- Airway clearance techniques
- Integumentary repair and protective techniques
- Electrotherapeutic modalities
- Physical agents and mechanical modalities

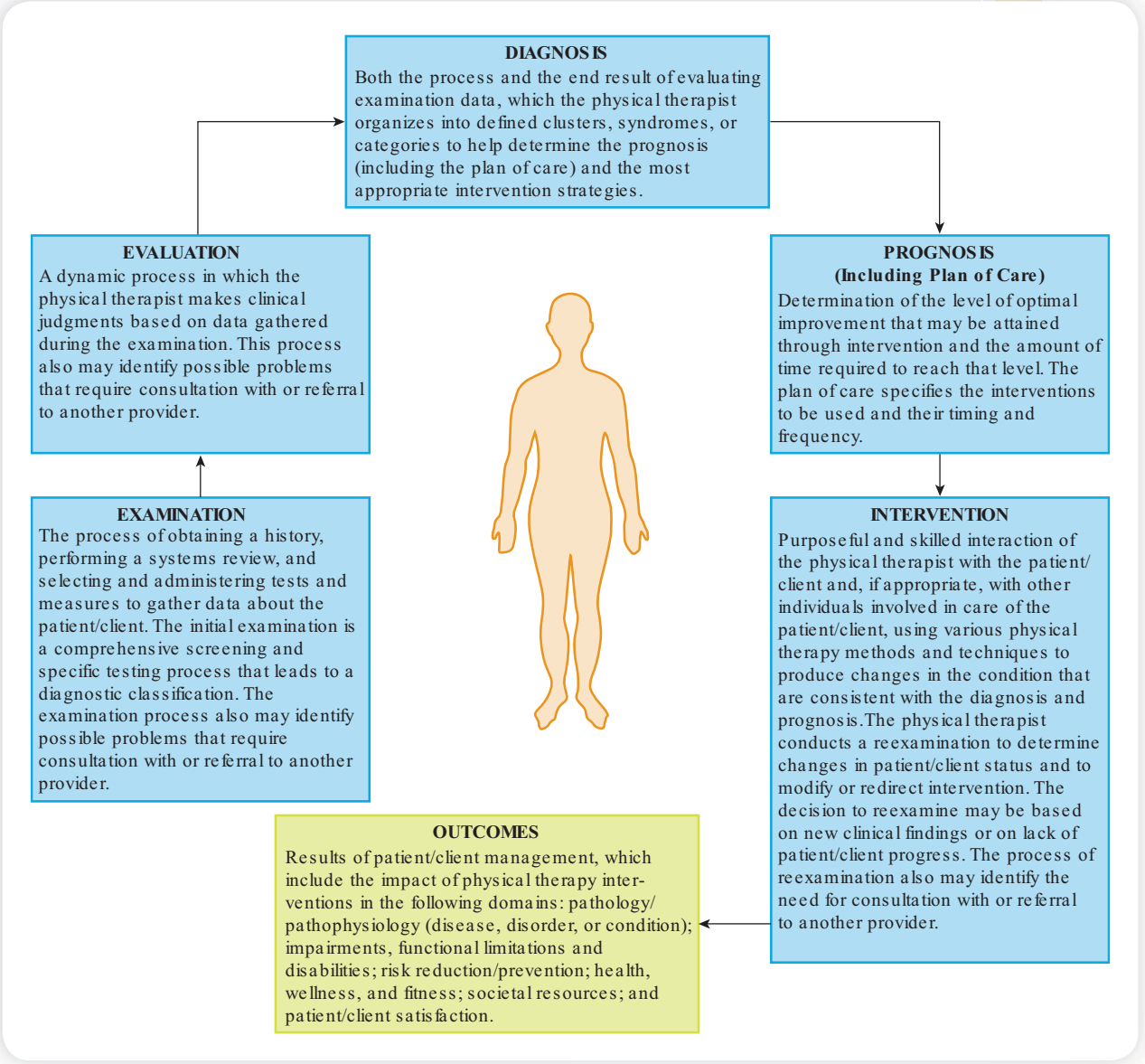

Figure 1-3 **The patient/client management model**

An expanded disablement model showing interactions among individual and environmental factors, prevention, and the promotion of health, wellness, and fitness. (Reproduced, with permission, from the APTA. The guide to physical therapist practice. 2nd ed. Phys Ther. 2001;81(1):9-738.)

