Relationship between Psychiatric Diagnosis and Functional Outcome in Physical Therapy

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RELATIONSHIP BETWEEN PSYCHIATRIC DIAGNOSIS AND FUNCTIONAL OUTCOME IN PHYSICAL THERAPY

by

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ABSTRACT
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Preliminary research suggests that psychiatric illness is associated with poorer functional outcomes in physical therapy (PT), but there is scant research examining this relationship specifically. In this study, the impact of psychiatric diagnosis on functional outcome in PT was investigated. Study design was a retrospective review of medical records. Participants were 310 veterans (M_{age} = 72.05 years; *SD* = 11.86; 96% male, 74% White) admitted for inpatient rehabilitation and referred for PT. Statistical analyses included MANCOVA and ANCOVA. Independent variables were mood disorder diagnosis, substance use disorder diagnosis, and any psychiatric diagnosis. Dependent variables were the sum of Functional Independence Measure (FIM) mobility and locomotion subscales (M+L FIM) at discharge, and percent with which participants met their PT treatment goals. Session frequency was entered as a covariate, because prior research indicated that treatment intensity is an independent predictor of functional outcome. Statistical analyses were not statistically significant. Overall, results suggest that historical psychiatric diagnosis is not associated with PT functional outcome. However, limitations in the data and the study's design may explain the null findings. Consistent with prior research, treatment intensity had a statistically and clinically significant relationship with functional outcome, such that more frequent treatment was associated with greater mobility, locomotion, and achieving PT goals at discharge.

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CHAPTER 1: INTRODUCTION

Overview of the Study

Among the 38 million Americans with disabling medical conditions, those related to the musculoskeletal system are the most prevalent. Musculoskeletal disorders account for 17.2% of disorders and injuries leading to physical disability (Matthews, 2000). This percentage is even higher after considering other medical conditions that secondarily affect the musculoskeletal system (e.g., neurological, cardiac, respiratory, and systemic conditions). Medical conditions that primarily or secondarily affect the musculoskeletal system are associated with movement and mobility deficits and disabilities, and are targets of intervention in the field of physical therapy.

Physical therapy (PT; also called physiotherapy), is a health care profession concerned with physical mobility and rehabilitation of movement dysfunction (Jette, 1989; Rose, 1989; Sahrmann, 1988; Sluijs, Kerssens, van der Zee, & Myers, 1998). The purpose of PT is to relieve pain, restore physical functioning, and ameliorate or prevent disability. PT is often medically indicated following certain illnesses, injuries, or surgeries (Matthews, 2000).

Over 90% of patients referred for PT suffer from diseases, disorders, or injuries affecting the musculoskeletal system (Kerssens & Groenewegen, 1990). The most common presenting problems in PT practice involve injuries and symptoms involving the back, neck, shoulder, and knee (Frymoyer, 1988; Kerssens & Groenewegen, 1990; Rekola, Keinanen-Kiukaanniemi, & Takala, 1993).

Functional mobility is a primary target of PT intervention and an important outcome measure in PT research. Several meta-analyses have demonstrated the efficacy of PT treatments for various types of disorders, such as orthopedic, neurological, and other medical conditions that primarily or secondarily affect the musculoskeletal system. These studies included 184 randomized clinical trials, 13,108 individuals, and assessed relevant clinical outcomes such as physical mobility, endurance, strength, and level of disability (Bailey, 2002; Beckerman, de Bie, Bouter, De Cuyper, & Oostendorp, 1992; Brandsma et al, 1998; Dagfinrud, Hagen, & Kvien, 2008; Di Fabio, 1995; Fior, Fydrich, & Turk, 1992; Leaver, Refshauge, Maher, & McAuley, 2010; Lee, McKeon, & Hertel, 2009; Lopopolo, Greco, Sullivan, Craik, & Mangione, 2006; Moreland & Thomson, 1994; Ottawa Panel evidence-based clinical practice guidelines for therapeutic exercises in the management of rheumatoid arthritis in adults [Ottawa Panel], 2004; States, Salem, & Pappas, 2009; Thomas & McIntosh, 1994, van der Heijden et al., 1995).

Although PT has robust support for its efficacy in treating movement-related dysfunction, there are patient and treatment-related variables that also influence functional outcome in PT. For example, younger age has frequently been associated with greater functional mobility at discharge (e.g., Jette & Jette, 1996; Keren et al., 2004; Kirk-Sanchez & Roach, 2001; Paolucci et al., 1999; Scopaz, Piva, Wisniewski, & Fitzgerald, 2009). Also, research has indicated that greater PT intensity (e.g., amount of PT treatment in a given time frame) has been associated with greater gains in functional outcome across a variety of medical conditions (e.g., Arinzon, Shabat, Peisakh, Gepstein, & Berner, 2010; Aronow, 1987; Basmajian et al., 1987; Carey, Matyas, & Oke, 1993; Fitzgerald, Moore, & Dittus, 1988; Guccione, Fagerson, & Anderson, 1996; Heinemann, Hamilton, Linacre, Wright, & Granger, 1995; Hesse et al., 1994; Kirk-Sanchez & Roach, 2001; Kramer et al., 1997; Lopopolo et al., 2006; MacDonnell et al., 1994; Richards et al., 1993; Roach et al., 1998).

Comorbid psychiatric illness is another clinically relevant factor to consider when assessing PT outcomes. Psychiatric illness is common in physical rehabilitation settings, such as patients presenting with musculoskeletal conditions (Härter et al., 2002). Also, research has suggested that psychiatric illness interferes with therapy participation (Kaplan, Wurtele, & Gillis, 1996; Shen, Wachowiak, & Brooks, 2005; Skidmore et al., 2010), which subsequently can impact functional outcome. However, empirical investigation of the impact of psychiatric illness on functional outcome in PT is scant. The limited available studies have almost exclusively focused on psychiatric symptom severity among general medical samples, and have excluded patients with diagnosed psychiatric disorders. Furthermore, there were too few available studies to draw firm conclusions about the relationship between psychiatric illness and functional outcome.

Statement of the Problem

Despite that research has shown that psychiatric illness is common in physical rehabilitation settings, and that psychiatric illness can interfere with therapy participation, there is a paucity of empirical research examining the relationship between psychiatric illness and functional outcome in physical therapy. Findings from the limited available studies have been mixed, with some research showing patients free from psychiatric illness and symptoms have better functional outcomes. In addition to the limited availability of studies on this topic, published studies are also limited by methodological issues, such as small sample sizes (which are underpowered) and use of univariate statistical analyses (which are unsophisticated relative to multivariate techniques). Also, many of the prior research studies failed to control for other predictors of functional outcome, such as treatment intensity. Moreover, published studies have frequently excluded patients with diagnosed psychiatric conditions, and instead have focused on depression and anxiety symptom severity among presumably psychiatrically healthy medical samples. Studies examining the relationship of psychiatric diagnosis on functional outcome were too few to draw reliable conclusions. Due to the limitations of previous research studies on the topic, this study focuses on examining the relationship between diagnosed psychiatric illness and functional outcome in PT, controlling for treatment intensity, among a relatively large sample, and using a multivariate statistical design.

Research Questions

The purpose of this study is to answer the following questions:

1. What is the impact of diagnosed psychiatric illness on functional outcomes among veterans admitted for inpatient rehabilitation, controlling for treatment intensity?
2. What is the impact of diagnosed psychiatric illness on attainment of treatment goals, controlling for treatment intensity?

Definition of Terms

Arthropathy: A disease of the joint (*Merriam-Webster Medical Dictionary*, 2009).

Capacity: A qualifier that describes an individual's ability to execute a task or action in a standardized environment (World Health Organization, 2001).

Coxarthrosis: Arthrosis of the hip (World Health Organization, 2001).

Disability: An umbrella term for impairments, activity limitations, and participation restrictions (World Health Organization, 2001; 2002) and often conceptualized as long-term patterns of behavior associated with limitations or lack of functional capacity typical for one's age and gender (Guccione, 1991).

Dorsopathy: Disease or disorders of the spine (World Health Organization, 2001).

Fasciae: Connective tissue which covers or binds together body structures (*Merriam-Webster Medical Dictionar*y, 2009).

Fibromyalgia: A chronic disorder characterized by widespread pain, tenderness, and stiffness of muscles and associated connective tissue structures that is typically accompanied by fatigue, headache, and sleep disturbances; also called fibromyalgia syndrome and fibromyositis (*Merriam-Webster Medical Dictionary*, 2009).

Functioning: An umbrella term encompassing all body functions, activities, and participation (World Health Organization, 2001).

Functional Limitation: An objective and measurable discrepancy between a person's performance compared to a standard or normative population, one without a similar health condition (World Health Organization, 2001); an inability to perform a task or obligation of usual roles and typical daily activities as the result of impairment; often used interchangeably with *disability* (Guccione, 1991).

Health Condition: refers to diseases, disorders, dysfunction, and injuries (World Health Organization, 2002).

Impairment: Problems in body functions or body structures and constitute a significant deviation or loss (World Health Organization, 2001; 2002); any loss or abnormality of anatomic, physiological, or psychological structure or function which result in functional limitations or lead to disability (Guccione, 1991); deficit of bodily structure or function, either congenital or acquired (Matthews, 2000).

Intermittent Claudication: Cramping pain and weakness in the legs (especially the calves) when walking and that disappears after rest and is usually associated with inadequate blood supply to the muscles (*Merriam-Webster Medical Dictionary*, 2009).

Kinesiology: the study of the principles of mechanics and anatomy in relation to human movement (*Merriam-Webster Medical Dictionary*, 2009).

Kinesiopathology: the study of disorders of movement as they relate to human anatomy and mechanics (Sahrmann, 1988).

Musculoskeletal: of, relating to, or involving both musculature and skeleton (*Merriam-Webster Medical Dictionary*, 2009).

Myofascial: Of or relating to the fasciae of muscles (*Merriam-Webster Medical Dictionary*, 2009).

Osteopathy: Disease of the bone, due chiefly to loss of structural integrity (*Merriam-Webster Medical Dictionary*, 2009).

Participation: Involvement in a life situation (World Health Organization, 2001; 2002).

Pathophysiology: the physiology of abnormal states; specifically, the functional changes that accompany a particular syndrome or disease (*Merriam-Webster Medical Dictionary*, 2009).

Performance: A qualifier that describes person’s ability to execute a task or action in one’s current or typical environment (World Health Organization, 2001).

Physical Therapy: A health profession, whose primary purpose is the promotion of optimal health and function through the application of scientific principles to prevent, identify, assess, correct, or alleviate acute or prolonged movement dysfunction (American Physical Therapy Association, 1993)

Physical Therapist: A rehabilitation professional who works to restore one's movement abilities (Matthews, 2000).

Plantar Fasciitis: Inflammation involving the plantar fascia (connective tissue at the sole of the foot) especially in the area of its attachment to the calcaneus (i.e., large bone in the heel) and causing pain under the heel in walking and running (*Merriam-Webster Medical Dictionary*, 2009).

Rehabilitation: The science and art of enabling persons with physical, mental, or sensory impairments to attain the highest degree of self-sufficiency an equality leading toward usefulness, satisfaction, and full participation in community life (Matthews, 2000), and which is aimed towards improving an individual's physical and mental quality of life.

Rehabilitation Outcome: Refers to gains in functional independence resulting from participation in rehabilitation treatment (Mosqueda, 1993).

Transcutaneous Electrical Nerve Stimulation (TENS): An electrical stimulation of the skin to relieve pain by interfering with the neural transmission of signals from underlying pain receptors; also called transcutaneous nerve stimulation (*Merriam-Webster Medical Dictionary*, 2009).

Trapezius Myalgia: Pain in the muscles of the upper back near the shoulders (*Merriam-Webster Medical Dictionary*, 2009).

CHAPTER II: LITERATURE REVIEW

Overview of Physical Therapy

Description of Physical Therapy

Physical therapy (PT), also called physiotherapy, is a health care profession concerned with physical mobility and rehabilitation of movement dysfunction (Jette, 1989; Rose, 1989; Sahrmann, 1988; Sluijs et al., 1998). According to the *Merriam-Webster Medical Dictionary* (2009) PT is "the treatment of disease by physical and mechanical means (as massage, regulated exercise, water, light, heat, and electricity)." This definition is limited, however, as the goals of PT extend beyond treating disease. In addition to treating the cause and symptoms disease, a central goal of PT is to improve functional capacity. In other words, PT aims to improve physical functioning in the context of activities of daily living (ADLs). Physical therapists are interested in reducing symptoms and treating disease only insofar as such amelioration leads to improvement in patients' daily functioning. This function-focus is espoused by the American Physical Therapy Association (APTA), the official professional organization representing physical therapists in the United States. APTA is the largest and most influential PT association in the nation, with a membership exceeding 77,000 (APTA, 2011). APTA's mission statement expands upon the dictionary definition of PT, and states the following:

> The mission of the American Physical Therapy Association (APTA), the principal membership organization representing and promoting the profession of physical therapy, is to further the profession's role in the prevention, diagnosis, and treatment of movement dysfunctions and the enhancement of the physical health and functional abilities of members of the public (APTA, 2009).

Purpose of Physical Therapy

PT is concerned with diseases, disorders, and symptoms affecting the musculoskeletal system. The purpose of PT is to relieve pain, restore physical functioning, and ameliorate or prevent disability. PT is often medically indicated following certain illnesses, injuries, or surgeries (Matthews, 2000). For example, diabetes is an illness associated with neuropathy of the lower extremities; an automobile accident or serious fall may cause broken bones; anterior cruciate ligament reconstruction (a surgical intervention) may cause trauma to the surrounding joints and muscles. A variety of orthopedic, neurologic, cardiovascular, and other conditions result in movement dysfunction. PT is often necessary in these and many other cases to restore functioning to affected muscles as well as keep unaffected muscles strong.

PT is also used to help people effectively utilize assistive devices. For example, physical therapists help patients with spinal cord injuries, sports injuries, broken bones, and amputations learn how to use crutches, braces, wheelchairs, and artificial limbs. PT is also used for patients with neurological illnesses (e.g., multiple sclerosis, Parkinson's disease, and stroke) and cardiovascular diseases (e.g., diabetes and peripheral aerterial occlusive disease). Again, the aim is to restore movement, thus enhancing independent living. Clearly, PT is a versatile form of treatment, with myriad intervention strategies for a wide range of conditions affecting movement and mobility. This explains in part its wide-spread use among various diagnostic classes consisting of disorders primarily or secondarily affecting the musculoskeletal system.

While PT is a highly utilized treatment modality in rehabilitation medicine, PT treats only one aspect of health. Medical illnesses, traumatic accidents, and surgical interventions often affect individuals systemically, affecting not just the structure and function of bones and muscles, but also central nervous system integrity and psychological health. Because of the impact of disease and injury on multiple bodily systems, PT is ordered for patients alongside other important rehabilitative treatments provided by allied health care specialties (e.g., occupational therapy, speech and language therapy, therapeutic recreation, and cognitive behavioral psychotherapy). These other treatment specialties work in concert to maximize patients' recovery. However, this study focuses specifically on functional outcomes in PT.

Presenting Health Problems in Physical Therapy

Over 90% of patients referred for PT suffer from diseases, disorders, or injuries affecting the musculoskeletal system (Kerssens & Groenewegen, 1990). Musculoskeletal disorders account for 17.2% of disorders and injuries leading to physical disability; among the 38 million Americans with disabling conditions, those related to the musculoskeletal system are the most prevalent (Matthews, 2000). The most common presenting problems in PT practice involve symptoms and injuries of the back, neck, shoulder, and knee (Frymoyer, 1988; Kerssens & Groenewegen, 1990; Rekola et al., 1993). Orthopedic conditions include for example, fracture and amputation. Other conditions that fall within the treatment purview of PT include neurological, cardiovascular, and systemic conditions, which primarily affect the nervous, cardiovascular, and multiple bodily systems, respectively. These conditions are also associated with decline and impairment in physical functioning. Stroke, for example, is a condition in which brain function is disrupted due to hemorrhage, embolism, or thrombosis (i.e., central nervous system events); stroke is also associated with dysfunction in mobility and locomotion (i.e., it secondarily affects the musculoskeletal system). Nearly two-thirds of stroke survivors have initial functional mobility deficits (Jørgensen, Nakayama, Raaschoi, & Olsen, 1995; Shaughnessy, Michael, Sorkin, Macko, 2005), and over 30% still cannot walk independently six months later (Jørgensen et al., 1995; Mayo, Wood-Dauphinee, Cote, Durcan, & Carlton, 2002; Patel, Duncan, Lai, & Studenski, 2000). PT also treats functional impairment associated with other primary neurological disorders such as Parkinson’s disease and multiple sclerosis, dysfunction associated with cardiovascular diseases such as diabetes, peripheral vascular disease, and peripheral aerterial occlusive disease, and dysfunction associated with general deconditioning and debility, which is frequently found among patients with extended inpatient hospital stays. While many problems seen by physical therapists relate to acute conditions (e.g., accidental injury), approximately one-third of disorders are chronic conditions (Sluijs et al., 1998).

Musculoskeletal and Movement Disorders

Classification. Disorders affecting the musculoskeletal system are systematically classified by the World Health Organization Family of International Classifications, which is a collection of taxonomies on medical diseases, disorders, and other health-related problems affecting humans. This classification system is designed to facilitate the reliable description, storage, retrieval, analysis, and interpretation of health-related information at national and international levels (Madden, Sykes, & Usten, 2007). The World Health Organization Family of International Classifications provides a conceptual framework for understanding and describing health conditions while providing a standardized language to improve communication between health care providers, researchers, and policy makers. Central in the classification system is the *International Statistical Classification of Diseases and Related Health Problems* (*ICD*), which is used by various health care professions, including medicine, nursing, and PT. The *ICD* is currently in its 10th revision (*ICD-10*; World Health Organization, 2006). Another relevant volume is the *International Classification of Functioning, Disability, and Health* (*ICF*; World Health Organization, 2001). The *ICD-10*, and its companion, the *ICF* provide complimentary perspectives on disorders of the musculoskeletal system; the former focuses on underlying disease processes, while the latter focuses on functional implications.

According to the *ICD-10*, diseases of the musculoskeletal system are divided into the following six categories: (1) arthropathies (i.e., disorders affecting predominantly the peripheral (limb) joints; (2) systemic connective tissue disorders; (3) dorsopathies (i.e., spine-related disorders); (4) soft tissue disorders (including disorders of the muscles, tendons, and other soft tissue diseases); (5) osteopathies and chondropathies (i.e., disorders of bone density and structure); (6) other disorders of the musculoskeletal system and connective tissue (e.g., acquired deformities, postprocedural musculoskeletal disorders). These six categories are further subdivided into hundreds of unique medical diagnoses, each represented by a 3- or 4-point alphanumeric code that identifies the specific disease or disorder within each category. Three-point codes represent distinct disease entities. Four-point codes provide greater specificity of diseases or disorders. For example, diseases of the musculoskeletal system encompass codes M00 through M99; arthropathies encompass codes M00 through M25; and arthorosis disorders encompass codes M15 through M19. Coxarthrosis (arthrosis of the hip) is coded as M16 and is a specific disorder. A fourth digit adds further clinical information; for example, M16.4 refers to posttraumatic coxarthrosis, bilateral (World Health Organization, 2004).

In contrast to the *ICD-10*, a classification of disease stated from an etiological framework, the *ICF* systematically categorizes states of health and health-related domains as they relate to functioning and disability (World Health Organization, 2001). Information contained within the *ICF* is organized according into four main components: (1) body functions (i.e., the physical and psychological functions of body systems); (2) body structures (i.e., anatomical body parts such as organs and limbs); (3) activities (i.e., task execution) and participation (i.e., involvement in life situations); and (4) environmental factors (i.e., factors external to the individual and that make up the physical, social, and attitudinal milieu in which the individual lives). These four main components are relevant to understanding and describing functioning and disability due to disease, dysfunction, or injury involving the musculoskeletal system.

