A Clinical Reasoning Model for Manual Physical Therapy

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ABSTRACT

Background and Purpose: Evidence-based practice and accountability for clinical outcomes are crucial components of professional autonomy. While several clinical reasoning models exist for diagnosing a patient, minimal literature exists on the reasoning models physical therapists use when developing, implementing, and progressing a plan of care. **Clinical Relevance:** An evidence-based approach to the development and implementation of a plan of care can enhance the consistency of how physical therapy is provided across the profession and may improve patient outcomes. This is crucial for further development of evidence-based practice and greater recognition of the profession. One such model for manual physical therapy is Functional Manual Therapy. It is based on an understanding of the human movement system, motor development, and motor learning. **Conclusion:** This model provides physical therapists with a clinical reasoning paradigm for the development, implementation, and progression of a plan of care that can be used across the patient management model.

Key Words: movement system, Functional Manual Therapy, plan of care, physical therapy

BACKGROUND AND PURPOSE

In 1994, Miller[1] described her experience visiting 5 physical therapists (PTs) in search of care for a diagnosed chondromalacia patella. In this *Wall Street Journal* article, the author described how all PTs agreed with the diagnosis but provided vastly differing treatment plans with less than optimal explanations for the chosen interventions.[1] This pattern of comparable diagnosis with vastly divergent treatment plans is not uncommon in physical therapy practice. Some of this disparity may be explained by variability in physical therapy education, clinician bias, a clinician's specialized clinical training, or a combination of the above. In an American Physical Therapy Association (APTA) memorandum, McGehee et al[2] discussed the disparity existent in physical therapy practice as a concern of the profession. While it appears that PTs have become better skilled and more consistent in diagnosing a patient's problems (diagnostic reasoning),[3,4] physical therapy education and the profession lack a common clinical reasoning model for the development and progression of a plan of care (therapeutic or procedural reasoning).[3,4]

Clinical reasoning is defined as a multidimensional process involving cognitive skills to process information, make decisions, and take action.[4-7] Clinical decision making, which results from clinical reasoning, has been described as the "basis of the patient/client management model"[5] and "central to the practice of professional autonomy."[4] Both are crucial components of effective physical therapy practice and Vision 2020.[8] Extensive research exists on the clinical reasoning models used within medical and nursing practices for the primary purpose of clinical diagnosis. These models have been frequently applied to physical therapy education and practice and are reliable models for the differential diagnosis process. However, physical therapy interventions are on-going and must be adaptable at each phase of the plan of care and individualized to the patient's current status. In a time of autonomous practice and a rapidly changing health care environment, PTs are expected to have increased accountability for their decision making while providing clients with robust functional and clinical outcomes in a timely manner. Hence the importance of clinical reasoning models in physical therapy education that extend beyond diagnosis to provide clinicians with a clinical reasoning process that is rational, evidence-based, and easy to implement across the plan of care.

Clinical Reasoning Models Used In Physical Therapy

The patient management model (examination, evaluation, diagnosis, prognosis, plan of care, re-examination)[5] and the International Classification of Functioning, Disability and Health (ICF)[9] have provided PTs with a common language and a strong framework for clinical decision making aimed at addressing all levels of human function (body structure and function, activity, and participation).[10] These models have been instrumental in the development of the profession's preferred practice patterns, outlined in the original *Guide to Physical Therapist Practice*,[11] which provided a list of possible interventions for specific clinical presentations. Several articles have described the importance of connecting the patient management model and the ICF model to the clinical reasoning process used in clinical practice.[3,10,12,13] However, none have provided a reasoning process for treatment progression.

The most common clinical reasoning models described in the medical literature include hypothetico-deductive reasoning (backward reasoning), pattern recognition (forward reasoning), narrative reasoning, dialectical reasoning, collaborative reasoning, and diagnostic reasoning.[3,4,6,7,14] These models are effective and have been widely used in physical therapy practice for the diagnosis phase of patient care. Extensive information is available on the difference between an experienced clinician's use of pattern recognition and reflection-in-action with increased reliance on directive factors and a novice clinician's s use of hypothetico-deductive reasoning and reflection-on-action with increased reliance on informative factors for clinical decision making.[15,16] These various medical reasoning models for diagnosis have provided a valuable framework for the physical therapy profession for many years helping advance the profession towards direct access.