Examination findings, the evaluation, diagnosis, and prognosis and any available research evidence should support the choice of intervention. Factors that might influence the choice of interventions as well as the prognosis include[1]:

- Chronicity or severity of current condition
- Level of current impairment
- Functional limitation or disability
- Living environment

- Multisite or multisystem involvement
- Physical function and health status
- Potential discharge destinations
- Preexisting conditions or diseases
- Social supports
- Stability of the condition(s)

Overview of The Guide: Part 2

Part 2 of *The Guide* has 4 sections, each dedicated to a system: musculoskeletal, neuromuscular, cardiopulmonary, and integumentary. The 4 chapters in Part 2 are distinguished by a specific graphic that relates to and depicts a structure within the content area. Chapter 4 contains the musculoskeletal patterns, Chapter 5 contains the neuromuscular patterns, Chapter 6 contains the cardiopulmonary patterns, and Chapter 7 contains the integumentary patterns. Of note to the reader of this textbook is Chapter 4, which contains general information and practice patterns describing provision of care for those with musculoskeletal dysfunction.

Musculoskeletal Practice Patterns[1-3]

A group of experts from a wide variety of musculoskeletal practice backgrounds assisted in the development of the practice patterns. Patterns of disorders were considered, grouped because of their similarities, and it was determined that many were managed similarly and have comparable outcomes. Thus, the development of the 10 preferred musculoskeletal practice patterns occurred.

The musculoskeletal patterns are impairment based and their titles reflect this. Each has key associations to pathology and medical/surgical diagnoses noted within the descriptive information about the practice pattern. Primary prevention is a significant component to each pattern because the progression from pathology to impairment, functional limitation, and disability is not inevitable. The first preferred practice pattern, like the first in the other systems' chapters, is a primary prevention pattern. The aim of such a pattern is not intervention for a preexisting condition, impairment, or functional limitation, rather prevention of each of these conditions. The rest of the patterns are for intervention in conditions that fit into the cluster of signs and symptoms that form the movement-based diagnosis. The following is a description of each pattern, the purpose of which is to get a sense of which patients and diagnoses would fall within this category of practice patterns[1-3]:

4A. Primary prevention/risk reduction for skeletal demineralization

4B. Impaired posture

4C. Impaired muscle performance

4D. Impaired joint mobility, motor function, muscle performance, and range of motion associated with connective tissue dysfunction

4E. Impaired joint mobility, motor function, muscle performance, and range of motion associated with localized inflammation

4F. Impaired joint mobility, motor function, muscle performance, range of motion, and reflex integrity associated with spinal disorders

4G. Impaired joint mobility, motor function, muscle performance, and range of motion associated with fracture

4H. Impaired joint mobility, motor function, muscle performance, and range of motion associated with joint arthroplasty

4I. Impaired joint mobility, motor function, muscle performance, and range of motion associated with bony or soft tissue surgery

4J. Impaired joint mobility, motor function, muscle performance, gait, locomotion, and balance associated with amputation

Clinical Pearl

Note that many of the first descriptive words in Musculoskeletal Practice Patterns 4D-4J are the same! They describe impairments and movement dysfunction commonly seen and predictably related in similar diagnostic groups.

The original *Guide* had areas of musculoskeletal practice not covered by the preferred practice patterns. For instance, there was no pattern dealing with the management of patients with impairments caused by upper-extremity amputations. Because *Guide* is a fluid document and is subject to updating and evolution, the second edition of *Guide* included amputations of both the upper and the lower extremities. It is likely that other diagnoses will be added to or placed in different practice patterns on a regular basis as practice evolves and *Guide* continues to evolve.