ICF chapters that are most relevant to the treatment of musculoskeletal conditions include: (1) in body functions: (a) sensory functions and pain and (b) neuromusculoskeletal and movement-related functions; (2) in body structures: (c) structures of the nervous system and (d) structures related to movement; (3) in activities and participation: (e) general tasks and demands, (f) mobility, and (g) self-care; and (4) in environmental factors: (h) products and technology (World Health Organization, 2001).

ICF classifications are subdivided into hundreds of unique codes, each represented by a 4- or 5-digit alphanumeric code. The first digit in the alphanumeric code refers to one of the four main components (“B” for body functions, “S” for body structures, “D” for activities and participation, and “E” for environmental factors). This multiperspective framework permits a code to be assigned from each component for the same individual. The second digit refers to the chapter within the components; that is, “1” refers to chapter 1, “2” refers to chapter 2, and so on. The third and fourth digits refer to the associated body structures, body functions, activities and participation, and environmental factors. Additional digits or qualifiers may be added to provide greater specificity within each standard 4- or 5-digit code. These qualifier digits represent severity of functional impairment (for body functions and body structures), need for assistance during activities and participation, and environmental barriers and facilitators. Qualifiers may also be used to refer to the localization and change of a particular body structure (World Health Organization, 2001).

To elucidate the relationship between ICD-10 and ICF diagnoses, consider the following example. An individual with an *ICD-10* diagnosis of Posttraumatic Coxarthrosis, Bilateral could be classified according to the *ICF* with the following codes: (1) B7101.3, which represents severe impairment in mobility of more than one joint; (2) S7401.3, which represents severe impairment of the joints of the pelvic region; (3) D4200.2, which refers to moderate difficulty transferring oneself while sitting (e.g., from wheelchair to another seat); and (4) E1201+3, which refers to a substantial facilitating environmental factor related to products and technology for personal indoor and outdoor mobility and transportation such as a walker (World Health Organization, 2001). This example explicates the complimentary nature of the function-focused *ICF* and the etiologic-focused *ICD-10*.

Another classification system within the WHO-FIC that appears to be highly relevant for the assessment and treatment of movement disorders and functional impairment is the *International Classification of Musculoskeletal Disorders* (*ICMSD*). However, to my knowledge, the *ICMSD* has not yet been published. The *ICMSD* was reported as being developed by the International League of Associations of Rheumatology (World Health Organization, 2004). However, my attempts to locate the *ICMSD* as well as scholarly information about this system (e.g., via the Ovid Medline and PsycINFO databases, Marquette University Raynor-Memorial Library Reserves, Internet search) were not fruitful.

The strength of the *ICD-10* and *ICF* is the provision of a standard framework and language for describing conditions of health and disease. The *ICF* has the potential for great utility in PT practice, given its focus on the consequences of disease as it relates to the individual and their daily functioning (Wagstaff, 1982). The *ICF* also helps rehabilitation specialists, such as physical therapists, describe changes in body structure and function including what an individual can do in a standard environment (capacity) as well as what they can do in their usual environment (performance). Knowledge and use of the *ICF* has direct implications for treatment of musculoskeletal disorders (Jette, 1989; World Health Organization, 2001; 2002). However, the *ICF* does is not used in practice as widely as the *ICD*.

Mortality. According to the World Health Organization (2004), the majority of primary musculoskeletal disorders are conditions unlikely to cause death, although there are exceptions (e.g., scoliosis with mention of pulmonary heart disease, heart failure, or heart disease; post-procedural musculoskeletal disorders not elsewhere classified). While most disorders seen by physical therapists are not life threatening, they may have a severely negative impact on patients' quality of life. Treatment is aimed at restoring movement, reducing or eliminating dysfunction and disability, and increasing functional independence. PT focuses on both ameliorating symptoms, such as pain, and improving physical functioning, such as range of motion and gait speed. This dual focus facilitates patients' return to independent functioning and active participation in social and occupational activities, such as returning to work following sick leave (Lindström et al., 1992).

Role and Function of the Physical Therapist

Physical therapists (also called physiotherapists) treat patients with disorders that affect movement (e.g., physical mobility, joint range of motion, muscle strength, and physical endurance). Physical therapists are practitioners whose scope of practice includes (1) evaluation and diagnosis of disorders and dysfunction related to physical mobility, and (2) clinical intervention such as direct treatment and patient education (APTA, 1997). Physical therapists utilize classification systems such as the *ICD-10* and *ICF* for diagnosing musculoskeletal conditions and plan treatment interventions (Jette, 1989).

Diagnosis. Diagnosis in PT names the primary dysfunction toward which the physical therapist directs treatment. The dysfunction is identified by the physical therapist based on the information obtained from the history, signs, symptoms, examination, and tests that the physical therapist performs or requests (Sahrmann, 1988). Historically, physicians prescribed PT treatment after diagnosing musculoskeletal disorders. The physician's diagnosis, based on the *ICD-10*, is based on a collection of relevant signs and symptoms. According to Sahrmann, such general medical diagnoses, while important, were insufficient to inform PT treatment.

To accommodate the needs of the PT profession, Sahrmann (1988) proposed that physical therapists possess knowledge and training that should be utilized to form a classification scheme which would lead to more practice-relevant treatment. Specifically, Sahrmann stated that physical therapists' education and training in anatomy, physiology, pathophysiology, kinesiology, and kinesiopathology allows them to identify key factors underlying movement dysfunctions. This function-centered perspective, as opposed to the medically-oriented disease-focused perspective, provides clinically useful way to classify diagnoses which in turn would better inform treatment, enhance PT practice, and lead to better patient outcomes.

Like the complimentary nature of the *ICD-10* and *ICF*, PT diagnoses are complimentary to medical diagnoses. An illustration of this complimentary relationship was described cogently by Sahrmann (1988) and is paraphrased here: A physician may diagnose the condition of the patient as a cerebrovascular accident and may even indicate the specific blood vessels involved, but the diagnosis provides limited information pertinent to the PT treatment. In contrast, the physical therapist's diagnosis will address factors such as movement, range of motion, strength, and muscle tone.

Intervention. The ultimate goal of PT is to restore physical functioning enough to enable patients to return to independent living. Rehabilitation frequently targets the neck, back, shoulder, and knee (Philadelphia Panel evidence-based clinical practice guidelines on selected rehabilitation interventions for knee pain [Philadelphia Panel 2001a]; Philadelphia Panel evidence-based clinical practice guidelines on selected rehabilitation interventions for low back pain [Philadelphia Panel 2001b]; Philadelphia Panel evidence-based clinical practice guidelines on selected rehabilitation interventions for neck pain [Philadelphia Panel 2001c]; Philadelphia Panel evidence-based clinical practice guidelines on selected rehabilitation interventions for shoulder pain [Philadelphia Panel 2001d]). Symptoms and dysfunction associated with these body sites are integral for physical functioning and are the most common causes for referral to PT. Interventions focus on rehabilitating basic functional abilities such as mobility, transfer, and locomotion. Interventions are designed to regulate muscle tone, reduce swelling, increase range of motion, improve muscle strength, improve gait and posture, reduce pain, improve aerobic capacity, teach patients how to use assistance devices, and reduce physically-related functional impairments (Dekker, van Baar, Curfs, & Kerssens, 1993; Lindström et al., 1992; Matthews, 2000).

Myriad intervention strategies are utilized in PT. Examples include elecrotherapies such as electromyographic biofeedback, laser therapy, transcutaneous electrical nerve stimulation (TENS), and ultrasound (Beckerman et al., 1992; Dagfinrud et al., 2008; Moreland & Thompson, 1994; Ottawa Panel, 2004; Philadelphia Panel 2001a; 2001b; 2001c; 2001d; education and information (Brandsma, Robeer, van den Heuvel, Smit, Wittens, & Oostendrop, 1998; Cohen, Heinrich, Naliboff, Collins, & Bonebakker, 1983; Crockett, Foreman, Alden, & Blasberg, 1986; Dagfinrud et al., 2008; Di Fabio, 1995; Foster et al., 2007; Golby, Moore, Doust, & Trew, 2006; Klässbo, Larsson, & Harms-Ringdahl, 2003; Lindström et al., 1992; Matthews, 2000; Michaelson, Sjölander, Johansson, 2004; Ottawa Panel, 2004), manual therapies such as massage, joint manipulation and mobilization, soft tissue mobilization, and traction treatment (Cohen et al., 1983; Crockett et al., 1986; Leaver et al., 2010; Matthews, 2000; Ottawa Panel, 2004; Philadelphia Panel 2001a; 2001b; 2001c; 2001d; van der Heijden et al., 1995), relaxation training, including deep breathing and other methods (Cohen et al., 1983; Leaver et al., 2010; Michaelson et al., 2004); therapeutic exercise, including aerobic exercise, coordination training, gait training, and strength training (Baskett, Broad, Reekie, Hocking, & Green, 1999; Brandsma et al., 1998; Cohen et al., 1983; Dagfinrud et al., 2008; Di Fabio, 1995; Foster et al., 2007; Golby et al., 2006; Lauridsen, de la Cour, Gottschalck, & Svensson, 2002; Leaver et al., 2010; Lindström et al., 1992; Long, Donelson, & Fung, 2004; Lopoplo, Greco, Sullivan, Craik, & Mangione, 2006; Lysack, Dama, Neufield, & Andreassi, 2005; Matthews, 2000; Michaelson et al., 2004; Ottawa Panel, 2004; Philadelphia Panel 2001a; 2001b; 2001c; 2001d; Schachter, Busch, Peloso, & Sheppard, 2003; Smeets et al., 2008; Smeets, Severens, Beelen, Vlaeyen, & Knottnerus, 2009; States et al., 2009; Waling, Järvolm, & Sundelin, 2002; Wang, Wang, & Chen, 2004; Wilder & Barrett, 2005); and wound management (Matthews, 2000). In rehabilitation units, techniques typically focus on enhancing mobility and locomotion (e.g., improving gait, ambulating independently or with a walker, operating a wheelchair, climbing stairs, etc).

Assessment. A vital part of the role of the physical therapist is formal assessment of functional status for the purpose of establishing intervention needs and measuring outcomes. When relevant, psychometrically sound measurement tools are utilized to facilitate outcomes measurement (APTA, 1997). Some of the more common assessment tools for evaluating functional mobility include the Functional Independence Measure, the Barthel Index, and the Rivermead Mobility Index.

One of the most widely researched and used measure of functional status is the Functional Independence Measure (FIM; Granger, Hamilton, Keith, Zielezny, & Sherwin 1986; Hamilton, Granger, Sherwin, Zielezny, & Tashman, 1987; Keith, Granger, Hamilton, & Sherwin, 1987). Due to its pervasive use clinically and in research, its structure and psychometric properties are described in great detail.

The FIM is an 18-item clinician-rated measure designed to assess severity of functional disability and progress during medical rehabilitation. The FIM describes and measures a patient's functional limitations, specifically those required for the physical aspects of daily living, and the associated burden of care (Deutsch, Braun, & Granger, 1997; Fucile, 1992; Granger, 2008; Granger, Hamilton, Linacre, Heinemann, & Wright, 1993; Hamilton et al., 1987; Keith et al., 1987). The FIM was created by the American Congress of Rehabilitation/American Academy of Physical Medicine and Rehabilitation Task Force as a method to uniformly measure the severity of disability, particularly activity restrictions that are associated with disability (Granger et al., 1986; Keith et al., 1987). The FIM was designed to measure functional abilities considered essential (i.e., the minimum number of key activities of daily living) and that are reflective of disability regardless of the underlying pathology (Byrnes & Powers, 1989; Granger et al., 1986; Hamilton et al., 1987). The current version of the FIM contains 18 items which are rated on a 7-point, ordinal scale (Hamilton et al., 1987; Keith et al., 1987).

The FIM has frequently been employed in medical rehabilitation settings and has been used with a variety of patient populations including patients with cancer, spinal cord injuries, osteoarthritis, orthopedic injuries, and neurological conditions such as multiple sclerosis, stroke, and brain trauma (Adachi, 1996; Dodds, Martin, Stolov, & Deyo, 1993; Fucile, 1992; Good et al., 2006; Granger, 2008; Granger, Cotter, Hamilton, Roger, Fiedler, & Hens, 1990; Granger, Divan, & Fiedler, 1995; Granger et al., 1986; Granger, Hamilton et al., 1993; Granger, Ottenbacher, & Fiedler, 1995; Marciniak, Sliwa, Spill, Heinemann, & Semik, 1996; Watson, Kanny, White, & Anson, 1995). It is widely used for tracking rehabilitative outcomes among medical patients (Fiedler & Granger, 1996; Granger, Cotter, Hamilton, & Fiedler, 1993; Granger, Hamilton et al., 1993; Owczarzak, 2003) and is frequently used by physical therapists to evaluate the amount of assistance required by a patient to perform basic activities of daily living safely and effectively (Adachi, 1996; Granger et al., 1986; Owczarzak, 2003; Watson et al., 1995).

The FIM's 18 items span six domains: (1) self care, (2) sphincter control, (3) mobility, (4) locomotion, (5) communication, and (6) social cognition (Hamilton et al., 1987; Keith et al., 1987). Higher scores reflect greater functional independence; scores 1-5 indicate that a helper is required in order to perform the activity safely and effectively, while scores 6 and 7 indicate that no helper is required. Scores reflect a patient's *typical* performance rather than *best* performance. The 18 items are summed to yield the total FIM score, which range from 18 to 126. The FIM are often divided into two subscales, the Motor FIM (items 1 to 13) and the Cognitive FIM (items 14 to 18). Scores on the Motor FIM subscale range from 13 to 91 and on the Cognitive FIM range from 5 to 35 with higher scores indicating greater functional independence (Deutch et al., 1997; Granger 2008; Granger, Hamilton et al., 1993).

The FIM has standardized administration procedures, and its psychometric properties have been extensively tested (Fiedler & Granger, 1996). Among a sample of over 11,000 patients with a variety of medical diagnoses (e.g., spinal cord injury, stroke, orthopedic conditions), internal consistency for the total FIM was excellent for the overall sample at admission and discharge (αs were .93 and .95, respectively), and when grouped by impairment (Dodds et al., 1993).

The FIM was shown to have excellent interrater agreement across a variety of studies. Regarding the 4-point pilot version of the FIM, Hamilton et al. (1987) reported that among 303 pairs of clinicians, interrater agreement for the total FIM score was high (ICC ranged from .86 to .88, average κ across the 18 items was .54). However, most studies on the psychometric properties of the FIM use the official 7-point version of the scale. For example, Hamilton, Laughlin, Fiedler, and Granger (1994), examined FIM data from 89 rehabilitation and acute hospitals and over 1000 patients; they reported excellent interrater reliability for the motor, cognitive, and total FIM (ICCs were .96, .91, and .96, respectively). Among inpatients with head injuries, the FIM demonstrated interrater agreement over .90 and test-retest stability over .80 (Byrnes & Powers, 1989). In a systematic review of 11 studies from the 1990s (Ottenbacher, Hsu, Granger, & Fiedler, 1996), interrater reliability of the total FIM was consistently high (ICCs ranged from .83 – .99), and test-retest stability was likewise high (ICC = .93; *r*s = .84 – .90). The average reliability across all studies was excellent for the Cognitive FIM (*M* = .93, *SD* = .10), Motor FIM (*M* = .97, *SD* = .04), and Total FIM (*M* = .95, *SD* = .05). Furthermore, the authors reported that that reliability was consistently high across medical populations (e.g., spinal cord injury patients, *M* = .86, *SD* = .24; stroke patients, *M* = .90, *SD* = .14; multiple sclerosis patients, *M* = .91, *SD* = .18; mixed medical populations, *M* = .93, *SD* = .19).

In terms of its precision, the FIM was shown to be sensitive to change (i.e., functional improvement) over time (Dahmer et al., 1993; Dodds et al., 1993) and was more sensitive to change when compared to the Barthel Index (Dahmer et al., 1993), another widely used measure of functional ability.

Turning to validity, construct validity was supported in a study by Dodd et al. (1993). Specifically, FIM scores were negatively correlated as expected with age and comorbid conditions related to functional impairments. Patients older than 75 and patients with coexisting comorbid conditions such as stroke, spinal cord injuries, and orthopedic conditions required more assistance compared to younger patients and patients without comorbid medical conditions.

The FIM also discriminated functional status differences among patients based on severity of comorbid conditions. Discharge FIM scores were also significantly lower than admission scores, which implies that patients' functional status improved as a result of treatment or natural recovery. In sum, Dodd and colleagues demonstrated that the FIM was able detect differences in functional status in a dose-dependent manner.

Construct validity was also supported by Granger, Divan, and Fiedler (1995). In their study of 22 brain-injured individuals and their caregivers, individuals with higher motor, cognitive, and total FIM scores were less likely to require supervision and help as reported by their caregivers. That is, those requiring constant supervision and help had, on average, the lowest FIM scores; those needing daily supervision had higher FIM scores; those needing weekly supervision and help had even higher FIM scores; and those needing no supervision and help had the highest FIM scores.

Factorial validity was supported in several studies (e.g., Granger, Hamilton et al., 1993; Linacre, Heinemann, Wright, Granger, & Hamilton 1994; Heinemann, Linacre, Wright, Hamilton, & Granger, 1994). Specifically, Rasch analyses indicated that, compared to a one-dimensional model, the FIM was better explained by a two-dimensional factor structure, with cognitive and motor items forming independent linear subscales (Granger, Hamilton et al., 1993; Linacre et al., 1994). Results from Rasch analyses also indicated that the Motor and Cognitive subscales were each unidimensional, with items within each subscale forming a clear interval continuum of functional ability (Fiedler & Granger, 1996; Granger, Hamilton et al., 1993; Heinemann et al., 1994; Linacre et al., 1994).

Additionally, the FIM has demonstrated predictive validity. Several studies have shown that FIM scores are a better predictor of functional improvement among multiple sclerosis, stroke, and head injury patients when compared to similar measures such as the Environmental Status Scale, Incapacity Status Scale, and Sickness Impact Profile (Granger, Cotter et al., 1993; Granger, Divan, & Fiedler, 1995; Granger et al., 1990). Scores on the FIM predicted the amount of help measured in minutes per day (Granger, Cotter et al., 1993; Granger, Divan, & Fiedler, 1995; Granger et al., 1990). Specifically, higher scores on the FIM (reflecting greater independence) were associated with less need for assistance from a helper. The FIM's motor items had particularly strong effect sizes (*r*s ranged from -.70 to -.84). Research by Stineman, Escarce, Goin, Hamilton, Granger, and Williams (as cited in Fiedler & Granger, 1996) reported that FIM scores were significant predictors of length of inpatient stay. Moreover, FIM scores predicted whether inpatients were discharged back into the community, with higher FIM scores indicating greater likelihood that inpatients were discharged back into the community versus discharge to a nursing home or acute care, or death (Granger, Hamilton, & Fiedler, 1992). Finally, Dodds et al. (1993) reported similar findings. In their study of over 11,000 inpatients, FIM scores were higher for patients transferred to supervised living settings compared to those transferred to a nursing unit. FIM scores also predicted self-reported general life satisfaction (Granger, Divan, & Fiedler, 1995; Granger et al., 1990). In sum, the FIM has demonstrated satisfactory psychometric properties across medical rehabilitation populations and is firmly established as a measurement of functional improvement.

Another widely used measure is the Barthel Index (BI; Mahoney & Barthel, 1965). The BI is a 10-item measure designed to assess functional mobility and ability to perform basic ADLs such as feeding, bathing, and grooming. The BI is used to record performance rather than capacity; in other words, to evaluate typical rather than optimal behavior. The BI was shown to have sufficient reliability and validity in research examining various clinical diagnoses, although most research studies focus on neurologic patients (e.g., Collin, Wade, Davies, & Horne, 1988; Green, Forster, & Young, 2001; Gresham, Phillips, & Labi, 1980; Hsueh, Lin, Jeng, & Hsieh, 2002; Loewen & Anderson, 1988; Shah, Vanclay, & Cooper, 1989; Stone, Ali, Auberleek, Thompsell, & Young, 1994; van der Putten, Hobart, Freeman, & Thompson, 1999).