In addition, Edwards et al[3] have proposed a model of clinical reasoning for PTs based on two clinical reasoning strategies: one for addressing diagnosis and another for patient management. *Diagnostic reasoning* (the formation of a diagnosis based on physical disability and impairments while taking into consideration tissue pathology, pain mechanisms, and other contributing factors) and *narrative reasoning* (the inclusion of the patient's experiences, beliefs, and cultures into the decision making process) make up the strategy for diagnosis.[3] The patient management strategies include *reasoning about procedure* (the reasoning involved in choosing and carrying out an intervention procedure), *interactive reasoning* (the on-going development and management of patient-therapist rapport), *collaborative reasoning* (collaboration in all aspects of examination, evaluation, development and implementation of a plan of care), *reasoning about teaching* (educating the patient in aspects of clinical practice), *predictive reasoning* (the exploration of future scenarios with patients), and *ethical reasoning* (assessment of the ethical implications of clinical interventions and its desired goals).[3] However, while PTs know intervention techniques should most often be chosen based on the identification of body structure or functional impairments and patient preferences, a rationale for the **sequencing** and the **progression** of interventions across the plan of care remains unclear. This lack of clarity contributes not only to a clinician's challenge in developing the progression for a plan of care but also to the existing differences in how patients are treated by different PTs. This discrepancy in patient care may very well contribute to the difficulty the profession experiences in objectively measuring and documenting outcomes across the profession, further contributing to the profession's poor recognition within the medical and public communities. Physical therapists must go beyond the diagnosing of a patient. Clinicians must have the reasoning tools necessary for the development, implementation, and progression of a sound treatment plan. The remainder of this paper will present a physical therapy clinical reasoning model for the development, implementation, and progression of a plan of care, Functional Manual Therapy (FMT), along with clinical scenarios illustrating the application of this model.

Functional Manual Therapy: A Clinical Reasoning Model for Physical Therapy Intervention Based on the Movement System

While delivering the 29th Mary McMillan lecture at the 1998 annual American Physical Therapy Association (APTA) conference, Shirley Sahrmann,[17] describing the basic definition of physical therapy, stated, "we must solidify our identity as a profession by developing the concept of movement as a physiological system and by accepting the role of practitioners responsible for a system of the human organism." The APTA's current vision statement, "Transforming society by optimizing movement to improve the human experience," notes that the "physical therapy profession will define and promote the movement system as the foundation for optimizing movement to improve the health of society."[8] At the 2015 APTA Annual Conference, Delitto[8] discussed the need for the human movement system to be part of physical therapy education, supporting the APTA vision that the movement system is the core of physical therapy practice, education, and research.[8] As a result of these efforts, the APTA has put forth a white paper proposing that PTs are indeed the experts of the movement system and further stating, based on our extensive understanding of the complexity of the human movement system, PTs should provide a "customized and integrated plan of care to achieve the individual's goal-directed outcomes."[19] It states dysfunction across a variety of body systems may indeed contribute to movement dysfunction and must therefore be addressed as part of the physical therapy examination and intervention.[19]

The FMT approach to physical therapy supports this vision and proposes a clinical reasoning model that is grounded on the individual patient and on our understanding of the movement system. Functional Manual Therapy suggests that the development and implementation of a treatment plan based on the physical therapy examination must include an integrated treatment progression within each session and across the episode of care. This progression must be based on an understanding of normal movement and must be, as described by the *Guide to Physical Therapist Practice*, "contingent on the timely monitoring of patient/client responses to interventions and on the progress made toward anticipated goals and expected outcomes."[11]