Overview of Guide: Parts 3 and 4

When the second edition and revision of *Guide* was initiated, a task force of expert clinicians and researchers was assembled to identify the vast array of test and measures used in examinations by a physical therapist and to collect the pertinent information on the reliability and validity of the tests or measures, as available in the peer-reviewed literature. Concomitantly, a second task force was convened to identify outcome measures relevant to physical therapist practice and provide similar documentation. The work of both groups was released on the CD-ROM version of *Guide* as the *Catalog of Tests and Measures*.[3] These task forces also helped to create the outline of a minimal data set for initial examination and several templates for documentation, which can also be found in the second edition of *Guide*. Because the focus of this textbook is intervention, the reader is directed to other comprehensive texts that exist regarding examination in physical therapy for additional information.

The impact of *Guide to Physical Therapist Practice* on the profession of physical therapy is evident, although its utilization clinically and in academic institutions varies. Ongoing incorporation of *Guide* into the practice of physical therapy will facilitate dialogue and improved understanding of how clinicians classify patients, develop clinical diagnoses, and determine prognoses for common groups of patients and clients. This document will continue to be a part of the professional landscape will continue to influence both the practice of and public understanding of physical therapy in positive ways.

Clinical Reasoning and Decision Making

Physical therapists make decisions related to examination, evaluation, diagnosis, prognosis, and intervention on a daily basis. Independent decision making is one of the hallmarks of an autonomous profession, a status for which the profession of physical therapy

is striving.[6] To make reasoned, independent decisions, the physical therapist must use refined, well-developed, clinical reasoning skills. Higgs and Jones have defined clinical reasoning as the practice used by the therapist to *structure* the health care process.[12] Knowledge, clinical data, patient preferences, and professional judgment all play a role in clinical reasoning. Clinical reasoning can also be described as the progression used by practitioners to plan, direct, carry out, and reflect on patient care. Clearly clinical reasoning is not a simple process; rather, it is a complex and multifaceted process of analysis and synthesis. Such a process enables therapists to view the client and their rehabilitation with depth and breadth of understanding.

Clinical reasoning is described by Edwards et al as "a way of thinking and taking action within clinical practice" (Ref. 6, p. 322). Clinical reasoning is often first utilized in the examination process and has both diagnostic and narrative components.[6] The construct known as clinical reasoning has also been discussed in Chapter 3 in relationship to the scanning examination. Once again, it is important to note that the clinical reasoning process cannot be separated from knowledge. If insufficient knowledge is present, it is likely that diagnoses and decisions based on such knowledge will provide faulty conclusions. In other words, the clinical reasoning process is only as strong and viable as the knowledge base from which the diagnosis or clinical decision is rendered.

Good clinical decision making is key to effective patient/client management. Physical therapists play a critical role in assessing neuromusculoskeletal problems, formulating a comprehensive picture of the problem(s), and choosing interventions to efficiently manage the problem. As more patients enter the physical therapy system directly or via the general practitioner, the ability of the therapist to skillfully assess patients and determine the need for care is paramount. Many patients present or are referred to therapy without a clear diagnosis, especially in the realm of musculoskeletal practice. At the most basic level, the therapist must be able to make the crucial "keep–refer" decision regarding whether the treatment needed is within their scope of practice. If the choice is made to refer, the therapist must know how to do so in order to get the best care for the patient.

Skillful clinical decision making requires foundational knowledge of anatomy, kinesiology, and biomechanics that is applied to each patient. The use of such knowledge is critical to assessing normal and abnormal movement, as well as understanding both the pathologic and normal healing processes. Together, this frame of reference helps the therapist determine the diagnosis, prognosis, and plan of care.

Tacit knowledge combined with accumulated clinical experience contributes to the art of the practice of physical therapy. Bruning, Schraw, and Ronning describe *schemata* as the complex representations of phenomenon by which individuals receive, store, and organize information.[4] As schemata help therapists to organize and retrieve knowledge, scripts or procedural rules help to guide thinking and organize common occurrences or events. Both of these strategies support effective processing of information by providing efficient mental frameworks for handling complex information.