The Rivermead Mobility Index (RMI; Collen, Wade, Robb, & Bradshaw, 1991) is another instrument designed to measure functional mobility and degree of disability. The RMI is a 15-item measure, which focuses on a patient's ability to move and use one's own body without assistance from others or devices (e.g., wheelchair or wheeled walker). The RMI was shown to have sufficient reliability and validity with neurologic patients (Antonucci, Aprile, & Paolucci, 2002; Collen et al., 1991; Franchignoni, Tesio, Benevolo, & Ottonello, 2003; Green et al., 2001; Hsieh, Hsueh, & Mao, 2000). However, its psychometric integrity with orthopedic patients is questionable (e.g., Franchignoni, Brunelli, Orlandini, Ferriero, & Traballeski, 2003; Ryall, Eyres, Neumann, Bhakta, & Tennant, 2003).

To summarize, there are various standardized measures of assessing functional abilities and disabilities in the context of physical rehabilitation. Among them, the FIM is superior in terms of the wealth of research supporting its psychometric soundness and clinical utility.

Efficacy of Physical Therapy

Efficacy of Physical Therapy in General

Empirical research has provided strong support for the efficacy of PT for various disorders that primarily or secondarily affect the musculoskeletal system. Absolute efficacy of myriad PT interventions has strong research support. That is, PT has been shown by research to be superior to no treatment, minimal treatment, and sham treatment. Relative efficacy of PT is less clear. Certain interventions have been found to be superior to others in restoring physical functioning. For other interventions, neither absolute nor relative efficacy has been firmly established. One such example is traction treatment for back and neck pain. Van der Heijden et al. (1995) meta-analyzed 17 RCTs comparing traction treatment to other PT or minimal interventions among patients with back and neck pain. Traction treatment is based on body mechanics and reflex mechanisms; spinal elongation and spinal muscles are manipulated by a harness, sling, or manually from a physical therapist. Traction treatment is theorized to improve pain and functional mobility by correcting spinal structure. The 17 studies reviewed were published between 1966 and 1991 and involved 2,559 patients with a variety of conditions such as low back pain, cervical pain, prolapsed lumbar disk, and other diagnoses with back and/or neck pain symptoms. Results from the meta-analysis indicated traction treatment was no better than minimal intervention (e.g., traction treatment administered at very low dosages). The authors concluded that while the efficacy of traction treatment was not demonstrated. That being said, the corpus of research supports the efficacy of PT interventions.

Several meta-analyses have demonstrated the efficacy of PT treatments for various types of disorders that primarily or secondarily affect the musculoskeletal system. PT has been show to be effective for orthopedic conditions, such as anklosing spondylitis (Dagfinrud et al., 2008), back pain (Bailey, 2002; Di Fabio, 1995; Fior et al., 1992), intermittent claudication (Brandsma et al, 1998), myofascial pain (Beckerman et al., 1992), neck pain (Leaver et al., 2010), joint disorders such as osteoarthritis and rheumatoid arthritis (Beckerman et al., 1992; Ottawa Panel, 2004), posttraumatic joint disorders such as ankle sprain (Beckerman et al., 1992), and plantar fasciitis (Lee et al., 2009). PT has also been shown to be effective for neurologic disorders that secondarily affect the musculoskeletal system, such as stroke (e.g., Moreland & Thomson, 1994; States et al., 2009), as well preventing postoperative complications following upper abdominal surgery (Thomas & McIntosh, 1994), and improving gait speed in a nonclinical elderly population (Lopopolo et al., 2006).

Functional mobility, being a primary target of PT intervention, is an important outcome measure in PT research. There is a wealth of research on the absolute and relative efficacy of PT in improving functional mobility. Treatment efficacy research has led to consensus guidelines on treating various conditions affecting the musculoskeletal system (e.g., Ottawa Panel, 2004; Philadelphia Panel 2001a; 2001b; 2001c; 2001d). Main findings from meta-analytic studies of PT efficacy are presented next.

Efficacy for Orthopedic Conditions

Beckerman et al. (1992) meta-analyzed 36 randomized clinical trials (RCTs) comparing laser treatment to either no treatment or other PT intervention. Laser treatment frequently includes helium-neon laser, infrared laser, or gallium-aluminum-arsenide lasers, or some combination of these, which are administered at low levels directly onto body tissue. Lasers stimulate biochemical and physiological reactions in cells, and this is theorized to improve functional mobility in patients with certain musculoskeletal conditions. The 36 RCTs were published between 1981 and 1990 and involved 1,704 patients with musculoskeletal conditions such as osteoarthritis, rheumatoid arthritis, ankle sprain, and myofascial pain. While conflicting results were observed across the 36 RCTs, the better quality studies argued in favor of laser treatment. Results from the meta-analysis indicated that in general laser treatment improved functional outcomes among patients when compared to no treatment or other PT.

Dagfinrud et al. (2008) meta-analyzed 11 RCTs and quasi-experimental studies examining the efficacy of various PT interventions versus no treatment as well as relative efficacy of specific interventions in the treatment of anklosing spondylitis. Anklosing spondylitis is a chronic inflammatory rheumatic disease affecting the joints and ligaments of the spine, and the disorder results in pain, stiffness, reduced spine mobility, and functional impairment. The 11 RCTs were published between 1990 and 2006 and involved 763 participants; four studies compared PT to no treatment, while seven studies compared different PT interventions to each other. Results from the meta-analysis indicated that educational and home exercise was superior to no treatment in increasing spine mobility and physical functioning, but was not significantly different than no treatment in reducing pain. Compared to home exercise, group PT exercise (supervised by a physical therapist) was superior in increasing spinal mobility, but the interventions were comparable in reducing pain and improving physical functioning. Spa therapy plus group PT exercise was superior to group PT exercise alone in reducing pain, but the treatments were comparable in improving physical functioning. No significant differences were found between balneotherapy plus exercise therapy and exercise therapy alone in reducing pain and stiffness and improving spine mobility and physical functioning. The authors noted that interventions types, intensities, durations, and levels of care were heterogeneous, and that research should examine the impact of these variables on PT outcome.

Di Fabio (1995) meta-analyzed 19 RCTs comparing back school (i.e. exercise training, didactic training on anatomy and spine function) to no treatment, placebo, or other PT. In addition, comprehensive back school programs, which included worksite visits, general physical conditioning, and/or cognitive behavioral group therapy, were compared to basic back school programs. The 19 RCTs were published between 1977 and 1992 and involved 2,373 patients in outpatient or inpatient treatment. Results from the meta-analysis indicated that back school was superior to no treatment and placebo treatment. To a lesser degree, back school was superior to other PT treatments. Comprehensive back school programs were superior to basic back school programs in decreasing pain, increasing spinal motion, increasing muscle strength, and improving endurance. Chronicity of back pain did not influence outcomes.

Leaver et al. (2010) meta-analyzed 33 RCTs examining the efficacy of various PT interventions on nonspecific neck pain. While neck pain symptoms are often associated with diseases and injuries such as inflammatory disease, vascular disorders, and fracture, cause of neck pain cannot be linked to specific etiology (i.e., it is nonspecific) in the majority of cases. Various PT interventions were reviewed and compared to no treatment, sham treatment, or minimal intervention. Outcomes examined were pain and disability reduction. The 33 RCTs were published between 1982 and 2007 and involved 3,766 patients. Results from the meta-analysis indicated that therapeutic exercise targeting specific muscles was superior to minimal intervention; manual therapy was superior to minimal treatment; and acupuncture was superior to sham treatment. No statistically significant results were found in favor of laser therapy, infrared therapies, and general conditioning compared to minimal or sham interventions.

Lee et al (2009) meta-analyzed 6 RCTs and quasi-experimental studies examining the efficacy of foot orthoses on improving pain and improving function in patients with plantar fasciitis. Plantar fasciitis is a chronic injury frequently seen in military recruits and athletic populations and which causes pain and inflammation on the plantar surface of the heel. Foot orthoses is a common treatment for plantar fasciitis and involves various methods of intervention such as forefoot and rearfoot posted orthoses, longitudinal arch supports, magnetized orthoses, heel pads and cups, and cushioned orthoses. Foot orthoses interventions help by decrease ground reaction forces while walking. The 6 RCTs and quasi-experimental studies were published between 2002 and 2006, and involved 277 patients who were diverse in age (range 20s to 70). Foot othoses was superior to minimal treatment in reducing pain and improving functioning at three measured time points: less than 6 weeks, 6 to 12 weeks, and over 12 weeks.

The Ottawa Panel (2004) meta-analyzed 16 RCTs and quasi-experimental studies examining the effectiveness of therapeutic exercise for rheumatoid arthritis. Rheumatoid arthritis is an inflammatory disease that produces a progressive degeneration of the musculoskeletal system. A variety of therapeutic exercise interventions were examined and compared to control conditions (i.e., placebo or sham treatments) or to each other. The 16 RCTs were published between 1971 and 1999 and involved 661 adult patients with rheumatoid arthritis. Results from the meta-analysis indicated that knee strengthening was superior to the control condition in improving physical functioning. Whole body strengthening was superior to the control condition in improving swollen joints at 2 months, improving femoris muscle torque after 8 years, and reducing number of sick leave days after 8 years. In contrast, shoulder strengthening and hand strengthening was not found to be superior to control conditions in improving functioning. Turning to relative efficacy, low intensity but not high intensity whole body exercise was superior to home based exercise in improving physical functioning and reducing pain after 12 weeks while low intensity whole body exercise was superior to high intensity whole body exercise in reducing pain and improving physical functioning. Moreover, physical activity was superior to bed rest at improving physical functioning and range of motion, but not pain. To summarize, active PT interventions were superior to no placebo or sham treatments in improving symptoms resulting from rheumatoid arthritis, with some interventions are superior to others.

Efficacy for Stroke

Moreland and Thomson (1994) meta-analyzed 6 RCTs comparing electromyographic (EMG) biofeedback to conventional PT in the treatment of upper extremity weakness among stroke survivors. During EMG biofeedback, electrodes are applied to the skin, patients are asked to activate their muscles, and the instrument conveys visual and/or audio information used to help patients become more attuned to their sensory-motor activity. The 6 RCTs were published between 1983 and 1987 and involved 135 patients who survived stroke. Results from the meta-analysis indicated that EMG biofeedback was superior to conventional PT in improving functional ability, with acute stroke patients (i.e., < 6 months post stroke) experiencing more treatment gains compared to chronic stroke patients.

States et al. (2009) meta-analyzed 9 RCTs examining the efficacy of overground gait training on walking distance among stroke survivors. Almost two-thirds of stroke survivors have initial mobility deficits while over 30% still cannot walk six months later. Gait graining is an intervention used to improve functional mobility among stroke survivors as well as other patient with gait-related dysfunction. Overground gait training involved the physical therapist's supervision and manipulation of the patient's gait over a regular floor surface and is accompanied by practice ambulating on stairs and ramps as well as flat ground. The 9 RCTs were published between 1987 and 2007 and involved 499 patients. Overground gait training was compared to control groups or other PT. Meta-analytic results indicated that overground gait training was superior to control groups in improving walking speed as treatment discharge. Overgait training and other PT interventions were equally effective.

Efficacy for Cardiovascular Conditions and Deconditioning

Brandsma et al. (1998) meta-analyzed 10 RCTs comparing walking exercise with no treatment, medication, or surgery among patients with intermittent claudication in the lower extremities. Intermittent claudication can occur in patients with peripheral vascular disease and is characterized by the commencement of pain or discomfort in the limbs during walking and absence of pain and discomfort at rest. When walking, pain and discomfort intensifies until walking becomes impossible. Walking exercise is prescribed in improve muscle strength and endurance. The 10 RCTs that were reviewed were published between 1966 and 1996 and included 291 patients. Results from the meta-analysis indicated that walking exercise improved pain free walking distance compared to control conditions. All studies showed positive treatment effects for walking, despite differences in treatment specifications between the studies, such as treadmill speed and elevation, frequency of sessions, and treatment duration.

Lopopolo et al. (2006) meta-analyzed 24 RCTs and quasi-experimental studies examining the efficacy of therapeutic exercise on gait speed among the elderly. Habitual (usual walking speed) and fast gait speed decline after age 70, and therapeutic exercise is used to improve muscle force-generating capacity and flexibility, which is required for gait. Types of therapeutic exercise, intensities, and dosages were compared. The 24 RCTs were published between 1995 and 2003; studies on habitual gait speed involved 1,302 community dwelling elderly while studies reporting on fast gait speed involved 752. Results from the meta-analysis indicated that therapeutic exercise was superior to control conditions in improving habitual gait speed. Specifically, strength training, combination training (i.e., aerobic exercise plus another form of exercise) both had positive statistically significant effects on habitual gait speed. High intensity and high dosage treatments had positive statistically significant effects while moderate and low intensities and dosages did not. There was no statistically significant effect for therapeutic exercise on fast gait speed compared to control conditions.

Thomas and McIntosh (1994) meta-analyzed 14 RCTs comparing deep breathing exercises, incentive spirometry, and intermittent positive breathing pressure to each other and no treatment. Incentive spirometry, intermittent positive breathing pressure, and deep breathing exercises are treatments used to reduce pulmonary complications following upper abdominal surgery. The studies were published between 1969 and 1990 and involved 1,337 patients. Results from the meta-analysis indicated that deep breathing exercises and incentive spirometry were superior to no treatment and comparable to each other. Too few studies were available to analyze the effectiveness of intermittent positive breathing pressure.

To summarize, PT interventions have been shown to be superior to no treatment for orthopedicic conditions, stroke, and cardiovascular/deconditioning disorders. While empirical research has provided strong support for the absolute efficacy of PT, relative efficacy of PT (i.e., efficacy differences between specific PT interventions) is less clear. Research has shown that certain conditions and problems benefit more from certain types of PT interventions, but for other clinical conditions, the efficacy of various PT interventions are equivalent with regard to functional outcome.

Variables Impacting Outcome in Physical Therapy

Treatment Intensity

Research on treatment intensity and its impact of treatment outcome has been recommended by various researchers (e.g., Beckerman et al., 1992; Brandsma et al., 1998; Dagfinrud et al., 2008; Thomas & McIntosh, 1994). Many studies examine treatment intensity by dividing the number of PT units (i.e., 15-minute intervals of PT) by the duration of treatment (typically in days), although other researchers used other calculations, such as total amount of PT, regardless of length of stay. Most research has found that greater PT intensity was associated with greater gains in functional outcome, and this included patients with stroke (e.g., Basmajian et al., 1987; Carey et al., 1993; Hesse et al., 1994; Kramer et al., 1997; MacDonnell et al., 1994; Richards et al., 1993), traumatic brain injury (Aronow, 1987; Heinemann et al., 1995), and orthopedic conditions (Arinzon et al., 2010; Fitzgerald et al., 1988; Guccione et al., 1996; Kirk-Sanchez & Roach, 2001; Lopopolo et al., 2006; Roach et al., 1998). On exception to this was a study by the Ottawa Panel (2004) who found that low (vs. high) intensity supervised whole body exercise was superior to home-based exercise in the treatment of rheumatoid arthritis. One explanation of this divergent finding is that rheumatoid arthritis is a unique clinical entity for which lower intensity treatment is more effective. Another plausible explanation is that there is an optimal range of treatment intensity, and too low or too high intensity may fail to produce functional gains. The research literature has no firm conclusions about either of these two explanations, although there seems to be greater consensus that a minimum intensity threshold needs to be reached to obtain positive treatment gains (e.g., Jette, Warren, & Wirtalla, 2005). A brief summary of research on treatment intensity and functional outcome is presented next.

Keren et al. (2004) examined the relationship between rehabilitation intensity and functional outcome in stroke patients ranging in age from 39 to 83 years. Patients were new admits to inpatient rehabilitation, with time between onset of stroke to admission ranging from 3 to 51 days. They received PT and other rehabilitation therapies such as occupational therapy and speech and language therapy. Treatment intensity was measured by total number of 15-minute therapy units. Patients generally received PT at a frequency of 5 days per week. Results indicated that patients made statistically significant functional gains between admission and discharge. However, bivariate and multivariate analyses found no statistically significant relationship between PT treatment intensity functional gains. That is to say that a greater amount of PT did not translate into greater motor functioning among these stroke patients. It is plausible that treatment effects of greater intensity was obscured because some patients stayed on the unit as little as 3 days, while others received PT for almost two months, suggesting differing functional status severity among patients with disparate lengths of stay.

Bode, Heinemann, Semik, and Mallison (2004) examined the relationship between treatment intensity and functional mobility gains among stroke patients in acute and subacute inpatient rehabilitation. Treatment intensity was measured by dividing the number of 15-minute PT units by the length of stay in days. Results indicated that above and beyond initial disease severity, more intense PT was associated with greater functional mobility at hospital discharge. That is, more PT within a course of rehabilitation (or greater frequency) was associated with greater functional gains between admission and discharge.

Jette et al. (2005) examined the relationship between treatment intensity and three groups of rehabilitation patients: those with stroke, orthopedic, and cardiovascular and pulmonary conditions. Treatment intensity was measured by dividing the number of hours of PT by the length of stay in days. Greater PT intensity was associated with greater functional gains in each of the three patient groups. It appears a threshold of PT was needed; intensity at greater than .75 hours per day was associated with greater functional gains compared to lesser amounts.

Cifu, Kreutzer, Kolakowsky-Hayner, Marwitz, and Englander (2003) examined the relationship between treatment intensity and functional outcome among patients with traumatic brain injury enrolled in post-acute inpatient rehabilitation. Therapy intensity was measured by dividing the total hours of PT received by length of stay. Results indicated that more intense PT was associated with greater functional gains on the motor FIM between admission and discharge.

Kirk-Sanchez and Roach (2001) examined the relationship between treatment intensity and functional mobility in patients with orthopedic conditions admitted for inpatient rehabilitation. After controlling for length of stay and functional mobility status at admission, greater intensity of PT was associated with greater functional mobility gains at discharge. That is, patients with orthopedic conditions achieved greater functional independence with more intense PT compared to those patients receiving less intense PT.

Karges and Smallfield (2009) conducted a non-experimental, retrospective review of records of patients receiving inpatient stroke rehabilitation to describe treatment intensity. Patients received on average 30 minutes of PT per session, on average of 1.5 times per day, for an average of 5 to 6 days per week. There was a statistically significant change between FIM scores between admission and discharge, indicating that patients on average gained functional improvement over 2 weeks of inpatient physical rehabilitation.

To summarize, the preponderance of research on the influence of treatment intensity on functional gains indicates that greater intensity predicts greater functional gains over the course of treatment. The following is a brief summary of the influence of pre-treatment factors on functional improvement. Research has examined demographic factors, such as gender and age. Less research is available on the impact of comorbid psychiatric illness on functional gains. A brief summary of available literature on these pre-treatment factors is presented next.

Gender

The majority of research indicates that there are no significant gender differences on functional gains made during PT treatment, and this was examined across wide variety of presenting PT diagnoses (Allen, Agha, Duthie, & Layde, 1989; Cully et al., 2005; Di Monaco, Di Monaco, Manca, & Cavanna, 2002; Kirk-Sanchez & Roach, 2001; Koval, Skovron, Aharonoff, &

Zuckerman, 1998; Lieberman & Lieberman, 2004; Lundgren, Dahllöf, Lundholm, Schersten, & Volkmann 1989; Magaziner, Simonsick, Kashner, Hebel, & Kenzora 1990; Wolf et al., 1979).

Age

Some research found no age effects on functional gains in PT (Allen et al., 2004; Hill, Lewis, Sim, Hay, & Dziedzic, 2007; Lundgren et al., 1989). Notably, much of this research focused on older adults or had patients who age fell within a restricted range. In contrast, research using wider age ranges among patients suggested that younger age was associated with greater functional mobility at discharge (e.g., Jette & Jette, 1996; Keren et al., 2004; Kirk-Sanchez & Roach, 2001; Paolucci et al., 1999; Scopaz et al., 2009). It makes intuitive sense that younger, healthier patients are more likely to make more functional gains in PT, because of their greater premorbid functioning at the time of their injury, illness, or surgery after which PT was warranted.