Among the components of the movement system that are implicit to the FMT clinical reasoning model are an understanding of anatomy, physiology, kinesiology (including osteo- and arthro-kinematics), normal motor development, the components of movement (mobility, stability, controlled mobility and skill)[20,21]; motor learning theories, patient examination and evaluation, and the skilled observation and palpation of functional motor tasks. Within FMT, movement and functional efficiency is the primary goal. Rosenbaum[22] describes movement efficiency as one that reduces stress on joints and muscles, allows for a high rate of success with few errors, is smooth and easy, and requires the least cognitive processing. Functional Manual Therapy embraces this concept and operationally defines "functional efficiency" as *the sufficient mechanical capacity (M), neuromuscular function (N), and motor control (M) to allow for options of strategies in the performance of any given action or task*.[23] The FMT clinical reasoning model is designed to restore and enhance human movement and function through the systematic examination and treatment of these three pillars of movement: the **M-N-M model**[23] (see Table 1 for operational definitions of the M-N-M pillars and the types of interventions used within each pillar). Based on an understanding of normal motor development and the interdependence of these pillars of movement, FMT proposes a sequence/progression for the examination and treatment of the impairments identified in each patient within each segment (local), across segments (regional), and across the whole body (global). Unique to the FMT paradigm is the concept of *local interdependence*, which expands on the concept of regional interdependence to address the 3-dimensional inter-relationship of the 3 pillars of movement within each segment of the body. Local interdependence is integral to regional interdependence, which is defined as "the concept that a patient's primary musculoskeletal symptom(s) may be directly or indirectly related or influenced by impairments from various body regions and systems regardless of proximity to the primary symptom(s)."[24] In other words, local dysfunctions must be addressed 3-dimensionally and across all systems so local functional efficiency is available for regional efficiency. By addressing local and regional dysfunctions and considering their interdependence, FMT aims to reinstate the coordinated synergistic strategies of mobility and stability that are inherent in normal growth and development and remain crucial to all motor learning across the lifespan.

The Functional Manual Therapy Paradigm for Examination, Evaluation, Diagnosis, Prognosis, and Intervention

A patient's FMT examination encompasses: (1) past medical and surgical history; (2) an extensive subjective history including history of current episode; (3) the observation and assessment of posture and functional movement patterns; (4) the identification of pain producing motions; (5) the identification of anatomical structures sensitive to palpation; (6) the assessment of local, regional, and global mechanical capacity; (7) the assessment of neuromuscular function of individual and synergistic movement patterns; and (8) the analysis of functional tasks. Examination results are evaluated to determine local and regional dysfunctions across the M-N-M paradigm. These are integrated with the patient's subjective history and functional skills to determine the physical therapy diagnosis and prognosis incorporating all

Table 1. Components of Efficient Movement: Mechanical Capacity, Neuromuscular Function, Motor Control (MNM)[23]

Components of Normal and Efficient Movement and Examples of Intervention Techniques	Definition
Mechanical Capacity (M) **<u>Techniques:</u>** functional mobilization, joint mobilization, joint manipulation, soft tissue mobilization, neural/vascular mobilization, stretching, mobilization with movement, myofascial release, etc.	Mechanical capacity refers to the quality and excursion of movement and the ability to attain functional postures. This includes mobility of joints (arthrokinematics, osteokinematics, and accessory motions) and soft tissues (skin, muscles, connective tissues, neurovascular structures, and viscera). A springy end feel, defined as the presence of an elastic recoil at the end motion of a joint or soft tissue, is indicative of the efficient state of mechanical capacity. - All tissues are examined in 3 dimensions and in various functional positions taking into consideration the location, the depth and the direction of any noted restrictions. This allows for individual variability in what is considered inherent efficient mechanical capacity. - In the FMT reasoning model soft tissue restrictions are often treated prior to joint restrictions. This sequencing allows the environment surrounding a joint to have the necessary freedom for mobility gains in the tissues treated.
***Neuromuscular Function (N)** **<u>Techniques:</u>** <u>Initiation:</u> Largely performed through PNF based techniques including, but not limited to prolonged isometric holds at the end of the range of motion; irradiation from a stronger source muscle; isotonic reversals, repeated quick stretches, etc. <u>Strength:</u> resistance through movement. <u>Endurance:</u> repetition of movement.	Neuromuscular function refers to the neurophysiological ability of synergistic muscles to initiate a contraction with proper strength and endurance for the given task, including the ability to return to a state of muscular relaxation. - The PT assesses the neurophysiological capability to initiate a muscle contraction with appropriate timing and magnitude, focusing on specific types of contractions (isometric vs isotonic). Hodges[27] has shown that once inhibited by pain or dysfunction, a muscle may not be able to initiate a contraction without specific facilitation of that contraction. This body of literature supports the need for facilitation techniques that are specific not only to the inhibited muscle or muscle group, but also to the type of muscle fibers that may have been inhibited (tonic vs phasic). Once a muscle is able to initiate a contraction, strength and endurance can be worked on. An efficient tonic/stabilizing muscle contraction, with proper timing, is necessary for efficient functional movement to be performed by the larger phasic/global muscles. Lastly, the ability to 'let go' or to relax a contraction is a learned motor behavior that must be re-instated in order for efficient function to be restored. - Consider patients with protective spasms secondary to low back pain or those who have suffered a stroke or a head injury without the ability to relax muscles that are hyperactive or hypertonic. Or the patients who have learned inefficient movement patterns (incorporating protective muscle spasms) that become part of a functional repertoire as a result of repetition. Relaxation of inefficient muscle contractions must be re-instated.
Motor Control (M) **<u>Techniques:</u>** Functional re-education, task specific training, etc.	Motor control refers to "the ability to learn and perform the skillful and efficient assumption, maintenance, modification and control of voluntary movement patterns and postures."[29] In addition to the fundamental goal of independence in functional skills, the FMT paradigm promotes the establishment of functional efficiency for the accomplishment of independence in functional skills with coordinated purposeful movement. In the FMT system, motor control addresses one's ability to integrate efficient mechanical capacity and neuromuscular function for efficient functional movement. It refers to one's ability to coordinate local (stabilizing) muscles with global (moving) muscles to produce functional movements that demonstrate dynamic proximal stability and efficient distal mobility with proper timing for functional activities. The smoothness and coordination of the desired movement is of utmost importance. Tasks are progressed from simple to complex leading to skilled functional movements. The ability to habitually utilize the most functionally efficient movement strategy, out of all available options, is the ultimate goal.