There are few certainties in patient care. Rather, biologic, physiologic, and psychological events occur in uncertain, but often in predictable patterns. Every problem solved or decision made by a clinician is probabilistic[11] and involves a combination of hypothesis testing and pattern recognition. Hypothetic deductive reasoning and early hypothesis generation can occur with a limited database and is a way to structure the clinical examination and thinking process. A hypothesis is really a clinical impression based on an assumption of causality. By definition, "a hypothesis is a testable idea—a tentative, but best, estimate that only time can prove correct" (Ref. 20, p. 1391). Hence, clinicians apply the clinical reasoning process to the clinical decision-making process for examination and diagnosis as well as selection of interventions.

Clinical Pearl

Effective decision-making about evaluation, diagnosis, and prognosis requires approaching the problem in a systematic and orderly fashion, and this approach can also carry over into decisions about therapeutic interventions.

Clearly, reasoning does not occur in a "clinician induced vacuum." Multiple factors play a role in the clinical reasoning process, not the least of which is the identified problem as it is seen and described by the patient. Narrative reasoning involves the ability to collect and attempt to understand patients' "stories,"[6] experiences, perspectives, contexts, cultural backgrounds, and beliefs. It is important to remember that the patient's personal descriptive traits and characteristics, culture, past experiences and history, comorbidities, life situation, and personal beliefs all strongly affect the process of clinical reasoning. Vital to the process of treatment planning is taking into account the problems as they are *seen by the patient*, named the patient-identified problems, as well as the non–patient-identified problems.[19] Non–patient-identified problems are problems not identified by the patient that may have been preexisting, unknown to a patient, or identified by the therapist or another. Identification of non–patient-identified problems are especially important for excellent care as well as a prevention- and wellness-orientated practice of physical therapy as described in *The Guide to Physical Therapist Practice* (Table 1-1).[1]

The second application of clinical reasoning is during the treatment planning and intervention selection process. Edwards[8] describes 6 types of reasoning that comprise decisions made regarding management of patients and clients. These are procedural or intervention reasoning, interactive patient–therapist rapport building reasoning, collaborative patient–therapist reasoning, instructional reasoning, predictive reasoning, and ethical reasoning. The prior-listed clinical reasoning strategies are often used in combination. An emergent

Table 1-1 HOAC II Definitions of Problems

	Impairments, functional limitations, and disabilities, easily identified by the patient	Pain, loss of ROM abou a joint, loss of strength, impaired gait, impaired
	Problems identified by someone other than the patient such as a health care provider, caregiver or family member	Postural impairments, respiratory dysfunction, general deconditioning, musculoskeletal imbala
ated ns	Problems that do not exist at the current time, but may develop related to existing problems (both PIPs and NPIPs); can be prevented with proper management	Secondary shortening o muscles because of poo posture or gait deviatio

ADL, Activities of daily living; NPIPs, non–patient-identified problems; PIPs, patient-identified problems; ROM, range of motion.

Data from Rothstein J, Echternach J, Riddle D. The Hypothesis-Oriented Algorithm for Clinicians II (HOAC II): a guide for patient management. Phys Ther. 2003;83:455-470.

dialectical model of clinical reasoning that includes cognitive and decision-making processes (hypothetic-deductive reasoning), as well as reasoning skills necessary to interact with patients in their individual unique scaffold of experience, personality, and assumptions (narrative or communicative reasoning), has been reported in the literature.[2,6,7,11,12] Although each individual must ultimately construct their own schemata and procedural rules for clinical reasoning, tools exist that may assist practitioners to develop expert skills.[20]

Expert Versus Novice Decision Making

There is a well-developed body of literature about how experts make decisions.[7,8,11,17] Experienced clinicians use a well-developed collection of clinical experiences for their reasoning, while novice clinicians rely on clear-cut patterns and clues. Experts see meaningful patterns, solve problems quickly, and rely on self-monitoring (reflection).[12]

May and Dennis stated: "Experts, when compared with novices in the same field, exhibit a superior structuring of knowledge into clinically relevant patterns that are unlocked by key cues in the decision environment. Patterns stored in memory enable the expert to recognize meaningful relationships and generate likely hypotheses" (Ref. 17, p. 191). In research across many health professions, experts have been shown to excel within their specific knowledge domains, are able to see relationships, possess enhanced memory (relates to banked experience), are skilled in qualitative analysis, and have well-developed reflection skills.[12]