Comorbid Mental Illness

Scant research has examined the impact of psychiatric disorders on PT functional outcomes. Psychiatric illness should be investigated for two reasons. First, psychiatric disorders are common among rehabilitation patients. In a multisite study of demographically diverse rehabilitation patients with musculoskeletal disorders (Härter et al., 2002), 12-month prevalence rates of psychiatric diagnoses (determined via structured clinical interviews) was high in that over 47% of patients had comorbid psychiatric diagnoses (anxiety disorders, 25%, mood disorders, 19%, substance use disorders, 14%, psychotic disorders, 3%). Second, by definition, most mental disorders are associated with social and occupational dysfunction (American Psychiatric Association, 1994; 2000). High base rate disorders such as mood, anxiety, and substance use disorders [SUDs] have symptoms that would intuitively negatively impact treatment participation, which in turn would impact treatment outcomes. For example, depressive disorders include physiological symptoms such as psychomotor slowing and cognitive symptoms such as disinterest, hopelessness, and irritability. Anxiety disorders include physiological symptoms such as hyperarousal and well as cognitive symptoms such as worry. Logically, such physiological and cognitive symptoms place demands on physical and cognitive resources, thereby interfering with availability of strength, flexibility, attention, and engagement in PT.

Research suggests that psychiatric symptoms such as depression and anxiety do indeed interfere with rehabilitation participation across individuals with a variety of medical conditions including cardiac patients (Shen et al., 2005), stroke survivors (Skidmore et al., 2010), and patients with low back pain (Kaplan et al., 1996). However, there is little empirical research examining the relationship between psychiatric disorders and PT outcomes. Although some research examined formal psychiatric diagnostic entities, most available research examines psychiatric symptoms (e.g., depressive or anxious symptoms from self-report questionnaires) regardless of whether patients were assigned a formal psychiatric diagnosis. Review of available research on psychiatric disorders (and symptoms) and PT outcome is provided below.

Diamond, Holroyd, Macciocchi, and Felsenthal (1995) examined the influence of depressive symptoms on functional gains among 51 patients admitted for acute inpatient rehabilitation. Patients were heterogeneous in terms of clinical diagnosis, and included patients with neurologic conditions, orthopedic conditions, and general debility. Depression was measured with the Geriatric Depression Scale (GDS; Brink et al., 1982; Yesavage et al., 1983). Patients with GDS scores from 0 to 10 were classified as not depressed and those with scores between 11 and 30 were classified as depressed. Functional gains were measured with the FIM. Groups were comparable regarding age, length of stay, admission FIM score, and Mini-Mental State Examination (MMSE; Folstein, Folsein, & McHugh, 1975) score. Compared to nondepressed patients, patients who were depressed at discharge had poorer functional outcomes at both admission and discharge. However, there was no statistically significant change in FIM scores over the course of treatment. Notably, the sample size of the depressed group was small ($n = 8$); thus, there may not have been enough power to detect anything but large differences between the two groups. Results from this study also fail to provide indication about the direction of the relationship between depression and functional status. It is possible that poorer functional status led to increased or sustained depressive symptoms rather than depressive symptoms negatively impacting functional improvement. Another flaw of this study was that depression treatment was not monitored, so it was possible that some depressed patients were being treated while others were not. Moreover, depression was diagnosed by the GDS, which was designed as a screening tool and symptom severity measure, and is not meant to be used as a diagnostic tool.

Paolucci et al. (1999) examined the relationship between depression and functional outcomes in a prospective study of 470 patients admitted for rehabilitation. Patients ranged widely in age and included middle and older adults. Depression was diagnosed using information from multiple sources, including a clinical interview with the patient, observations of the patient, conversation with family members, and responses to the Hamilton Rating Scale for Depression (Hamilton, 1960). The prevalence of depression in this sample was 27%. Discharge functional status was measured using the BI and RMI. Results from logistic regression indicted that greater depression was significantly related to poorer functional status at discharge, although the effect size was modest.

Cully et al. (2005) examined depressive symptoms and functional outcome among 509 older adults (ages 60 and older) receiving inpatient rehabilitation for a variety of presenting conditions, including stroke, Parkinson's disease, closed head injury, cardiac problems, and orthopedic conditions. Depressive symptoms were assessed with the GDS, with scores greater than 10 indicating clinically significant levels of depression. Functional status was assessed via the FIM. Approximately 32% of the sample had clinically significant depression, and rates were similar between patients with and without stroke. Depression was associated with poorer functional status at discharge. The relationship was statistically significant, but the effect size was modest.

Lai et al. (2006) examined the influence of baseline depressive symptoms on functional outcome among 100 stroke patients admitted for acute rehabilitation. Depressive symptoms were measures using the short form of the GDS (GDS-15; Sheikh & Yesavage, 1986). Patients were classified as depressed if they had GDS-15 scores between 6 and 15 (as suggested by Almeida & Almeida, 1999). Functional outcome was measured with the Stroke Impact Scale (Duncan, Lai, Bode, Perera, & DeRosa, 2003). There were no statistically significant differences in functional outcomes at discharge between depressed and nondepressed patients. Notably, the sample size of the depressed group was small (n = 19), thus there may have been inadequate power to detect differences between groups. Also, similar to the Diamond et al. (1995) study, this study used a depression screening instrument to diagnose depression. Although research has indicated that the long and short versions of the GDS are highly intercorrelated (Lesher & Berryhill, 1994; Sheikh & Yesavage, 1986), and have comparable sensitivity and specificity (Lesher & Berryhill, 1994; Shah, Phongsathorn, Bielawska, & Katona, 1996), GDS-15 score elevations suggest to the administrator that further evaluation for depression is warranted and is not meant to diagnose the disorder. A flaw of using this brief screening tool is that it may simply be measuring normal depressive symptoms in otherwise nondepressed individuals.

Van Wijk, Algra, van de Port, Bevaart, and Lindeman (2006) investigated the impact of depression on functional mobility status during the second year after stroke in patients who had previously received inpatient rehabilitation. This multicenter prospective study included 148 patients who received inpatient rehabilitation at 1 of 4 rehabilitation centers. Patients were at least 18 years old (M = 59, SD = 10). Depression was measured using the Center of Epidemiologic Studies Depression Scale (CES-D; Radloff, 1977). Patients with scores greater than 15 were classified as depressed. Functional mobility was measured using the RMI (Collen et al., 1991). Most patients retained their functional status between 12-month follow up and 24-month follow up. However, depressed patients were more likely to experience functional decline compared to nondepressed patients (25% versus 7%, respectively).

Scopaz et al. (2009) examined depression and anxiety symptoms and physical functioning in 182 patients receiving rehabilitation for knee osteoarthritis. Patients were middle aged and older adults (ages 40 to 85). Depression was measured using the CES-D. Anxiety was measured using the Beck Anxiety Inventory (BAI; Beck, Epstein, Brown, & Steer, 1988; Beck & Steer, 1993) and Fear Avoidance Beliefs Questionnaire, Physical Activity Scale (Wadell, Newton, Henderson, Somerville, & Main, 1993). Balance and gait functioning was assessed with the Get Up and Go Test (Piva, Fitzgerald, Irrgang, Bouzubar, & Starz, 2004). Results from bivariate correlations suggested that higher BAI scores, but not depression or fear avoidance, was associated with poorer physical functioning. However, after controlling for age, severity of knee osteoarthritis, and other factors, anxiety was associated with self-reported but not performance-based physical functioning. Notably, psychiatric symptom scores were heavily skewed and restricted in range, suggesting that for most individuals, psychiatric symptoms did not surpass clinical threshold.

Smeets, Maher, Nicholas, Refshauge, and Herbert (2009) examined the influence of depression and anxiety symptoms on self-reported functional outcomes among 259 PT patients with nonspecific low back pain. Psychiatric diagnosis was not assessed. Depression and anxiety symptoms were assessed using the 21-item version of the Depression, Anxiety, and Stress Scales (DASS-21; Henry & Crawford, 2005). Functional outcome was measured using the Patient-Specific Functional Scale (PSFS; Stratford, Gill, Westaway, & Binkley, 1995). Research supports the reliability, validity, and change sensitivity of the PSFS in patients with musculoskeletal conditions (e.g., Chatman et al., 1997; Cleland, Fritz, Whitman, & Palmer, 2006; Pengel, Refshauge, & Maher, 2004; Westaway, Stratford, Binkley, 1998). Results indicated that greater depression and anxiety symptoms were significantly related to poorer functional outcomes at 6- and 52-week follow up. However, effect sizes were small.

Allen et al. (1994) examined the influence of minor depression on functional outcome among 209 patients admitted for subacute rehabilitation. Minor depression was diagnosed according to research criteria proposed in the fourth edition of the *Diagnostic and Statistical Manual of Mental Disorders* (*DSM-IV*; American Psychiatric Association, 1994). Functional outcome was measured using the FIM. Results indicated that compared to nondepressed patients, depressed patients were less likely to improve over the course of rehabilitation treatment.

Howard, Mayer, Brian, Theodore, and Gatchel (2009) examined the influence of *DSM-IV* diagnoses on PT treatment completion (and functional outcome secondarily). Patients were 3052 individuals with musculoskeletal conditions admitted for acute or post-acute rehabilitation. Diagnoses were determined via structured clinical interviews, and included major depressive disorder, generalized anxiety disorder, SUDs, and personality disorders. Univariate analyses indicated that compared to treatment completers, noncompleters were more likely to be diagnosed with generalized anxiety disorder, SUDs, and personality disorders, at a rate of about 2 to 1. Similarly, noncompleters had higher scores on the BDI (Beck, Ward, Mendelson, Mock, & Erbaugh, 1961), and the effect size was small-to-moderate. In turn, treatment noncompleters had poorer functional outcomes.

To summarize, the literature has produced mixed findings about the impact of psychiatric disorders and symptoms on functional gains in PT. While the bulk of findings suggest a negative relationship between symptoms and functional outcome, and between diagnosis and functional outcome, the amount of research in this area is limited. The relationship between depressive symptoms and disorders on PT outcomes is inconclusive, and research on others disorders (e.g., SUDs) was scant. Most research focused on symptoms, which may occur in patients without psychiatric disorders (i.e., at subclinical levels). Rather than examining symptoms, this study focuses on history of psychiatric diagnosis and its impact on PT functional outcome.

CHAPTER III: METHODOLOGY

Participants and Setting

Participants

Participants were inpatients at the Clement J. Zablocki Veterans Affairs Medical Center, Milwaukee, Wisconsin (hereafter referred to as the Zablocki VAMC) who received inpatient PT between 2006 and 2010.

Setting

Zablocki VAMC. The Zablocki VAMC is located in the City of Milwaukee and is part of an integrated health services delivery network which also includes facilities in Iron Mountain, MI, Tomah, WI, Madison, WI, North Chicago, IL, Chicago, IL, and Hines, IL. The Zablocki VAMC delivers primary, secondary, and tertiary medical care, with 168 acute care operating beds and over 500,000 outpatient visits, annually. The nursing home care unit of 113 beds offers older adult programming. There are also 356 domiciliary beds for residential-type substance abuse rehabilitation, psychiatric rehabilitation and posttraumatic stress disorder treatment. Specialty programs at the Zablocki VAMC include, for example, cardiac surgery, comprehensive cancer care, spinal cord injury care, geriatric evaluation and management, and palliative care (U. S. Department of Veterans Affairs, 2009).

Inpatient Units. Patients receiving inpatient PT were admitted to the following Zablocki VAMC inpatient units: Community Living Center, Comprehensive Integrated Inpatient Rehabilitation, Geriatric Evaluation and Management, Palliative Care, Spinal Cord Injury Services, and Transitional Care. The *Community Living Center* is a long-term, nursing home setting for veterans with chronic and disabling conditions such as dementia and schizophrenia. The *Comprehensive Integrated Inpatient Rehabilitation* unit provides rehabilitative services for patients with acute and subacute conditions. Patients on this unit present with a variety of medical ailments, such as orthopedic problems (e.g., joint replacements, fractures, or amputations), stroke, other brain dysfunction, and physical dysfunction resulting from multiple medical complications. Patients typically remain on the Comprehensive Integrated Inpatient Rehabilitation unit for approximately two weeks for orthopedic rehabilitation and up to three months for neurologic-related problems. The *Geriatric Evaluation and Management* unit is an interdisciplinary assessment and treatment unit that emphasizes rehabilitation for geriatric patients with acute and chronic physical conditions. Patients typically remain on the Geriatric Evaluation and Management unit for approximately one month. The *Palliative Care* unit provides inpatient care for veterans with end-stage diseases such as advanced stages of cancer. Typically, patients residing on the Palliative Care unit are admitted for end-of-life care, while other patients are admitted for palliative radiation and/or chemotherapy with the expectation of returning to community living upon completion of treatment. Length of stay on the Palliative Care unit varies, but is typically less than six months. *Spinal Cord Injury Services* is an acute and post-acute rehabilitation unit for veterans with previous or new spinal cord injuries and in need of rehabilitative services. Length of stay ranges from 2 to 4 months or longer. *Transitional Care* is an inpatient unit which addresses rehabilitative concerns such as wound healing, post-surgical care, and complicated medical convalescence. Length of stay in Transitional Care is typically 1 to 3 months (Hart, 2008).

Eligibility Criteria

Patient cases were eligible for inclusion if they were (1) referred for inpatient PT, (2) completed an initial PT evaluation, (3) determined to be in need of PT, and (4) agreed to PT treatment. Patient cases were ineligible if they had substantial cognitive dysfunction such that they were deemed unable to make their health care decisions at the time of their PT evaluation. An activated durable power of attorney for health care (DPOA-HC) served as the primary indicator of substantial cognitive dysfunctional and incapacity regarding health care decisions. Patient cases were also ineligible if medical records indicated that patients were medically unfit for PT as indicated by the Karnofsky Performance Scale (KPS; Karnofski & Burchenal, 1949).

The KPS is an instrument frequently used to evaluate the medical status of Palliative Care patients at the Zablocki VAMC. It is a provider-rated instrument designed to measure functional impairment and survival potential. Medical status is rated on an 11-point scale ranging in deciles from 0 (dead) to 100 (normal, no complaints, and no evidence of disease). The scale has demonstrated high interrater reliability among physicians and mental health providers (*r*s .89 – .97), and superior construct validity and predictive validity (Crooks, Waller, Smith, & Hahn; 1991; Mor, Laliberte, & Wiemann, 1984; Schag, Heinrich, & Burchenal, 1984). Patients admitted for inpatient rehabilitation typically have KPS scores at or below 70, which indicates that patients require varying degrees of assistance in daily activities. Scores at or below 20 suggest rapid disease progression accompanied by the inability to care for oneself. Scores in this range usually indicate that death is near or imminent (Doyle, Hanks, & MacDonald, 1993; Karnofski & Burchenal, 1949). In light of this information, patients with KPS scores at or below 20 at the time they were referred for inpatient PT were not included in this study.

Research Design and Procedures

Research Design

This study was a retrospective, cross-sectional design. A retrospective design was chosen because the goal of this study is exploratory and because a variety of clinically relevant variables are already tracked and available in the Zablocki VA medical records electronic database. The study consisted of a review of medical records for veterans receiving inpatient PT.

Consent for Research Participation

Consent was not obtained for this research study for two main reasons. First, there was no more than minimal risk to participants: (1) identifiable information was removed from the database following completion of data entry, (2) information collected (e.g., diagnosis, outcome measures) were already in existence in the Zablocki VAMC's electronic database, and (3) no additional procedures were being performed on participants. Second, it was impractical and sometimes impossible to contact participants to obtain consent: (1) many participants were no longer residing as an inpatient at the Zablocki VAMC, and (2) some patients had since died. Because there was no more than minimal risk to patients, archival data was the only information being collected for this study, and impracticality of obtaining consent, it was requested that the requirement for participant informed consent be waived, which was granted by the Institutional Review Boards (IRBs) at Marquette University and the Zablocki VAMC.

Addressing Ethical Considerations

A reasonable concern with reviewing medical records is maintaining and protecting patients' privacy. As a doctoral student in the Counseling Psychology PhD program at Marquette University, I have completed formal coursework in professional ethics and legal issues, which included training on privacy, confidentiality, and appropriate use of patient records. In addition, I have completed the required Zablocki VAMC trainings in information security awareness and usage of the electronic medical records system. Only the minimal data necessary for conducting this study was collected. Identifying information was deleted from the database upon completion of data entry.

Patient Records Content and Format

The Zablocki VAMC stores and maintains patient medical records electronically on a secure network available to employees and trainees whose job duties necessitate access to patient medical records. Information in this electronic system is organized in a systematic manner. The medical records database is accessible from VA computers, thus patient records can be accessed at any day and time, provided there are no network server problems. Information available in these records includes for example diagnoses, active medications, admission date, PT initial evaluation results, number of PT treatment sessions, and PT discharge summaries.

Treatment Time Frame

Records were reviewed for patients seen for inpatient PT between the years 2006 and 2010. This time frame was chosen in order to capture a sufficiently large sample size. No major changes in admission or treatment policies were made during this time frame (Smith, H. M., personal communication) suggesting equivalence of treatment admission experiences among patients across this time span.

Data Entry Procedure

I visited the Zablocki VAMC between 1 and 5 times per week, between December 2009 and June 2010 to review records and extract data. As part of my employee status, I had access to a VA computer and was issued a unique user name and password to access patient records. As part of my graduate training at Marquette University and employee training at the Zablocki VAMC, I have completed required classroom- and computer-based trainings in topics such as research ethics, research design, and protection of patients' personally identifying information. Following approval by the IRBs at Marquette University and the Zablocki VAMC, I began systematically reviewing patient records. The CPRS Face Sheet was reviewed to obtain socio-demographic variables, including service connection status. The Problem List was reviewed for medical and psychiatric diagnoses. Only diagnoses assigned prior to their initial PT evaluation were included. Pharmacy records from the same month of their PT evaluation were reviewed to obtain patients' prescribed medications. PT consults and PT progress notes were reviewed to obtain relevant PT-related variables such as FIM scores and frequency of sessions. Data were entered into an electronic database, which was password protected.

Study Variables

Names and brief descriptions of study variables are provided below. Variables are grouped according to the following categories: demographic characteristics, medical disorders, psychiatric disorders, other pretreatment health care variables, and PT treatment variables.

Demographic Variables

The following demographic characteristics were examined: Age, Sex, Race, Marital Status, and Distance from Home. Age refers to the participant's chronological age in years and months at the time the PT initial evaluation. Sex refers to whether the participant was male or female. Race refers to whether the patient was classified as White, Black, Hispanic or Latina/o, Asian or Pacific Islander, or Native American. Marital Status refers to whether the participant was never married, married, divorced, widowed, or separated at the time of the PT initial evaluation. Distance from Home refers to the distance in miles between the participant's place of residence and the Zablocki VAMC. When place of residence was unavailable, the residence of the patient's next of kin was selected.

Medical disorders

Medical disorders were recorded according to the ICD-10 taxonomy and were grouped according to ICD-10 diagnostic class. Diagnostic classes included the following: (1) infectious diseases; (2) neoplasms; (3) endocrine, nutritional, and metabolic disorders; (4) diseases of the blood; (4) mental disorders; (5) diseases of the nervous system; (6) diseases of the circulatory system; (7) diseases of the respiratory system; (8) diseases of the digestive system; (9) diseases of the genitourinary system; (10) complications of pregnancy and childbirth; (11) diseases of the skin and subcutaneous tissue; (12) diseases of the musculoskeletal system; (13) congenital abnormalities; and (14) sign, symptoms, and ill-defined conditions. For this study, signs, symptoms, and ill-defined conditions affecting the musculoskeletal system were grouped with diseases of the musculoskeletal system. Total ICD-10 diagnoses were also recorded.