Abbreviations: PNF, proprioceptive neuromuscular facilitation; PT, physical therapist; FMT, functional manual therapy
* All aspects of the FMT model are reinforced with very specific exercises assigned following each session as part of a focused home exercise program.

aspects of the bio-psycho-social model of pain management.[25] A plan of care is then developed to promote functional efficiency and independence in functional skills with coordinated purposeful movement. As described in the case of a triathlete diagnosed with chronic exertional compartment syndrome,[26] interventions for each of the M-N-M pillars are continuous and seamlessly used during each treatment session and across the episode of care to restore functional efficiency at the local and regional levels of interdependence. Every treatment session beyond the initial evaluation incorporates a continuous and seamless interaction between examination, clinical reasoning, and intervention.

Treatment progression strategies depend on whether the focus is local, regional, or global. Inherent within the *local progression* is the systematic assessment and management of surrounding soft tissues prior to progressing to the mobilization of joints, while *regional progression* is based on the understanding that the evaluation and treatment of key structures can accelerate the enhancement of posture and movement across segments, and the *global progression* is addressed by evaluation and treatment of structures that can impact the patient's ability to attain a balanced posture for functional movement. An individualized, continuous and seamless examination and evaluation, re-examination and re-evaluation, allows for the development and implementation of a patient-specific treatment plan progression. Treatment techniques are used to address each component of the FMT paradigm as indicated: **M**echanical capacity dysfunctions can be treated with functional mobilization techniques for joints, soft tissue and fascia, neural tissue, and other mobilization techniques aimed at releasing restricted tissue. Dysfunctions in **N**euromuscular function can be addressed with facilitation techniques aimed at eliminating muscle inhibition by restoring the ability of a tonic or phasic muscle (or muscle group) to initiate and terminate a contraction and to develop strength and endurance. Only then can **M**otor control be addressed through activities aimed at restoring function and promoting transfer of learning.