Likewise, researchers agree that novice decision makers function differently than their expert counterparts. They tend to value quantitative data, likely have more error during the process, and are slower in problem solving.[12]

How then do novices develop into competent decision makers and experts? Although experience is necessary for the contextual problem-solving process used by experts, less is known about the process of how problem-solving expertise is developed.[13] A major distinction that has been described between expert and novice problem solvers is that experts use *forward reasoning* rather than the *backward reasoning* or hypothetic-deductive process used by novices.[7,8] Forward reasoning is the application of a number of "if–then" rules to a problem to move forward from data to diagnosis or treatment intervention. An algorithmic approach seeks to use a number of "if–then" decisions to assist in problem solving. As previously noted, any problem-solving model that attempts to assist novices and developing clinicians must take into account the knowledge base and organizational skills of the individual. Practitioners with "high knowledge" make more inferences from prior knowledge than novices and intermediate level practioners.[8] Interestingly, experts often seem to do less problem solving than novices because they have a depth and breadth of previously stored solutions to clinical problems that they recall and use.[14] It should be noted, however, that experience alone does not always provide *accurate* solutions to problems or enable clinicians to make efficient, reasoned diagnoses. Although novices tend to solve problems incorrectly or simplistically, experts can also develop patterned thinking and rely too heavily on experience and make premature diagnoses without fully examining subtle possibilities and varied data.[15]

Problem Solving, Clinical Decision Making, and the Use of Evidence-Based Practice

Being a good problem solver is not sufficient in this day and age. According to Miller, Nyland, and Wormal, "rehabilitation clinicians must be creative problem solvers who can translate relevant research into functional interventions" (Ref. 18, p. 453). It is important

to remember that in contemporary physical therapy practice, decisions related to clinical practice should be based on the best available evidence whenever possible.

Clinicians should use the available literature to determine the best treatment(s) for their patients. Evidence-based practice has been defined as "the conscientious and judicious use of current best evidence in making decisions about the care of individual patients."[21,25] Implicit in this definition is the need for a method of determining what constitutes the "best" evidence. Before evidence can be integrated into the management of patients, an appraisal of the quality of the evidence must be completed. A major problem in the appraisal process is that of deciding whether the evidence is definitive enough to indicate an effect other than chance. The ability to judge and interpret the evidence for intervention techniques is a skill that must be developed if a clinician wishes to become evidenced based in their practice. Therefore, the ability to interpret and evaluate the evidence becomes an integral part in the clinical decision-making process. The standard for the assessment of the efficacy and value of intervention is the clinical trial. Most desirable is the prospective study, which assesses the effect and value of an intervention against those found in a control group, using human subjects.[9] Unfortunately, many of the studies in the literature that address physical therapy topics are not clinical trials, as there is no control to judge efficacy of the intervention and there are no interventions from which to draw comparisons.[3] In addition to a control group, the ideal clinical trial uses a blinded, randomized design, both for subject assignment to groups and for assessment of outcomes (Table 1-2).[5] The control can be a current standard practice, a placebo, or no active intervention.[9] Clinicians must constantly remind themselves that without information gathered from controlled clinical trials, they have limited scientific basis for their interventions. Many interventions offered by physical therapists use low levels of evidence or worse, personal testimony for the rationale behind their use. As the profession grows and the evidence base from which physical therapists can glean information

Table 1-2 **Levels of Evidence for Research**

ice	Types of Studies
	• High-quality randomized controlled trials • Systematic review of level I randomized controlled trials • Prospective studies (all patients enrolled at the same point in their pathology with >80% follow-up of enrolled patients)
	• Prospective cohort studies • Poor-quality randomized controlled trial (eg, no blinding, or impro randomization, <80% follow-up) • Systematic review of level II studies • Retrospective study • Study of untreated controls from a previous randomized controlle
I	• Case-control studies • Retrospective cohort studies • Systematic review of level III studies
V	• Case series (no, or historical, control group)
	• Expert opinion

Data from the J Bone Joint Surg, instructions for Authors.