Psychiatric disorders

Psychiatric diagnoses were recorded according to the *DSM-IV-TR* taxonomy. Specific psychiatric diagnoses were recorded. Also, they were grouped according to *DSM-IV-TR* diagnostic class. Diagnostic classes examined in this study included adjustment disorders, anxiety disorders, mood disorders, personality disorders, psychotic disorders, and SUDs. Adjustment Disorder Status refers to whether a participant was diagnosed with an adjustment disorder, such as adjustment disorder with depressed mood or adjustment disorder with behavioral disturbance. Anxiety Disorder Status refers to whether a participant was diagnosed with an anxiety disorder such as posttraumatic stress disorder (PTSD) or generalized anxiety disorder. Mood Disorder Status refers to whether a participant was diagnosed with a mood disorder such as major depressive disorder or bipolar disorder. Personality Disorder Status refers to whether a participant was diagnosed with a personality disorder such as borderline personality disorder or personality disorder not otherwise specified (NOS). Psychotic Disorder Status refers to whether a participant was diagnosed with a psychotic disorder, such as schizophrenia or psychotic disorder NOS. SUD Status refers to whether a participant was diagnosed with a SUD such as alcohol dependence, cocaine abuse, or polysubstance dependence. Psychiatric Status refers to whether a participant was diagnosed with any psychiatric disorder.

Other Pretreatment Health Care Variables

Other pretreatment health care variables included the following: Service Connection, Service Connection Amount, DPOA-HC, Inpatient Unit, Total Medications, Pain Medication, Psychotropic Medication, and Psychotherapy. Service Connection refers to whether the participant is receiving financial compensation for a military service-related health condition. Service Connection Amount refers to the percentage at which the participant is service connected. DPOA-HC refers to whether the participant has an activated, unactivated, or no power of attorney for health care decisions. Inpatient Unit refers to the hospital unit on which the participant resided during the course of PT. Total Medications refers to the total number of active Zablocki VA prescribed medications. Pain Medication refers to whether the participant was prescribed an opiate-based pain medication. Psychotropic Medication refers to whether the participant was prescribed an antipsychotic, antidepressant, or anxiolytic medication. Psychotherapy refers to whether the participant had a history of receiving therapy by a psychologist, psychiatrist, or other mental health provider.

PT Treatment Variables

PT variables examined were Consult Response Time, PT Diagnosis Type, Past PT, Rehabilitation Potential, PT Duration, PT Session Frequency, Attendance, Missed Sessions, Baseline M+L FIM, Discharge M+L FIM, M+L FIM Change, Goals Attained, and Discharge Status. Consult Response Time refers to the number of days between the PT consult request and initiation of the PT initial evaluation. PT Diagnosis Type refers to whether the referring diagnosis was classified as primarily orthopedic, neurological, or other (i.e., cardiovascular, respiratory, systemic, or undefined). Past PT refers to the number of previous courses of PT the participant has received. Rehabilitation Potential is a prognostic indicator of how a patient will perform in an inpatient rehabilitation program (Rentz, 1991). Said differently, it refers to a health care provider's opinion regarding a participant's likelihood of making functional gains during rehabilitation. There is little consensus about which factors best predict who will be successful in rehabilitation, although research has supported that certain factors are influential, such as motivation, cognitive status, medical complications, economic factors, and family support (Mosqueda, 1993; Rentz, 1991). Rehabilitation potential is typically described as good, fair, or poor/guarded.

PT Duration refers to length of PT treatment course, measured in weeks. PT Session Frequency refers to number of times per week the participant received PT. Attendance refers to the percent of PT sessions attended. Missed Sessions refers to the number of PT sessions missed by the participant. Baseline M+L FIM and Discharge M+L FIM refer to the sum of the Mobility and Locomotion subscales of the FIM at the time of the PT initial evaluation and PT discharge, respectively. In this study, total FIM scores were not available in medical records at the time of data collection. Instead of reporting the full FIM scores, physical therapists reported only scores on the FIM Mobility and Locomotion subscales. These subscales consider most motor components of the FIM (but omit some motor components and all cognitive components). The items on these subscales include behaviors of interest to physical therapists, such as transfer (e.g., from bed to wheeled walker) and ambulation (e.g., on flat surface or on stairs). Mobility and Locomotion FIM subscale scores have been used as predictor or criterion variables in other research studies (e.g., Arinzon et al., 2010; Lin, Chang, Wu, & Chen, 2009; Kirk-Sanchez & Roach, 2001). M+L FIM Change refers to the change in FIM scores (improvement or decline) over the course of PT. Goals Attained refers to the percentage of PT goals achieved at PT discharge. Goals Attained was calculated by taking the total number of goals achieved at PT discharge and dividing it by the number of PT goals agreed upon at the PT initial evaluation.

Selection of Dependent Variables

In this study, Discharge M+F FIM was selected as a dependent variable because the FIM has substantial research supporting its psychometric properties and because it is a widely popular measure of functional status utilized by physical rehabilitation providers. Goals Attained was selected as a dependent variable because of its practical utility. Examples of PT goals included the following: ambulate with modified independence; climb stairs with modified independence; transfer from bed to chair with minimal assistance.

Selection of the Covariate

Research has demonstrated a positive relationship between treatment intensity and functional outcome (Arinzon et al., 2010; Aronow, 1987; Basmajian et al., 1987; Carey et al., 1993; Fitzgerald et al., 1988; Guccione et al., 1996; Heinemann et al., 1995; Hesse et al., 1994; Kirk-Sanchez & Roach, 2001; Kramer et al., 1997; Lopopolo et al., 2006; MacDonnell et al., 1994; Richards et al., 1993; Roach et al., 1998). Some researchers measured treatment intensity by divided the total number of PT units (i.e., 15-minute intervals of PT) by the total duration of treatment. Others defined treatment intensity as the total amount of PT regardless of length of stay. In this study PT units were not available in medical records, but frequency of PT sessions per week was available. As expected, there were small but significant positive correlations between PT Session Frequency and Discharge M+F FIM ($r = .13$; $p = .027$) and Goals Attained ($r = .19$; $p = .001$). In addition to the significant statistical relationship, frequency of PT sessions per week is conceptually an index of treatment intensity (i.e., it is an index of the amount of PT in a standard time frame). For these reasons, PT Session Frequency was selected as the measure of treatment intensity for this study and included as a covariate in this study’s statistical design.

Statistical Design and Procedures

Statistical Design

One-way multivariate analyses of covariance (MANCOVAs) were selected to examine the impact of having a psychiatric diagnosis on functional outcome after PT treatment, controlling for treatment intensity. MANCOVA is an appropriate statistical technique for examining average group differences when independent variables (also called factors) are categorical and dependent variables (also called criterion variables) are continuous (Green & Salkind, 2005; Tabachnick & Fidell, 2007; Wienfurt, 1995).

Because this study is exploratory, multiple one-way MANCOVAs were conducted to examine whether having a psychiatric diagnosis in general or having a diagnosis in a specific *DSM-IV-TR* diagnostic class would impact functional outcome. In this study, Psychiatric Status and selected *DSM-IV-TR* Classes (i.e., those with sufficient sample sizes) were included as independent variables in separate one-way MANCOVAs. The independent variables had two levels: 0-*No Diagnosis* and 1-*Yes Diagnosis*; Discharge M+L FIM and Goals Attained were the dependent variables, and PT Session Frequency was entered as a covariate.

One-way MANCOVA is an appropriate statistical design when examining an independent variable, a covariate, and multiple dependent variables (Green & Salkind, 2005; Tabachnick & Fidell, 2007. MANCOVA designs require that the dependent variables be statistically and theoretically correlated with one another (Weinfurt, 1995). In this study, Discharge M+L FIM was moderately correlated with Goals Attained ($r = .67$, $p < 001$). Also, logically it makes sense that participants achieving greater functional independence on mobility and locomotion measures will be more likely to meet their PT treatment goals.

MANCOVA was selected for primary analyses instead of univariate techniques because the latter may overestimate the impact of independent variables on dependent variables (Tabachnick & Fidell, 2007; Weinfurt, 1995). MANCOVA takes into account shared variance among the dependent variables, while univariate analyses such as analysis of variance (ANOVA) and analysis of covariance (ANCOVA) examine the impact of the independent variable on each dependent variable individually (i.e., shared variance is not accounted for).

MANCOVA was selected instead of MANOVA because MANCOVAs statistically control for covariates. In the current study, treatment intensity was selected as the covariate because prior research has shown that treatment intensity is associated with functional outcome. Also, because this is a retrospective design, groups may differ from each other in other meaningful ways. Controlling for variables shown by research to influence the dependent variable of interest protects against erroneous results due to pretreatment group differences; while randomization is a more rigorous solution this problem, this study was a retrospective, quasi-experimental design. Also, controlling for all variables that may possibly be theoretically related to the dependent variable is challenging if not impossible. To minimize error from pretreatment factors, it is prudent to examine the research to identify variables that have been shown to have an influential relationship. In this study, demographic variables were examined but research in general has failed to find influences of age and gender on functional outcomes. Treatment intensity was found to be related to functional outcome, thus was included as a covariate in this study.

Sample Size

Review of available medical records produced 514 patients who were referred for inpatient PT between 2006 and 2010. From this, 38 were excluded because they were deemed unable to make their health care decisions (i.e., they had an activated DPOA-HC), 38 were excluded because it was determined after their PT initial evaluation that ongoing PT was not recommended, and 3 were excluded because they refused to complete the initial PT evaluation. No patients had a Karnofski score ≤ 20, thus no patients were excluded for this criterion. From the remaining 435 patients, 125 were excluded because they had no Discharge M+L FIM recorded in their medical chart, and this was a critical variable of interest. The remaining 310 patients were included for analysis, which is an adequate size for multivariate techniques (e.g., Green & Salkind, 2005; Tabachnick & Fidell, 2007; Weinfurt, 1995).

Data Screening

Accuracy of data file. Frequencies were examined to ensure entered values were within appropriate ranges. For continuous variables, the plausibility of means and standard deviations were examined. Values for each variable fell within predefined ranges (e.g., male = 0, female = 1, no values fell outside this range). Means and standard deviations were plausible (e.g., age ranged from 35.58 to 98.75 with a mean of 72.05 and standard deviation of 11.86).

Missing data. Missing data points occur frequently in research, often because of factors that are outside of the researcher's control, such as attrition, or incomplete questionnaires (Kline, 2005; Vriens & Melton, 2002). Relatively few missing observations may be of little concern, whereas many missing observations may cause problems. According to Kline (2005), when incomplete cases differ from complete cases in a given data set, results based only on complete cases may not generalize to the population. Said differently, when the pattern of missing data is systematic, analysis of just the complete cases may not adequately represent the population to which the researcher is trying to infer results.

Because substantial missing data is common (often 30% to 60% of data, as reported by Vriens & Melton, 2002), methods have been developed to replace missing values. Most methods for dealing with missing data assume that the pattern of missing data is not systematic and therefore ignorable (Kline, 2005). Ignorable missing data patterns are those that are *missing at random* (MAR), or *missing completely at random* (MCAR). When missing observations on a given variable differ from the observed scores on the same variable by chance only, the pattern of missing data is said to be MAR. When missing observations on a given variable differ from observed scores on the same variable by chance only, *and the presence versus absence of data on a given variable is unrelated to other variables*, the pattern of missing data is said to be MCAR (Kline, 2005; Vriens & Melton, 2002).

Various methods for dealing with missing data have been proposed. Of these, multivariate estimation methods generally outperform more traditional methods which impute a single value based on available cases (Kline, 2005; Vriens & Melton, 2002). That is, multivariate estimation methods impute values based on observed responses from combinations of multiple variables; essentially, regression equations are used to predict values for missing data points. Multivariate estimation methods are superior to less sophisticated methods, such as replacing missing values with simple arithmetic means. Thus, multivariate estimation methods are the preferred method for replacing missing data. Methods for imputing missing data are available in Rubin (1987) and Schafer (1997), for example. Only missing data for variables included in the one-way MANCOVAs were considered for replacement.

Data Analysis

Descriptive statistics are reported first. Means of pretreatment variables were compared via one-way ANOVAs (for continuous variables) and chi square analyses (for categorical variables), to examine equivalence among pretreatment variables. Next, data points for missing data were imputed where relevant. Then, variables with distributions that are highly skew or have high kurtosis were transformed. Following replacement of missing data, data were analyzed using one-way MANCOVA.

Descriptive Statistics

Examination of central tendency and variability were conducted using SPSS. For continuous variables, descriptive features include, for example, means (*M*), standard deviations (*SD*), medians (*Me*), and interquartile ranges (*IQR*). For categorical variables, percentages are reported.

Evaluating the Model

The overall model is analyzed using the one-way MANCOVA design. Four multivariate test indices were examined: (1) Pillai's Trace, (2) Wilks' Lambda, (3) Hotelling's Trace, and (4) Roy's Largest Root. There is disagreement in the literature about which of these tests is superior.

When sample sizes are large, the test statistics appear to be equivalent. Marcoulides and Hershberger (1997) recommended examining all four test statistics and looking for consensus among at least two.

Secondary analyses included discriminant function analyses and follow up ANCOVAs. Both are common follow up procedures after running MANCOVA (Green & Salkind, 2005; Weinfurt, 1995). Running follow up ANCOVAs has been criticized however for inflating Type I error and for ignoring the multivariate assumptions of MANCOVA designs (Tabachnick & Fidell, 2007). However, this study is exploratory in nature, thus this study will look at models that both take into account shared variance (i.e., MANCOVA) as well as models that examine the dependent variables individually, ignoring the correlation between dependent variables (i.e., multiple ANCOVAs). Also, M+L FIM is a measure with considerable research support for its psychometric properties. In contrast, the psychometric soundness of Goals Attained as an outcome variable is unknown, although it has clinical utility. Moreover, while M+L FIM is a standardized measure, the goals are individualized for each patient. In other words, the variable Goals Attained is measuring different concepts for each patient. For these reasons, it is worthwhile to examine the influence of psychiatric diagnosis on each dependent variable individually.

In addition to tests of significance, magnitude was assessed by examining partial eta squared (η_p^2), a measure of effect size often used in MANCOVA and ANCOVA designs. The η_p^2 effect size ranges in value from 0 to 1, with 0 indicating no relationship and 1 indicating a strong relationship (Green & Salkind, 2005).

CHAPTER IV: RESULTS

Study Sample Characteristics

Demographic Characteristics

Three hundred ten patients met study inclusion criteria and were included in primary statistical analyses. Patients ranged in age from 35.58 to 98.75 years, although most were older than age 60 (*M* = 72.05, *SD* = 11.86). As expected given the veteran sample, the majority of participants (96.1%) were male. Patients were more likely to be Caucasian (74.2%) versus a racial minority (19.0%). Race was not available for 6.8% of patients. Most patients were not married at the time of PT treatment (66.5% vs. 33.5%). Sixty-one percent of patients lived within 30 miles of the Zablocki VAMC (if no address was on file for the patient, next of kin's address was used). The average distance between patients' residence and Zablocki VAMC was higher than expected (*M* = 51.45, *SD* = 98.10), because two patients with no address had a next of kin who lived in other regions of the county (i.e., California and Texas). When these two cases were removed and descriptive statistics re-run, the average distance was lower (*M* = 46.04, *SD* = 70.49). Service connection ranged from 0% to 100% (*M* = 23.65, *SD* = 35.83). Table I provides greater detail on the breakdown of patients' socio-demographic characteristics.

Medical Diagnoses

Total *ICD* diagnoses per patient ranged from 2 to 33 (*M* = 11.66, *SD* = 5.58; *Me* = 11, *IQR* = 7-15). Diseases of the circulatory system were the most common (*M* = 2.47, *SD* = 1.91; *Me* = 2; *IQR* = 1-4; range 0-12). Diseases of the musculoskeletal system and signs, symptoms, and ill-defined conditions related to the musculoskeletal system were also common (*M* = 1.32, *SD* = 1.34; *Me* = 1; *IQR* = 0-2; range 0-7). No patients were diagnosed with conditions of the perinatal period. Table II provides greater detail on the frequency of *ICD* diagnoses by diagnostic class.

Table I

Socio-demographic Characteristics (*N*=310)

Variable	*n*	%
Age at PT Evaluation		
30-59	47	15.2%
60-69	93	30.0%
70-70	74	23.9%
80-80	88	28.4%
90-99	8	2.6%
Gender		
Male	298	96.1%
Female	12	3.9%
Race		
White	230	74.2%
Black	51	16.5%
Hispanic	4	1.3%
Asian/Pacific Islander	3	1.0%
Native American	1	0.3%
Unknown	21	6.8%
Marital Status		
Married	104	33.5%
Divorced	85	27.4%
Widowed	62	20.0%
Never Married	54	17.4%
Separated	5	1.6%
Distance from Home to VA in Miles		
0-9.99	133	42.9%
10-29.99	59	19.0%
30-99.99	69	22.3%
100-199.99	27	8.7%
200-399.99	20	6.5%
>400	2	0.6%
Service Connected		
No	190	61.3%
Yes	120	38.7%

Table II

Medical Disorders by ICD Diagnostic Class (*N*=310)

ICD Diagnostic Class	*M* (*SD*)	*Me* (*IQR*)	Range
Infectious Diseases	0.14 (0.39)	0 (0-0)	0 – 2
Neoplasms	0.68 (0.90)	0 (0-1)	0 – 5
Endocrine, Nutritional, and Metabolic Disorders	1.50 (1.22)	1 (1-2)	0 – 5
Diseases of the Blood	0.21 (0.47)	0 (0-0)	0 – 3
Mental Disorders	1.15 (1.26)	1 (0-2)	0 – 6
Diseases of the Nervous System	1.02 (1.24)	1 (0-2)	0 – 5
Diseases of the Circulatory System	2.47 (1.91)	2 (1-4)	0 – 12
Diseases of the Respiratory System	0.37 (0.67)	0 (0-1)	0 – 3
Diseases of the Digestive System	0.62 (0.83)	0 (0-1)	0 – 4
Diseases of the Genitourinary System	0.85 (0.99)	1 (0-1)	0 – 6
Complications of Pregnancy/Childbirth/Pueperium	0.00 (0.06)	0 (0-0)	0 – 1
Diseases of the Skin and Subcutaneous Tissue	0.32 (0.65)	0 (0-0)	0 – 4
Diseases of the Musculoskeletal System plus Signs, Symptoms, and Ill-defined conditions of the Musculoskeletal System	1.32 (1.34)	1 (0-2)	0 – 7
Congenital Abnormalities	0.00 (0.00)	0 (0-0)	0 – 0
Signs, Symptoms, and Ill-defined Conditions except those affecting the musculoskeletal system	0.80 (0.98)	1 (0-1)	0 – 8
Injuries and Poisonings	0.18 (0.45)	0 (0-0)	0 – 2
Total Diagnoses	11.66 (5.58)	11 (7-15)	2 – 33

Note. ICD: International Classification of Diseases and Health Related Problems

Psychiatric Diagnoses

One hundred and sixty-three patients (52.6% of the total sample) were diagnosed with a disorder within one of the *DSM-IV-TR* diagnostic classes. Among those with a psychiatric diagnosis, mood disorders were the most common (69.3%), followed by SUDs (44.8%), anxiety disorders (36.8%), psychotic disorders (4.9%), adjustment disorders (2.5%), and personality disorders (2.5%). Frequencies of specific diagnoses can be found in Table III. Among patients with psychiatric disorders, 44.2% has disorders in multiple diagnostic classes. Patients with diagnoses in multiple diagnostic classes included 100% of those with personality disorders, 83.3% of those with anxiety disorders, 75.0% of those with adjustment disorders, 64.4% of those with SUDs, 62.5% of those with psychotic disorders, and 54.9% of those with mood disorders. Among those with a psychiatric disorder, a single patient (0.6%) had a disorder in four diagnostic classes, 15.3% had diagnoses in 3 classes, 28.2% had disorders in two classes, and 55.8% had a disorder in a single diagnostic class. Table III contains details of the frequencies of specific diagnoses and diagnoses within diagnostic classes.