As illustrated in clinical scenarios 1 and 2 (Table 2 and 3), the FMT clinical reasoning process used to determine how to begin and progress a treatment plan requires that the clinician identify the M-N-M pillar affected and then choose appropriate intervention techniques for each segment and across segments. If a patient presents with complaints of hip pain related to walking or running, demonstrating inefficient weight shift and weight acceptance on the affected lower extremity (LE) during stance, the clinician must assess for, and treat, the mechanical capacity of all aspects of the lower quadrant to assure the patient can weight shift and weight accept onto that LE without compensations or dysfunctions. Once mechanical capacity of the restricted segment (including superficial fascia, skin, muscle, neurovascular tissue) is restored, it is imperative that neuromuscular function (initiation and relaxation of a contraction, strength and endurance) be addressed immediately and in a manner very specific to where a deficit may have been present. The importance of facilitating one's ability to initiate a contraction into a new range of motion or to initiate a contraction that may have been inhibited by pain or inefficient function is supported by the findings of Hodges et al[27,28] that the inhibited muscles do not return to normal function unless specifically facilitated to do so. Based on the FMT clinical reasoning model, it is only when proper initiation has been facilitated, with adequate strength and endurance, that the segment can be progressed to the motor control pillar where functional movements are learned and practiced and transference of learning is possible. It is important to note the assessment and treatment of the M-N-M pillars of movement is not a linear process but instead, it is a continuous assessment and reassessment of the interdependency between these pillars of functional movement, which must occur within each treatment session.

Table 2. Clinical Scenario 1

Clinical Scenario 1
The patient is a 15-year-old soccer player presenting 4 months following a left lateral ankle sprain. The patient reports she no longer has any pain but has difficulty with running and any cutting during games and feels decreased power in push-off when attempting to run harder. The interview reveals no past history of trauma and no complaints prior to this injury. Physical therapy examination reveals decreased DF mobility to 5° with a hard end-feel. Single limb stance is unstable and limited to 15 seconds. An observational gait analysis reveals decreased weight shift and acceptance onto the LLE, decreased stance time when compared to the R, absent L push-off with minimal engagement of the L pelvis into push off. Joint mobility assessment reveals decreased posterior and medial glide of the talus limiting DF mobility. **Clinical Reasoning:** This seems like a straightforward case of a lateral ankle sprain leading to decreased talus mobility affecting DF ROM and limiting the patient's ability to stand effectively onto that LE. A treatment plan aimed at restoring the mobility of the talus followed by therapeutic exercises focused on balance and strengthening would seem appropriate and is the most likely traditional physical therapy plan of care. However, as simple as this case appears to be, lateral ankle sprains recur at a rate of 80%[30] questioning the efficiency of traditional physical therapy in these cases. **FMT Clinical Reasoning Model:** the decreased mobility of the talus must indeed be addressed for increased ankle DF motion. However, an assessment and treatment of the mechanical capacity (M) of the calcaneus, the tibia, and the fibula must be considered to assure the functional efficiency of this segment. Adequate mechanical capacity in the surrounding articulations as well as the surrounding soft tissues and neurovascular tissues must be present to allow for the mobilization of the talus. Once mechanical capacity of the talus is addressed in an open chain position, facilitation techniques must be used to engage appropriate muscle activation across the ankle joint within the newly gained range of motion. This assessment must incorporate weight-bearing positions to assure that full mobility is restored proximal to distal and distal to proximal addressing regional interdependence across the lower quadrant. In other words, intra-segmental patterns of restrictions may have developed following the original injury and the extremity must be examined and treated as a whole when attempting to restore function at the ankle. Techniques aimed at facilitation of muscle contractions at the end of the newly gained ROM are used in open and closed chain activities to assure proper neuromuscular function. At this point the patient is instructed on functional movement patterns aimed at restoring motor control for functional activities. In this case the patient will be instructed on activities aimed at improving weight shift and weight acceptance onto the LLE while using the newly gained ROM and neuromuscular function across the lower quadrant and, specifically, the ankle. A home exercise program is prescribed so that through continuous repetition the patient will achieve proper activation of muscles for strengthening and functional re-training of the entire LE in a weight-bearing position with proper weight acceptance and active push-off initiated from the trunk and pelvis. This clinical reasoning process and the interventions that follow should occur throughout the episode of care assuring that passive mechanical capacity is restored and active neuromuscular control is trained 3-dimensionally and in stages across each treatment session progressing the patient towards full return to painfree function, in this case, playing soccer.
Abbreviations: DF, dorsiflexion; L, left; R, right; LE, lower extremity; ROM, range of motion