Medical and Psychiatric Treatment

Most participants were prescribed several medications (M = 18.75, SD = 6.56), which is not unexpected given the numerous physical and mental health conditions among participants. The number of prescribed medications per participant varied widely (range 0 to 38). Opioid pain medication was prescribed to 63.9% of the total sample and 64.4% of those with a psychiatric diagnosis. Psychotropic medication (i.e., an antidepressant, antipsychotic, or anxiolytic) was prescribed to 72.4% of patients with psychiatric disorders and 30.6% of patients without such diagnoses. The majority of patients in the total sample had no receipt of psychotherapy (74.8%). Even among those with psychiatric diagnoses, over half (52.1%) had no record of receiving psychology services at the Zablocki VAMC. Table IV provides greater detail on the frequency of psychotherapy and medication treatment.

Table III

Psychiatric Diagnoses by DSM-IV-TR *Diagnostic Classes* (*N*=310)

DSM-IV-TR Diagnostic Class	*n*	% of total sample	% of diagnostic class
Adjustment Disorders	4	1.3%	
With Anxiety and Depressed Mood	2	0.6%	50.0%
With Anxiety	1	0.3%	25.0%
Unspecified	1	0.3%	25.0%
Anxiety Disorders	60	19.4%	
PTSD	31	10.0%	51.7%
Anxiety Disorder NOS	20	6.5%	33.3%
Generalized Anxiety Disorder	6	1.9%	10.0%
Panic Disorder/Agoraphobia	5	1.6%	8.3%
Obsessive Compulsive Disorder	1	0.3%	1.7%
Mood Disorders	113	36.5%	
Depressive Disorder NOS	54	17.4%	47.8%
Major Depressive Disorder	45	14.5%	39.8%
Bipolar Disorder	11	3.5%	9.7%
Dysthymic Disorder	5	1.6%	4.4%
Personality Disorders	4	1.3%	
Personality Disorder NOS	3	1.0%	75.0%
Borderline Personality Disorder	1	0.3%	25.0%
Psychotic Disorders	8	2.6%	
Schizophrenia	4	1.3%	50.0%
Schizoaffective Disorder	2	0.6%	25.0%
Delusional Disorder	1	0.3%	12.5%
Psychotic Disorder NOS	1	0.3%	12.5%
Substance Use Disorders	73	23.5%	
Alcohol Abuse/Dependence	69	22.3%	94.5%
Cocaine Abuse/Dependence	17	5.5%	23.3%
Cannabis Abuse/Dependence	7	2.3%	9.6%
Opioid Abuse/Dependence	5	1.6%	6.8%
Other Substance Abuse/Dependence	4	1.3%	5.5%
Sedatives/Anxiolytics/Hypnotic	1	0.3%	1.4%

Note. Many patients were diagnosed with multiple diagnoses within diagnostic classes, thus totals within diagnostic classes do not equal 100%. For *Other Substance Abuse/ Dependence*, the substance of choice was not specified in medical records

Table IV

Medication and Therapy

Variable	Total Sample (*N*=310) *n* (%)	Psychiatric Sample (*N*=163) *n* (%)
Any Psychotropic Medications		
No	147 (47.4)	45 (27.6)
Yes	163 (52.6)	118 (72.4)
Antipsychotic Medications		
No	275 (88.7)	134 (82.2)
Yes	35 (11.3)	29 (17.8)
Antidepressant/Anxiolytic Medications		
No	160 (51.6)	54 (33.1)
Yes	150 (48.4)	109 (66.9)
Severe Mental Illness Therapy		
No	291 (93.9)	144 (88.3)
Yes	19 (6.1)	19 (11.7)
Substance Use Disorder Therapy		
No	284 (91.6)	137 (84.0)
Yes	26 (8.4)	26 (16.0)
Other Psychotherapy		
No	265 (85.5)	118 (72.4)
Yes	45 (14.5)	45 (27.6)

Other Pretreatment Variables

Certain inpatient units had greater representation than others. Distribution of patients among the inpatient units at the time of the PT evaluation was as follows: 29.4% resided on the Transitional Care Unit, 26.5% on the Acute Rehabilitation Unit, 23.2% on the Geriatric Evaluation and Management Unit, 14.5% on the Palliative Care Unit, 3.5% on the Long Term Care/Nursing Home Unit, 2.6% on the Extended Rehabilitation Unit, and 0.3% (one patient) on the Spinal Cord Rehabilitation Unit. Most patients (91%) were evaluated within 2 days of the PT consult request (*M* = 1.41; *SD* = 2.41; *Me* = 1; *IQR* = 1-1). Over three quarters of patients (78.1%) were seen within one day of the consult request. The range of days between consult request and initiation of the PT evaluation was wide (0 to 39 days) because of two outliers (one patient evaluated after 13 days, another patient after 39 days). These two outliers aside, the remaining patients (99.4%) began their PT evaluation within 6 days of the consult requested.

All patients had a PT diagnosis of deconditioning which was related to various etiologies; 29.0% of patient were referred for orthopedic reasons (e.g., deconditioning following fracture or amputation), 18.7% were referred because of deconditioning related to neurological conditions (e.g., multiple sclerosis exacerbation, Parkinson's disease), 17.7% were referred for deconditioning with etiology unspecified, 13.2% were referred for deconditioning in the context of cancer, 11.6% were referred for deconditioning due to cardiac conditions (e.g., following myocardial infarction), and 8.4% were referred for deconditioning due to respiratory conditions (e.g., pneumonia). Baseline M+L FIM was available on a subsample of patients (n = 142) and ranged from 6 to 36 (M = 18.25; SD = 8.02). For most patients, rehab potential was determined as good (46.5%), followed by fair (26.8%), and poor/guarded (21.3%). See Tables V and VI for greater detail on pretreatment variables.

Table V

Pretreatment and PT Treatment Continuous Variables

Variables	*n*	*M*(*SD*)	*Me*(*IQR*)	Range
Pretreatment Variables				
Consult to PT Evaluation in Days	310	1.41 (2.41)	1 (1-1)	0 – 39
M+L FIM at PT Admission	142	18.25 (8.02)	19 (11-24)	6 – 36
PT Treatment Variables				
PT Duration in Weeks	310	20.52 (17.02)	16 (9-27)	1 – 118
PT Session Frequency in Weeks	310	6.93 (2.59)	5 (5-10)	2 – 10
PT Percent Attendance	310	91.27 (18.03)	100 (100-100)	0 – 100
PT Missed Sessions	310	1.25 (2.21)	0 (0-2)	0 – 16
M+L FIM at PT Discharge	310	30.45 (7.55)	32 (28-36)	6 – 42
M+L FIM Change	142	11.71 (10.82)	13.5 (2.8-21)	-16 – 36
Goals Attained at Discharge	310	75.60 (36.51)	100 (100-100)	0 – 100

Note. M+L FIM: Mobility plus Locomotion subscales of Functional Independence Measure.

Table VI

Pretreatment and PT Treatment Categorical Variables

Variables	*n*	%
Pretreatment Variables		
Inpatient Unit		
Transitional Care	91	29.4%
Acute Rehabilitation	82	26.5%
Geriatric Evaluation and Management	72	23.2%
Palliative Care	45	14.5%
Long Term Care/Nursing Home	11	3.5%
Extended Rehabilitation	8	2.6%
Spinal Cord Rehabilitation	1	0.3%
PT Diagnosis Type		
Cardiac/Cancer/Other	181	58.4%
Orthopedic	80	25.8%
Neurological	49	15.8%
Rehab Potential	310	100.0%
Good	144	46.5%
Fair	83	26.8%
Poor/Guarded	66	21.3%
PT Session Frequency		
10 x per week	126	40.6%
5 x per week	170	5.8%
3 x per week	10	3.2%
2 x per week	4	1.3%
Discharge Status		
Completed PT	254	81.9%
Intervening Factor	43	13.9%
Patient Terminated	13	4.2%

Note. M+L FIM: Mobility plus Locomotion subscales of Functional Independence Measure.

PT Treatment Variables

PT Session Frequency ranged from 0 to 10 times per week (*M* = 6.93; *SD* = 2.59). PT duration ranged from 0.14 to 16.96 weeks (*M* = 2.93; *SD* = 2.43; *Me* = 2.29; *IQR* = 1.29-3.86). PT was well attended. Over half (58.7%) missed zero PT sessions, and on average the number of missed sessions was low (*M* = 1.25; *SD* = 2.21; *Me* = 0; *IQR* = 0-2). One patient failed to attend any PT appointments beyond the initial evaluation. The average percentage of attended appointments was high (*M* = 91.27; *SD* = 18.03; *Me* = 100; *IQR* = 90.80-100). Discharge M+L FIM ranged from 6 to 42 (*M* = 30.45; *SD* = 7.55; *Me* = 32; *IQR* = 28-36). Change in M+L FIM (i.e., from initial evaluation to discharge) was available for a subset of patients (*n* = 142), and ranged from -16 to 36 (*M* = 11.71; *SD* = 10.82). Goals Attained ranged from 0 to 100 (*M* = 75.60; SD = 36.51; *Me* = 100, *IQR* = 100-100). Most patients (81.9%) completed PT by meeting their goals or reaching a plateau, 13.9% stopped PT due to an intervening factor (e.g., illness, discharge from hospital), and 4.2% of patients terminated PT against provider recommendations. Tables V and VI provide greater detail on these treatment-related variables.

Statistical Analyses

Missing Data

Minimal data were missing overall, and no data were missing for predictor variables. For Race, 6.8% of data were missing; for Rehabilitation Potential, 5.5%, and for Baseline M+L FIM, 54.2%. By default, FIM Change also had 54.2% of data missing, since the FIM Change variable was dependent upon a valid score or Baseline M+L FIM. For Race and Rehabilitation Potential, the magnitude of missing data was relatively low, although substantial data were missing for Baseline M+L FIM (and by default, FIM Change). To determine whether there was a nonrandom pattern of missing data, those with missing data were compared to those without missing data across the variables planned for primary statistical analyses. First, variables with missing data were recoded with the following levels: 0-*missing* and 1-*not missing*. Next, ANOVAs and chi square analyses were conducted. There were no statistically significant differences between those with and without missing data in terms of Discharge M+L FIM, Goals Attained, PT Session Frequency, and Psychiatric Status (*p*s > .05). Table VII provides details about missing data frequency and patterns.

The reasons for the missing data are unclear, as the design of this study was a review of medical records. Race may have been omitted by the patient (e.g., by not disclosing their race/ ethnic identity) or because of provider negligence (e.g., forgetting or deciding not to ask about

Table VII

Comparing Patients with vs. without Missing Data on Selected Study Variables (N=310)

Selected Variable		Missing $M(SD)$ or n (%)	Not Missing $M(SD)$ or n (%)	Significance Test ANOVA or Chi Square
PT Session Frequency				
Race		7.14 (2.54)	6.91 (2.60)	$F(1,308)=1.03$, $p=.70$, $\eta_p^2<.01$
Rehab Potential		6.18 (2.19)	6.97 (2.61)	$F(1,308)=1.52$, $p=.22$, $\eta_p^2=.01$
Baseline M+L FIM		7.10 (2.60)	6.73 (2.60)	$F(1,308)=1.62$, $p=.20$, $\eta_p^2=.01$
Discharge M+L FIM				
Race		28.29 (9.61)	30.61 (7.37)	$F(1,308)=1.87$, $p=.17$, $\eta_p^2=.01$
Rehabilitation Potential		30.94 (8.30)	30.43 (7.52)	$F(1,308)=.07$, $p=.79$, $\eta_p^2<.01$
Baseline M+L FIM		30.88 (7.39)	29.96 (7.73)	$F(1,308)=1.14$, $p=.29$, $\eta_p^2<.01$
Discharge % Goals Met				
Race		65.15 (44.34)	76.36 (35.85)	$F(1,308)=1.85$, $p=.18$, $\eta_p^2=.01$
Rehab Potential		74.85 (36.77)	75.64 (36.55)	$F(1,308)=.01$, $p=.93$, $\eta_p^2<.01$
Baseline M+L FIM		78.63 (34.03)	72.00 (39.05)	$F(1,308)=2.56$, $p=.11$, $\eta_p^2=.01$
Any DSM Diagnosis				
Race	No Dx	9 (6.1%)	138 (93.9%)	$\chi^2(1)=.19$, $p=.67$, Cramer's $V=.03$
	Yes Dx	12 (7.4%)	151 (92.6%)	
Rehab Potential	No Dx	6 (4.1%)	141 (95.9%)	$\chi^2(1)=1.06$, $p=.30$, Cramer's $V=.06$
	Yes Dx	11 (6.7%)	152 (93.3%)	
Baseline M+L FIM	No Dx	88 (59.9%)	59 (40.1%)	$\chi^2(1)=3.62$, $p=.06$, Cramer's $V=.11$
	Yes Dx	80 (49.1%)	83 (50.9%)	
Mood Disorder				
Race	No Dx	11 (5.6%)	186 (94.4%)	$\chi^2(1)=1.21$, $p=.27$, Cramer's $V=.06$
	Yes Dx	10 (8.8%)	103 (91.2%)	
Rehab Potential	No Dx		188 (95.4%)	$\chi^2(1)=.87$, $p=.35$, Cramer's $V=.05$
	Yes Dx	9 (4.6%)	105 (92.9%)	
Baseline M+L FIM	No Dx	109 (55.3%)	88 (44.7%)	$\chi^2(1)=.28$, $p=.60$, Cramer's $V=.03$
	Yes Dx	59 (52.2%)	54 (47.8%)	
Substance Use Disorder				
Race	No Dx	17 (7.2%)	220 (92.8%)	$\chi^2(1)=.25$, $p=.62$, Cramer's $V=.03$
	Yes Dx	4 (5.5%)	69 (94.5%)	
Rehab Potential	No Dx	14 (5.9%)	223 (94.1%)	$\chi^2(1)=.35$, $p=.56$, Cramer's $V=.03$
	Yes Dx	3 (4.1%)	70 (95.9%)	
Baseline M+L FIM	No Dx	130 (54.9%)	107 (45.1%)	$\chi^2(1)=.18$, $p=.68$, Cramer's $V=.02$
	Yes Dx	38 (52.1%)	35 (47.9%)	

Note. M+L FIM: Mobility plus Locomotion subscales of Functional Independence Measure.

race/ethnic identity, or neglecting to record the information in the records). Rehabilitation Potential and Baseline M+L FIM may not have been assessed, or it may have been assessed but not recorded in the electronic medical record. Regardless of the reasons for the missing data, none of these variables were included in primary statistical analyses, thus no further analysis of missing data was conducted, and missing values were not replaced.

Preliminary Analyses

Analysis of group differences on pretreatment variables. Prior to running primary statistical analyses, patients with and without a psychiatric diagnosis were compared to ascertain whether they differed according to pretreatment variables. One-way ANOVAs were conducted to compare group means for continuous variables, while chi square analyses were conducted to compare proportions for categorical variables. There were no statistically significant differences between the two groups in terms of age, sex, race/ethnicity, marital status, distance in miles between their resident and the Zablocki VAMC, service connection (yes/no), percent service connection, total ICD diagnoses, total prescribed medications, prescribed pain medication (yes/no), days between PT consult request and PT evaluation, inpatient unit on which patients resided, and Baseline M+L FIM (*p*s > .05). There were no statistically significant differences between groups for the following treatment-related variables: PT diagnosis type, rehabilitation potential, duration of PT in weeks, number of missed PT sessions, percent attendance of PT sessions, and discharge status (*p*s > .05). In contrast, there was a statistically significant difference in PT Session Frequency, $F(1,308) = 6.95$, $p < .01$, $\eta_p^2 = .02$, with patients diagnosed with a psychiatric disorder having less intense PT compared to those without a psychiatric diagnosis (6.56 times per week vs. 7.33 times per week, respectively). While the result was statistically significant, the effect size was marginal. For primary statistical analyses, PT Session Frequency was to be included as a covariate, thus statistically controlling group differences on this variable.

Not surprisingly, there were statistically significant differences between groups in receipt of psychotherapy ($\chi^2(1) = 93.99$, $p < .01$, Cramer's $V = .55$), and receipt of psychotropic medications ($\chi^2(1) = 54.11$, $p < .01$, Cramer's $V = .41$), and effect sizes were moderate. Patients with a psychiatric diagnosis were more likely to have received therapy or medication for mental health reasons. Tables VIII and IX detail descriptive statistics for selected pretreatment and PT related variables. Although there were statistically significant differences between groups on receipt of mental health treatment variables, this was not statistically controlled for, because there are no a priori assumptions or research evidence suggesting that receiving mental health services impacts functional outcome in PT.

Addressing the assumptions of MANCOVA. Prior to running the primary analyses, the data were examined to ensure that assumptions underlying MANCOVA analyses were met. Assumption 1 states that the dependent variables are multivariately normally distributed for each population, with the different populations defined by levels of the factor (Green & Salkind, 2005). This assumption essentially means that the dependent variable is normally distributed at every combination of values for other variables. The power of the MANCOVA is reduced when population distributions are not multivariately normal. According to Green and Salkind, this assumption is difficult to meet. Guidelines suggest avoiding small sample sizes and heavily skewed and thick-tailed distributions. According to Tabachnick and Fidell (2007), sample sizes of at least 20 in each cell or 40 overall ensure robustness to nonnormality. This study attempts to meet Assumption 1 by analyzing a relatively large sample size ($N = 310$). Also, data were transformed when necessary to lessen the effect of skewness and kurtosis. Three methods of transforming the data were attempted: squaring the values, taking the square root, and taking the log. This was done for the sample as a whole as well as for each level of the independent variables (i.e., 0-*no diagnosis*, and 1-*yes diagnosis*). For the sample as a whole, squaring the values had the best results, reducing the skewness from -1.48 to -0.66 for Discharge Motor plus Locomotion FIM, and reducing skewness from -1.21 to -0.84 for Percent Goals Met. A similar pattern occurred for kurtosis which was reduced from 2.19 to 0.10 for Discharge Motor plus Locomotion FIM. However, kurtosis increased from -0.12 to -1.06 for Percent Goals Met.

Similarly, squaring the values largely improved skewness and kurtosis at each level of the independent variable. For those with a psychiatric diagnosis, squaring the values reduced skewness from -1.52 to -0.68 for Discharge M+L FIM, and reduced skewness from -1.23 to -0.90 for Goals Attained. Kurtosis was reduced from 2.46 to 0.19 for Discharge M+L FIM. However,

Table VIII

Differences between patients with and without a psychiatric diagnosis on selected continuous variables (*N*=310)

	Psychiatric Diagnosis				
Variable	No *M*(*SD*)	Yes *M*(*SD*)	*F*(*df*)	*p*	η_p^2
Age	71.73(11.72)	72.35(12.02)	29.60(1,308)	.65	<.01
Distance	49.29(87.40)	53.41(107.07)	.14(1,308)	.71	<.01
% Service Connection	25.03(37.77)	22.39(34.06)	.42(1,308)	.52	<.01
Total ICD Diagnoses	10.29(5.31)	11.05(5.42)	1.54(1,308)	.22	.01
Total Medications	18.03(6.16)	19.40(6.85)	3.42(1,308)	.07	.01
Consult to PT Evaluation in Days	1.27(.87)	1.55(3.22)	1.05(1,308)	.31	<.01
Duration of PT in Weeks	2.79(2.35)	3.06(2.51)	.89(1,308)	.35	<.01
PT Session Frequency	**7.33(2.62)**	**6.56(2.51)**	**6.95(1.308)**	**<.01**	**.02**
PT Session % Attendance	92.20(17.13)	90.42(18.83)	.76(1,308)	.39	<.01
PT Sessions Missed	1.10(1.80)	1.39(2.52)	1.41(1,308)	.24	<.01
Baseline M+L FIM	18.31(8.18)	18.20(7.96)	.02(1,139)	.88	<01
M+L FIM Change Score	11.39(10.82)	11.94(10.88)	.24(1,139)	.62	<.01

Note. M+L FIM: Mobility plus Locomotion subscales of Functional Independence Measure.

Table IX

Differences between patients with and without a psychiatric diagnosis on selected categorical variables (*N*=310)

Variable		Psychiatric Diagnosis No %	Psychiatric Diagnosis Yes %	$\chi^2(df)$	*p*	Cramer's *V*
Sex	Male	47.0	53.0	.60(1)	.44	.04
	Female	58.3	41.7			
Race	White	50.8	49.2	.29(1)	.59	.03
	Non-White	47.0	53.0			
Marital Status	Never Married	53.7	46.3	2.88(3)	.41	.10
	Married	45.2	54.8			
	Separated or Divorced	42.2	57.8			
	Widowed	53.2	46.8			
Service Connected	No	47.9	52.1	.04(1)	.83	.01
	Yes	46.7	53.3			
Inpatient Unit	GEM	51.4	48.6	1.86(4)	.76	.08
	Acute Rehabilitation	41.5	58.5			
	Transitional Care	49.5	50.5			
	Palliative Care	48.9	51.1			
	EC, LT Care, SCI	45.0	55.0			
PT Diagnosis Type	Orthopedic	41.3	58.8	1.95(2)	.38	.08
	Neurological	53.1	46.9			
	Other	48.6	51.4			
Rehab Potential	Good	47.9	52.1	.09(2)	.96	.02
	Fair	49.4	50.6			
	Poor/Guarded	47.0	53.0			
Pain Medication	No	48.2	51.8	.04(1)	.83	.01
	Yes	47.0	53.0			
MH Therapy	**No**	**63.4**	**36.6**	**93.99(1)**	**<.01**	**.55**
	Yes	**0.0**	**100.0**			
MH Medications	**No**	**69.4**	**30.6**	**54.11(1)**	**<.01**	**.41**
	Yes	**27.6**	**72.4**			
Discharge Status	Completed PT	48.4	51.6	1.56(2)	.46	.07
	Intervening Factor	46.5	53.5			
	Patient Terminated	30.8	69.2			

Note. EC: Extended Care; GEM: Geriatric Evaluation and Management; LT Care: Long Term Care; MH: Mental Health; SCI: Spinal Cord Injury

kurtosis increased slightly for Goals Attained, from -0.10 to -0.99. For those with no psychiatric diagnosis, squaring the values reduced skewness from -1.50 to -0.71 for Discharge M+L FIM, and reduced skewness from -1.19 to -0.77 for Goals Attained. Kurtosis was reduced from 2.04 to 0.08 for Discharge M+L FIM. Kurtosis increased slightly for Percent PT goals met, from -0.11 to -1.11. Overall, squaring the values improved data distribution for the sample as a whole and at each level of the independent variable.

In the addition to the above assumption, MANCOVAs are sensitive to outliers (Tabachnick & Fidell, 2007). Outliers were examined by converting the dependent variables to z-scores. Outliers are defined as any value outside 3 standard deviations from the mean (i.e., z-scores greater than ±3.0). Values exceeding this range would be replaced with ±2.9, to avoid the influence of outliers on the results of the statistical test. After converting the raw data to z scores, neither of the dependent variables had values that fell beyond ±3.0.

Assumption 2 states that MANCOVA results may be invalid if sample sizes between levels are highly disparate and the variances and covariances are unequal (Green & Salkind, 2005). Simple descriptive statistics will tabulate sample sizes between levels. SPSS allows one to test the assumption of homogeneity of the variance-covariance matrices with Box's *M* statistic. A nonsignificant result indicates that homogeneity between levels can be considered equivalent.

Analysis of the frequency distribution indicated that sample sizes were fairly equivalent for those with and without a psychiatric diagnosis (52.6% and 47.4%, respectively). Box's *M* test was not statistically significant, $F(3,25862264) = .21$, $p = .89$. This indicates a failure to reject to hypothesis that the homogeneity of dispersion matrices is different for patients with versus without a psychiatric diagnosis. Said differently, observed covariance matrices across these two groups did not differ significantly.

Assumption 3 states that scores on a variable for any one participant are independent from the scores on this variable for all other participants (Green & Salkind, 2005). Assumption 3 is considered met because participants' functional mobility status and degree to which they attain their goals are independently determined and are not reliant on the performance of other patients.

Assumption 4 states that the covariate is linearly related to dependent variables at all levels of the factor, and the weights or slopes relating the covariate to the dependent variable are equal across all levels of the factor (Green & Salkind, 2005). In other words, the covariate should not influence the relationship between the independent and dependent variables differently at each level of the independent variable. The fourth assumption can be tested by assessing whether there is a statistically significant interaction effect between the covariate and independent variable on the dependent variable. A significant interaction indicates that differences on the dependent variable among groups vary as a function of the covariate, and subsequently the results of the MANCOVA are not meaningful. There was no statistically significant interaction between PT Session Frequency and Psychiatric Status for Discharge M+L FIM, $F(1,6643) = .05$, $p = .83$, $\eta_p^2 < .01$.

Primary Analyses

As recommended by Marcoulides and Hershberger (1997), four multivariate test indices were examined: (1) Pillai’s Trace, (2) Wilks’ Lambda (Λ), (3) Hotelling’s Trace, and (4) Roy’s Largest Root. A one-way MANCOVA was conducted to examine whether having a diagnosed psychiatric disorder impacted Discharge M+L FIM and Goals Attained. The MANCOVA was not statistically significant: Wilks’ $\Lambda = .98$, Pillai’s Trace = .02, Hotelling’s Trace = .02, Roy’s Largest Root = .02; $F(2,306) = 2.56$, $p = .08$. The effect size was small: $\eta_p^2 = .02$. According to these results, there were no functional outcome differences between patients with and without a psychiatric diagnosis. Although results were not significant, means and standard deviations of Discharge M+L FIM and Goals Attained are presented for descriptive purposes. There was a nonsignificant 1.37 point difference on Discharge M+L FIM ($M = 31.10$; $SD = 7.55$ for those with a psychiatric diagnosis; $M = 29.73$; $SD = 7.51$ for those with no psychiatric diagnosis). There was a nonsignificant 1.68 point difference on Percent Goals Met ($M = 76.39$; $SD = 36.73$ for those with a psychiatric diagnosis; *M* = 74.71; *SD* = 36.36 for those with no psychiatric diagnosis).

Additional analyses were conducted to examine the effects of specific classes of diagnoses on functional outcomes. Only diagnostic classes with sufficient sizes (i.e., $n > 20$) were selected in order to have confidence in the stability of test results. Diagnostic classes considered for further investigation were mood disorders ($n = 113$), anxiety disorders ($n = 60$), and SUDs ($n = 73$). Diagnostic classes not considered because of insufficient sample sizes were psychotic disorders ($n = 8$), adjustment disorders ($n = 4$), and personality disorders ($n = 4$).

In order to improve internal validity of these groups, only diagnostically pure groups were considered. That is, individuals with diagnoses in multiple diagnostic classes were excluded from further analyses. On one hand, this omits patients with co-occurring psychiatric conditions, which is a large proportion of patients who present for treatment. On the other hand, this permits the examination of subgroups, which may provide clinically meaningful information, such as whether patients with diagnoses in certain diagnostic classes relative to others experience poorer functional outcome. Looking at diagnostically pure groups reduced the sample sizes as follows: mood disorders ($n = 51$), SUDs ($n = 26$), and anxiety disorders ($n = 10$). The anxiety disorders group was then excluded because the sample size was less than 20. Thus, only patients with mood disorders and SUDs were selected using MANCOVAs to examine the impact of those having a mood disorder or SUDs on functional outcome in PT. Again, treatment intensity was included in the model as a covariate. Prior to conducting the MANCOVAs those with a mood disorder were compared to those without a mood disorder (Tables X and XI), and those with a SUD were compared to those without a SUD (Tables XII and XIII) on selected pretreatment variables. One-way ANOVAs were conducted to compare group means for continuous variables (Tables X and XII), while chi square analyses were conducted to compare proportions for categorical variables (Tables XI and XIII). After group comparisons, one-way MANCOVAs were conducted.

Mood disorders. There were no statistically significant differences between those with and without a mood disorder on age, sex, race, marital status, distance in miles between their resident and the Zablocki VAMC, service connection (yes/no), percent service connection, total ICD diagnoses, total prescribed medications, prescribed pain medication (yes/no), days between PT consult request and PT evaluation, inpatient unit on which patients resided, and Baseline M+L FIM (*p*s > .05). Also, there were no statistically significant differences between groups on PT diagnosis type, rehabilitation potential, duration of PT in weeks, number of missed PT sessions, percent attendance of PT sessions, and discharge status (*p*s > .05). This time, there was no statistically significant difference in PT Session Frequency ($F(1,196) = 2.56$, $p < .11$, $\eta_p^2 = .01$). Not surprisingly, there were statistically significant differences between groups in receipt of psychotherapy ($\chi^2(1) = 71.34$, $p < .01$, Cramer's $V = .60$), and receipt of psychotropic medications ($\chi^2(1) = 32.60$, $p < .01$, Cramer's $V = .41$) Patients with a mood disorder diagnosis were more likely to have received therapy or medication for mental health reasons, and effect sizes were moderate.

A one-way MANCOVA was conducted to examine the effects of having a mood disorder (and no other psychiatric diagnosis) on functional outcomes. Box's M test was not statistically significant, $F(3,147500) = .49$, $p = .69$, indicating that the covariance matrices did not differ significantly between those with and without a mood disorder. The MANCOVA was not statistically significant: Wilks' $\Lambda = .99$, Pillai's Trace = .01, Hotelling's Trace = .01, Roy's Largest Root = .01, $F(2,98) = .32$, $p = .73$. The effect size was small: $\eta_p^2 = .01$. According to these results, there were no functional outcome differences between patients with and without a mood disorder diagnosis among diagnostically pure groups. Although results were not significant, means and standard deviations of Discharge M+L FIM and Goals Attained are presented for descriptive purposes. There was a nonsignificant 0.96 point difference on Discharge M+L FIM ($M = 30.69$; $SD = 7.63$ for those with a mood disorder diagnosis; $M = 29.73$; $SD = 7.51$ for those with no mood disorder diagnosis). There was a nonsignificant 8.09 point difference on Goals

Attained (*M* = 82.80; *SD* = 29.78 for those with a mood disorder diagnosis; *M* = 74.71; *SD* = 36.36 for those with no mood disorder diagnosis). To see if results would differ if a larger sample was included in the analysis, another MANCOVA was conducted comparing all patients with a mood disorder (including those with comorbid psychiatric condition) compared to patients with no psychiatric disorders. Again, the MANCOVA was not statistically significant: Wilks' Λ = .99, Pillai's Trace = .02, Hotelling's Trace = .02, Roy's Largest Root = .02, $F(2,194) = 1.50$, $p = .23$. The effect size was small: $\eta_p^2 = .02$.

Table X

Differences between patients with and without a mood disorder diagnosis on selected continuous variables (*N*=198)

	Mood Disorder Diagnosis				
Variable	No *M*(*SD*)	Yes *M*(*SD*)	*F*(*df*)	*p*	η_p^2
Age	71.73(11.72)	72.31(13.89)	.08(1,196)	.77	<.01
Distance	49.29(87.40)	54.49(81.44)	.14(1,196)	.71	<.01
% Service Connection	25.03(37.77)	18.43(31.65)	1.25(1,196)	.26	<.01
Total ICD Diagnoses	10.29(5.31)	10.14(5.31)	.03(1,196)	.86	<.01
Total Medications	18.03(6.16)	19.90(6.41)	3.44(1,196)	.07	.02
Consult to PT Evaluation in Days	1.27(.87)	2.06(5.36)	3.02(1,196)	.08	.02
Duration of PT in Weeks	2.79(2.35)	2.99(2.59)	.25(1,196)	.62	<.01
PT Session Frequency	7.33(2.62)	6.67(2.38)	2.56(1.196)	.11	.01
PT Session % Attendance	92.20(17.13)	94.34(13.88)	.65(1,196)	.42	<.01
PT Sessions Missed	1.10(1.80)	.75(1.37)	1.61(1,196)	.21	<.01
Baseline M+L FIM	18.31(8.18)	17.97(7.60)	.10(1,85)	.75	<..01
M+L FIM Change Score	11.39(10.82)	11.48(10.61)	.07(1,85)	.80	<.01

Note. M+L FIM: Mobility plus Locomotion subscales of Functional Independence Measure.

Table XI

Differences between patients with and without a mood disorder diagnosis on selected categorical variables (*N*=198)

Variable		Mood Disorder Diagnosis No %	Mood Disorder Diagnosis Yes %	$\chi^2(df)$	*p*	Cramer's *V*
Sex	Male	74.9	25.1	.69(1)	.41	.06
	Female	63.6	36.4			
Race/Ethnicity	White	74.0	26.0	.80(1)	.37	.07
	Non-White	81.1	18.9			
Marital Status	Never Married	78.4	21.6	1.24(3)	.74	.08
	Married	74.6	25.4			
	Separated or Divorced	69.1	30.9			
	Widowed	76.7	23.3			
Service Connected	No	74.6	25.4	.02(1)	.89	.01
	Yes	73.7	26.3			
Inpatient Unit	GEM	74.0	26.0	.38(4)	.98	.04
	Acute Rehabilitation	72.3	27.7			
	Transitional Care	73.8	26.2			
	Palliative Care	78.6	21.4			
	EC, LT Care, SCI	75.0	25.0			
PT Diagnosis Type	Orthopedic	67.3	32.7	2.08(2)	.35	.10
	Neurological	72.2	27.8			
	Other	77.9	22.1			
Rehab Potential	Good	70.4	29.6	1.21(2)	.55	.08
	Fair	77.4	22.6			
	Poor/Guarded	77.5	22.5			
Pain Medication	No	71.1	28.9	.66(1)	.42	.06
	Yes	76.2	23.8			
MH Therapy	**No**	**83.5**	**16.5**	**71.34**	**<.01**	**.60**
	Yes	**0.0**	**100.0**			
MH Medications	**No**	**89.5**	**10.5**	**32.60**	**<.01**	**.41**
	Yes	**53.6**	**46.4**			
Discharge Status	Completed PT	74.1	25.9	.28(2)	.87	.04
	Intervening Factor	76.9	23.1			
	Patient Terminated	66.7	33.3			

Note. EC: Extended Care; GEM: Geriatric Evaluation and Management; LT Care: Long Term Care; MH: Mental Health; SCI: Spinal Cord Injury

Substance Use Disorders. There were no statistically significant differences between those with and without a SUD on age, sex, race, marital status, distance in miles between their resident and the Zablocki VAMC, service connection (yes/no), percent service connection, total ICD diagnoses, total prescribed medications, prescribed pain medication (yes/no), days between PT consult request and PT evaluation, inpatient unit on which patients resided, and Baseline M+L FIM (*p*s > .05). Also, there were no statistically significant differences between groups on PT diagnosis type, rehabilitation potential, duration of PT in weeks, number of missed PT sessions, percent attendance of PT sessions, and discharge status (*p*s > .05). Again, there was no statistically significant difference in PT Session Frequency ($F(1,171) = 3.39$, $p < .07$, $\eta_p^2 = .02$). There were statistically significant differences between groups in receipt of psychotherapy ($\chi^2(1) = 35.14$, $p < .01$, Cramer's $V = .45$), but not receipt of psychotropic medications ($\chi^2(1) = .63$, $p > .05$, Cramer's $V = .06$). Compared to patients with no SUD, those with a SUD were more likely to have received therapy, but not to have received psychotropic medication.

A one-way MANCOVA was conducted to examine the effects of having a SUD (and no other psychiatric disorder) on functional outcomes. Box's M test was not statistically significant, $F(3,25218) = .35$, $p = .79$, indicating that the covariance matrices did not differ significantly between those with and without a SUD. MANCOVA results were not statistically significant: Wilks' $\Lambda = .95$, Pillai's Trace = .05, Hotelling's Trace = .05, Roy's Largest Root = .05, $F(2,48) = 1.21$, $p = .31$. The effect size was small: $\eta_p^2 = .05$. According to these results, there were no functional outcome differences between patients with and without a mood disorder diagnosis among diagnostically pure groups. Although results were not significant, means and standard deviations of Discharge M+L FIM and Goals Attained are presented for descriptive purposes. There was a nonsignificant 1.69 point difference on Discharge M+L FIM ($M = 31.42$; $SD = 7.41$ for those with a SUD diagnosis; $M = 29.73$; $SD = 7.51$ for those with no SUD diagnosis). There was a nonsignificant 7.86 point difference on Goals Attained ($M = 66.85$; $SD = 43.04$ for those with a SUD diagnosis; $M = 74.71$; $SD = 36.36$ for those with no SUD diagnosis). To see if results would differ if a larger sample was included in the analysis, another MANCOVA was conducted comparing all patients with a SUD disorder (including those with comorbid psychiatric condition) compared to patients with no psychiatric disorders. Again, the MANCOVA was not statistically significant: MANCOVA results were not statistically significant: Wilks' Λ = .97, Pillai's Trace = .03, Hotelling's Trace = .03, Roy's Largest Root = .03, $F(2,169) = 2.52$, $p = .08$. The effect size was small ($\eta_p^2 = .03$).

Table XII

Differences between patients with and without a substance use disorder diagnosis on selected continuous variables (N=173)

	Substance Use Disorder Diagnosis				
Variable	No $M(SD)$	Yes $M(SD)$	$F(df)$	p	η_p^2
Age	71.73(11.72)	71.08(11.16)	.07(1,171)	.79	<.01
Distance	49.29(87.40)	54.51(80.44)	.08(1,171)	.78	<.01
% Service Connection	25.03(37.77)	15.00(21.17)	1.68(1,171)	.20	.01
Total ICD Diagnoses	10.29(5.31)	12.00(6.65)	2.11(1,171)	.15	.01
Total Medications	18.03(6.16)	16.88(8.17)	.69(1,171)	.41	<.01
Consult to PT Evaluation in Days	1.27(.87)	1.00(.85)	2.07(1,171)	.15	.01
Duration of PT in Weeks	2.79(2.35)	3.08(2.30)	.34(1,171)	.56	<.01
PT Session Frequency	7.33(2.62)	6.31(2.59)	3.39(1.171)	.07	.02
PT Session % Attendance	92.20(17.13)	91.83(20.08)	.01(1,171)	.92	<.01
PT Sessions Missed	1.10(1.80)	1.81(3.20)	2.63(1,171)	.12	.02
Modified FIM at PT Admission	18.31(8.18)	16.20(9.37)	.81(1,71)	.37	.01
Modified FIM Change Score	11.39(10.82)	13.87(12.18)	.69(1,71)	.41	.01

Note. M+L FIM: Mobility plus Locomotion subscales of Functional Independence Measure.

Table XIII

Differences between patients with and without a substance use disorder diagnosis on selected categorical variables (*N*=173)

		Substance Use Disorder Diagnosis				Cramer's
		No %	Yes %	$\chi^2(df)$	*p*	*V*
Sex	Male	84.3	15.7	1.29(1)	.26	.09
	Female	100.0	0.0			
Race/Ethnicity	White	83.7	16.3	.42(10	.52	.05
	Non-White	88.2	11.8			
Marital Status	Never Married	87.9	12.1	.96(3)	.81	.07
	Married	85.5	14.5			
	Separated or Divorced	80.9	19.1			
	Widowed	86.8	13.2			
Service Connected	No	82.7	17.3	1.19(1)	.28	.08
	Yes	88.9	11.1			
Inpatient Unit	GEM	94.9	5.1	6.55(4)	.16	.20
	Acute Rehabilitation	82.9	17.1			
	Transitional Care	80.4	19.6			
	Palliative Care	78.6	21.4			
	EC, LT Care, SCI	100.0	0.0			
PT Diagnosis Type	Orthopedic	76.7	23.3	3.78(2)	.15	.15
	Neurological	92.9	7.1			
	Other	86.3	13.7			
Rehab Potential	Good	85.5	14.5	.72(2)	.70	.07
	Fair	82.0	18.0			
	Poor/Guarded	86.1	13.9			
Pain Medication	No	84.4	15.6	.03(1)	.87	.01
	Yes	85.3	14.7			
MH Therapy	**No**	**88.0**	**12.0**	**35.14(1)**	**<.01**	**.45**
	Yes	**0.0**	**100.0**			
MH Medications	**No**	86.4	13.6	.63(1)	.43	.06
	Yes	85.0	15.0			
Discharge Status	Completed PT	85.4	14.6	1.67(2)	.43	.10
	Intervening Factor	87.0	13.0			
	Patient Terminated	85.0	15.0			

Note. EC: Extended Care; GEM: Geriatric Evaluation and Management; LT Care: Long Term Care; MH: Mental Health; SCI: Spinal Cord Injury

Secondary Analyses

Discriminant Function Analyses. Three discriminant function analyses were conducted to determine whether scores on Discharge M+L FIM and Goals Attained could predict whether participants were diagnosed with any psychiatric disorder, a mood disorder, or a SUD. One can conceptualize discriminant analysis as the reverse of MANCOVA. In a MANCOVA, the levels of categorical (predictor) variables are compared to determine whether they differ significantly on some quantitative (dependent) variable. In discriminant analysis, individuals are classified into groups based on linear combinations of quantitative variables. That is, the quantitative variables are the predictors and the categorical variables are the dependent variables. Discriminant analyses are commonly conducted after one-way MANCOVAs (Green & Salkind, 2005) as follow up statistical tests.