Table 3. Clinical Scenario 2

Clinical Scenario 2
The patient is a 24-year-old male pitcher in a college baseball team presenting with recurrent R shoulder pain that has limited his playing time for the last year. In each occurrence the patient was treated by the team PT and athletic trainer with ice, massage, soft tissue and joint mobilization, and strengthening to the shoulder and the UQ. Each episode of care was successful in relieving pain and getting the patient back on the field. However, pain recurred after pitching in 2 to 3 games, thus necessitating the patient being placed on the injured list unable to participate in the sport. The patient presents with decreased shoulder flexion and abduction secondary to anterior deltoid pain, which is exacerbated by resistance or manual palpation. The patient has no limitations in functional ROM but slightly decreased posterior and inferior glide of the humeral head on the glenoid fossa are noted. **Clinical Reasoning:** A treatment plan aimed at addressing the localized pain and decreased mobility with modalities, joint mobilization, soft tissue mobilization and strengthening of the upper quadrant and the shoulder would seem appropriate for the local dysfunction and symptoms described by the patient. The continued recurrence of symptoms, however, indicate that the source of the dysfunction may be elsewhere explaining why local treatment may get the patient back on the field but is not sufficient for keeping him painfree and playing. **FMT Clinical Reasoning Model:** While local treatment may be effective in addressing the local symptoms, this presentation requires a thorough examination and evaluation of the patient's pitching technique to determine the primary source of dysfunction that could be affecting the local shoulder dysfunction. It is possible that dysfunction elsewhere might be the driving force of the local symptoms as explained through the concept of regional interdependence.[24] A thorough observation of the patient performing the pitching motion reveals that the left ankle has decreased active motion during the deceleration and follow through phases of pitching. Thus, causing the patient to compensate by moving excessively through the shoulder. A careful examination confirms decreased mechanical capacity of ankle DF and inversion. Following the M-N-M model of FMT, a thorough examination of the LE reveals restricted mechanical capacity of the midfoot, calcaneus, talus, tibia, hip, and lumbo-pelvic girdle. A POC based on the FMT clinical reasoning model is developed to address the limited mechanical capacity of all segments of the LE in an OKC as well as in a CKC to progress to neuromuscular function of the newly gained ROM and is reinforced by a HEP. All treatment sessions are followed by a HEP with few but very specific exercises aimed at practice and repetition of the newly gained motion through functional exercises emphasizing motor control. It is only when all mechanical capacity and neuromuscular function deficits across the lower quadrant have been addressed that physical therapy can progress to interventions aimed at the affected shoulder and the upper quadrant. The final stages of the POC, when mechanical capacity and neuromuscular function of the entire UQ has been restored, will focus on the motor control pillar aiming to restore functional efficiency beyond the local and regional segments to restore the integration of all segments with functional efficiency at the global level for the task of pitching.
Abbreviations: R, right; PT, physical therapist; UQ, upper quadrant; ROM, range of motion; FMT, Functional Manual Therapy; DF, dorsiflexion; POC, plan of care; LE, lower extremity; OKC, open kinetic chain; CKC, closed kinetic chain; HEP, home exercise program

DISCUSSION AND CONCLUSION

In summary, physical therapists must possess the ability to develop a plan of care that is based on a sound clinical reasoning model aimed at restoring painfree function if we are to provide our clients with robust outcomes in a timely manner. The FMT clinical reasoning paradigm presents a reasoning process in which the therapist is guided to specifically and seamlessly cycle the examination and intervention, addressing every aspect of the patient management model in every treatment session. Underlying this paradigm is the inherent guiding principle of determining and re-establishing the interdependent relationship of the body's **M**echanical capacity, **N**euromuscular function, and **M**otor control. It proposes a treatment progression and clinical reasoning process that must be applied to each individual treatment session as well as to the entire plan of care aimed at facilitating 3-dimensional mechanical capacity locally and regionally with appropriate neuromuscular function and motor control for the restoration of functional efficiency and painfree living.[23] The ability to hit-the-ground running, as physical therapy graduates are expected to do today, requires that clinicians possess not only a strong knowledge of the human movement system, and all the techniques and approaches covered in a physical therapy curriculum, but also the ability to think through and progress a treatment plan. The FMT clinical reasoning paradigm does not require extensive clinical experience. Instead, it provides the new graduates and advanced clinicians alike with a reasoning paradigm that can be used at any level of clinical experience or expertise. It is the toolbox that holds and supports all of our clinical tools.

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