Assumptions underlying discriminant analyses are similar to those underling MANCOVAs: (1) the quantitative variables are multivariately normally distributed for each of the populations, with the different populations defined by the levels of the grouping variable; (2) population variances and covariances among the dependent variables are the same across all levels of the factor; and (3) the score on a variable or any one participant is independent from the scores on that variable for all other participants (Green & Salkind, 2005). These assumptions have already been addressed.

No discriminant analyses results were statistically significant: Psychiatric Status, Wilks's $\Lambda = .99$, χ^2 (2) = 4.42, $p = .109$, $\eta^2 = .01$; Mood Disorder Status, Wilks's $\Lambda = .99$, χ^2 (2) = 1.74, $p = .419$, $\eta^2 = .01$; SUD Status, Wilks's $\Lambda = .99$, χ^2 (2) = 5.50, $p = .064$, $\eta^2 = .03$. In other words, scores on Discharge M+L FIM and Goals Attained did not differentiate between those with and without mood disorders, SUDs, and any psychiatric diagnosis.

ANCOVAs. A series of ANCOVAs were conducted to examine the relationships between Psychiatric Status, Mood Disorder Status, and SUD Status on each dependent variable individually. As stated prior, the two dependent variables were highly correlated with each other

($r = .67$, $p < .001$). Univariate analyses were conducted to ascertain whether the independent variables had an effect on the dependent variables without taking into account their interrelationship.

Assumptions of ANCOVAs are similar to those of MANCOVAs: (1) the dependent variable is normally distributed for any value of the covariate and for each factor level; (2) variances of the dependent variable are equivalent at any value of the covariate and for each factor level; (3) scores on the dependent variable are independent of each other; and (4) the covariate is linearly related to the dependent variable within all levels of the factor, and the weights and slopes relating the covariate to the dependent variable are equal across all levels of the factor. These assumptions have already been addressed. Regarding the second assumption, equivalence of variances of the dependent variable at each level of the factor can be evaluated using Levene's Test of Equality of Error Variances.

The first one-way ANCOVA was conducted to examine the relationship between Psychiatric Status and Discharge M+L FIM. Levene's Test of Equality of Error Variances was not statistically significant, $F(1,308) = .44$, $p = .51$, indicating that homogeneity of variance between groups was equivalent. The interaction between Psychiatric Status and PT Session Frequency was not statistically significant, $F(1,306) = 0.05$, $p = .83$, $\eta_p^2 < .001$, indicating that the linearity and homogeneity of slopes of the covariate at each level of the factor (i.e., whether or not the patient had a psychiatric diagnosis) was equivalent. The ANCOVA was statistically significant, $F(1,307) = 4.93$, $p = .03$, $\eta_p^2 = .02$). Compared to those with no psychiatric diagnosis, patients with a psychiatric diagnosis had an average of 1.69 points higher on the Discharge M+L FIM. The effect size was marginal.

A second one-way ANCOVA was conducted to examine the relationship between Psychiatric Status and Goals Attained. Levene's Test of Equality of Error Variances was not statistically significant, $F(1,308) = 0.39$, $p = .53$,indicating that homogeneity of variance between groups was equivalent. The interaction between Psychiatric Status and PT Session Frequency was not statistically significant, $F(1,306) = 0.05$, $p = .83$, $\eta_p^2 < .01$, indicating that the linearity and homogeneity of slopes of the covariate at each level of the factor (i.e., whether or not the patient had a psychiatric diagnosis) was equivalent. The ANCOVA was not statistically significant, $F(1,307) = 1.18$, $p = .29$, $\eta_p^2 < .01$), indicating no difference in meeting goals at discharge between those with and without a psychiatric diagnosis.

A third one-way ANCOVA was conducted to examine the relationship between Mood Disorder Status and Discharge M+L FIM. Levene's Test of Equality of Error Variances was not statistically significant, $F(1,196) = 0.03$, $p = .87$, indicating that homogeneity of variance between groups was equivalent. The interaction between mood disorder and PT Session Frequency was not statistically significant, $F(1,194) = 1.04$, $p = .31$, $\eta_p^2 = .01$, indicating that the linearity and homogeneity of slopes of the covariate at each level of the factor (i.e., whether or not the patient had a mood disorder diagnosis) was equivalent. The ANCOVA was not statistically significant, $F(1,195) = 1.41$, $p = .24$, $\eta_p^2 = .01$), indicating no differences in Discharge M+L FIM between those with and without a mood disorder.

A fourth one-way ANCOVA was conducted to examine the relationship between mood disorder and Goals Attained. The interaction between mood disorder and PT Session Frequency was not statistically significant, $F(1,194) = 1.31$, $p = .25$, $\eta_p^2 = .01$, indicating that the linearity and homogeneity of slopes of the covariate at each level of the factor (i.e., whether or not the patient had a mood disorder diagnosis) was equivalent. This time, Levene's Test of Equality of Error Variances was statistically significant, $F(1,196) = 4.12$, $p = .04$, indicating that homogeneity of variance of the dependent variable was not equivalent between those with and without a mood disorder. Unequal sample sizes between groups can lead to differences in error variances. In this case, there were 147 patients with no psychiatric diagnosis and 51 patients with a mood disorder. To reduce the unequal variance differences between groups, a random sample of 51 patients with no diagnosis was selected, and the ANCOVA was again conducted. This time, Levene's Test of Equality of Error Variances was not statistically significant, $F(1,100) = 0.05$, p

= .83. The ANCOVA was not statistically significant, $F(1,99) = 0.23$, $p = .63$, $\eta_p^2 < .01$, indicating that there were no differences in meeting goals between those with and without a mood disorder.

A fifth one-way ANCOVA was conducted to examine the relationship between SUD Status and Discharge M+L FIM. The interaction between SUD Status and PT Session Frequency was not statistically significant, $F(1,169) = 0.09$, $p = .77$, $\eta_p^2 < .01$, indicating that the linearity and homogeneity of slopes of the covariate at each level of the factor (i.e., whether or not the patient had a SUD) was equivalent. Levene's Test of Equality of Error Variances was not statistically significant, $F(1,171) = 0.62$, $p = .43$, indicating that homogeneity of variance between groups was equivalent. The ANCOVA was not statistically significant, $F(1,170) = 2.11$, $p = .15$, $\eta_p^2 = .01$, indicating that there were no differences in Discharge M+L FIM between those with and without a SUD.

The final one-way ANCOVA was conducted to examine the relationship between SUD Status and Goals Attained. The interaction between SUD Status and PT Session Frequency was not statistically significant, $F(1,169) = 0.06$, $p = .81$, $\eta_p^2 < .01$, indicating that the linearity and homogeneity of slopes of the covariate at each level of the factor (i.e., whether or not the patient had a SUD) was equivalent. This time, Levene's Test of Equality of Error Variances was statistically significant, $F(1,171) = 5.56$, $p = .02$, indicating that homogeneity of variance of the dependent variable was not equivalent between those with and without a SUD. As stated prior, unequal sample sizes between groups can lead to differences in error variances. There were 26 patients with a SUD. To reduce error variance differences between groups, a random sample of 26 patients with no psychiatric diagnosis was selected, and the ANCOVA was again conducted. This time, Levene's Test of Equality of Error Variances was not statistically significant, $F(1,50) = 1.52$, $p = .22$. The ANCOVA was not statistically significant, $F(1,49) = 0.01$, $p = .92$, $\eta_p^2 <$ .01), indicating no differences in meeting goals between those with and without a SUD.

In summary, all multivariate analyses were not statistically significant (ps > .05). Five of six univariate analyses were not statistically significant. The significant relationship between Psychiatric Status and Discharge M+L FIM was likely a spurious finding, as running multiple analyses when testing a single hypothesis inflates Type I error. After correcting for Type I error using the Bonferroni procedure (.05/6 = .008) all six univariate analyses were not statistically significant. An alternative assumption is that better D+L FIM performance among those with any psychiatric illness reflects a true relationship in this sample. However, this is in contrast with the majority of prior research which reported worse functional outcomes among patients with psychiatric symptoms and disorders compared to psychiatrically healthy patients. Also, in this study, effect sizes were small across all analyses ($\eta_p^2 \leq 05$). Minimal differences were observed on the Discharge M+L FIM (< 2 points) and on Goals Attained (< 8 percentage points), and these minimal differences were not clinically meaningful.

Treatment Intensity

Consistent with prior research, treatment intensity had a statistically significant relationship with functional outcome. Treatment intensity (as measured by PT Session Frequency) was significantly correlated with a created variable which the sum of standardized (i.e., z scores) M+L FIM and Percent Goals ($r = .17$, $p < .01$). Also, it was entered as a covariate in the MANOVAs and ANCOVAS, and the relationship was significant across the majority of analyses. Among multivariate analyses, PT Session Frequency was significantly related to functional outcome when Psychiatric Status or Mood Disorder Status were included in the model: For Psychiatric Status, Pillai's Trace = .03, Wilks' Λ = .97, Hotelling's Trace = .03, Roy's Largest Root = .03, $F(2,306) = 5.00$, $p < .01$, $\eta_p^2 = .03$; for Mood Disorder Status, Pillai's Trace = .06, Wilks' Λ = .94, Hotelling's Trace = .06, Roy's Largest Root = .06, $F(2,194) = 5.88$, $p < .01$, $\eta_p^2 = .06$. When SUD was examined as the independent variable, the failed to reach statistical significance, but just barely: For SUD Status, Pillai's Trace = .03, Wilks' Λ = .97, Hotelling's Trace = .04, Roy's Largest Root = .04, $F(2,169) = 2.95$, $p = .06$, $\eta_p^2 = .03$. Among univariate analyses, PT Session Frequency was significantly associated with Discharge M+L FIM in the models that included Psychiatric Status, $F(1,307) = 4.06$, $p = .05$, $\eta_p^2 = .01$, Mood Disorder Status, $F(1,195) = 1.42$, $p = .05$, $\eta_p^2 = .02$, but not SUD Status, $F(1,170) = 2.28$, $p = .15$, $\eta_p^2 = .01$. PT Session Frequency was associated with Goals Attained in all the ANCOVAs: Psychiatric Status, $F(1,307) = 10.03$, $p < .01$, $\eta_p^2 = .03$; Mood Disorder Status, $F(1,195) = 11.80$, $p < .01$, $\eta_p^2 = .06$; SUD Status, $F(1,170) = 5.92$, $p = .02$, $\eta_p^2 = .03$.

CHAPTER V: DISCUSSION

Results from this study suggest that having a diagnosed mood disorder, SUD, or any psychiatric disorder was associated with functional outcome in PT. However, these findings are inconsistent with results from prior research. Notably, published studies were scant and findings were inconsistent such that some studies find that either psychiatric illness is associated with poorer functional outcome or no relationship was found. No studies reported that psychiatric illness is associated with better functional outcome. Prior studies typically examined depression or anxiety, and only one study looked at substance use disorders. Prior research was too limited to confidently draw conclusions, however most studies tended to report that psychiatric illness or symptoms, particularly depression and anxiety, were associated with poorer functional outcome. Several study limitations and other factors likely contributed to the failure to find a relationship between psychiatric illness and functional outcome.

Possible reasons for the inconsistency of current results and prior research include differences in psychiatric diagnosis assessment method and outcome measures. First, past research assessed psychiatric diagnosis using interview (e.g., semi-structured clinical interviews) to determine psychiatric diagnoses, whereas in this study psychiatric diagnoses were obtained from medical records. Thus, past research examined whether patients currently met diagnostic criteria for a *DSM* disorder. The practice of obtaining psychiatric diagnoses from medical charts (specifically, the Problem List page of CPRS) is limited in multiple ways. First, study participants may have met diagnostic criteria for the disorder at one time, but may have been in remission or not met *DSM-IV-TR* criteria at all during their PT evaluation and treatment. Also, the reliability of diagnoses being placed on the CPRS problem list is questionable. Psychiatric diagnoses are commonly included in official psychological evaluation reports, which are stored in a different location, instead of being placed on the CPRS Problem List. This may occur for various reasons. Typically primary health care providers assign diagnoses to the problem list. However, they may consult mental health providers for a psychological or psychiatric evaluation, for the purpose of diagnostic clarification. After conducting the evaluation, the psychiatric or psychologist will furbish a report, including their diagnostic impression, and send the report to the consulting primary care provider. Because the psychiatric or psychologist is not the primary provider in charge of the patient's care and are not providing treatment, they may not add the diagnoses to the problem list. The primary care provider may or may not add the problem to the problem list, and instead include the psychiatric diagnosis or diagnoses in their medical notes, stored in a different location. Another reason certain diagnoses may fail to appear on the problem list is concern about stigma. The CPRS Problem List is viewable by a wide group of VA employees, including non-mental health personnel. There may be concern among mental health care providers that when non-mental health staff members see certain diagnoses on the problem list (e.g., personality disorders) this may intentionally or unintentionally bias the staff against the patient. There may be concern that the patient will be labeled as "difficult" and that they may be treated in a less therapeutic and empathic manner. Thus in this study, there may have been problems with the internal validity; the integrity of the psychiatric versus non-psychiatric groups was questionable. In this study, the group of individuals with a psychiatric diagnosis may have contained participants that were no longer psychiatrically ill (i.e., no longer met *DSM* criteria). In turn, the participants with no record of a psychiatric disorder may have had an undiagnosed psychiatric illness, or it may not have been placed on the CPRS Problem List. A semi-structured interview would likely have detected current psychiatric conditions. The finding that 27.6% of participants with no psychiatric diagnoses were currently prescribed psychotropic medication supports this assumption.

Second, there are limitations involved in attempting to examine diagnostically pure groups. In additional to comparing patients with and without any psychiatric diagnosis, in this study I attempted to compare patients with only a mood disorder diagnosis (and no other psychiatric disorder) to patients with no psychiatric disorder. Similarity, in this study, I attempted to compare patients with only a SUD diagnosis (and no other psychiatric disorder) to patients with no psychiatric disorder. Trying to distill a clinically heterogeneous group of patients into diagnostically pure subgroups is problematic because (1) there is considerable symptom overlap across psychiatric disorders; (2) psychiatric comorbidity is more common than not; (3) patients with comorbid psychiatric diagnoses are more reflective of the patient population seen in clinical practice. Attempting to isolate psychiatric groups based on singular diagnoses aims to improve internal validity but does so at the expense of external validity. Thus study findings based on diagnostically "pure" groups may have limited generalizability. Notably, when patients with comorbid conditions were included in analyses, results were still nonsignificant. However, the limitations regarding reliability of diagnoses still apply.

Lack of information on the severity of psychiatric illness is another limitation of this study. Past research assessed psychiatric symptoms using popular standardized measures of mood and anxiety symptoms, such as the BDI, BAI, CES-D, and GDS. However, psychiatric diagnosis was rarely assessed. While the presence of specific symptoms is important in diagnostic assessment, symptoms alone are insufficient to diagnose a psychiatric disorder. There must also be evidence of functional impairment related to the psychiatric symptoms. In the current study, symptom severity was not assessed due to limitations of the study's design. It is unclear whether the psychiatric group may have been heterogeneous in terms of symptom severity. Also, the degree of social and occupational functioning impairment is unclear due to limitations in this study's design. That participants were receiving inpatient services suggests current functional impairment. However etiology may have been physically rather than psychiatrically determined. Patients were admitted to physical rehabilitation units after all, and no measures of pre-admission functional status were available.

Another limitation is that in this study, I examined functional outcomes using the mobility and locomotion subscales of the FIM because full FIM scores were unavailable. Past research has used the full FIM or other psychometrically sound measures such as the BI. While

FIM subscales have been used in prior research on rehabilitation functional outcome (e.g., Arinzon et al., 2010; Lin et al., 2009; Kirk-Sanchez & Roach, 2001), there are limitations to using truncated measures. From a psychometric standpoint, the range of possible scores is reduced; the full FIM has a range of 108 points, while the M+L FIM was a range of 36. Other factors being equal, significant results are less likely to be found when range of possible scores if reduced. Moreover, the magnitude of results would be reduced with restricted range of possible responses. Also, from a conceptual standpoint, focusing solely on the mobility and locomotion subscales of the FIM ignores other important areas of functioning that are measured by the FIM, such as the cognitive and other motor domains (e.g., self-care, communication, social cognition). Assessing solely mobility and locomotion may fail to capture how psychiatric disorders influence functional independence, which is a multifaceted construct. Perhaps FIM domains are differentially affected by psychiatric disorders, resulting in significant results when the full FIM is used as an outcome measure. The BI also evaluates multiple aspects of functional independence (e.g., self-care abilities and mobility), with scores ranging from 0 to 100. Thus, there are both psychometric and conceptual reasons why results from the current study failed to reach statistical and clinical significance.

An additional limitation of this study was the use of the percentage of goals attained at discharge as a dependent variable. A problem with the Goals Attained variable is that it is an unstandardized measure. One participant may have five goals, another may have nine. Moreover, goals are individualized; while participants may achieve anywhere from 0% to 100% of their goals, the goals themselves may be markedly different between patients. This is particularly relevant in patient A who is confined to a wheelchair, whose goals focus on transfer from bed to wheelchair, and patient B who is able to ambulate and whose goals focus on stair climbing. The difficulty of these and other goal-related activities are not necessarily equivalent. This variable was selected for this study because of its potential clinical utility; the rate at which PT patients meet their goals is an index of their functional ability. However, this variable failed to achieve statistical significance in all statistical analyses. If future research seeks to examine the attainment of goals as a dependent variable, researchers should examine specific goals across participants (e.g., sit to stand, flat surface walking, stair climbing).

Consistent with prior research, treatment intensity was significantly associated with functional outcome. This relationship reached statistical significance for multivariate analyses including Psychiatric Status and Mood Disorder Status as the independent variable, as well as the majority of univariate analyses examining Discharge M+L FIM and Percent Goals independently. However, PT Session Frequency effect sizes were minimal ($\eta_p^2 < .05$). Even so, results from this study indicate that PT treatment intensity plays a larger role in functional outcome compared to psychiatric diagnosis.

Although results from this study were not statistically significant, providers should not conclude that psychiatric illness has no relationship with functional outcome in PT. Prior research suggests that greater psychiatric symptoms and select psychiatric diagnoses are associated with poorer functional outcome at discharge. While the current study had a sufficient sample size, there were limitations which hindered the probability of finding significant results. For PT patients suspected of having a psychiatric disorder, providers are strongly encouraged to refer these patients to psychology or psychiatry for a formal evaluation and treatment when indicated. Although not a focus of this study, adequate treatment of psychiatric symptoms may play a moderating role in functional outcome among the psychiatrically ill. Future research should carefully evaluate psychiatric status using scientifically rigorous methods, rather than relying on the CPRS Problem List. A prospective study using a semi-structured clinical interview such as the *SCID* is one such option. Also, future research should examine psychiatric symptom severity among the psychiatrically ill while taking into account degree of social and occupational functioning. Standardized measures of psychiatric symptom severity and participation in instrumental activities of daily living are recommended. Further, researchers are encouraged to use measures of functional impairment with adequate psychometric properties, and which take into account the multiple domains that comprise the construct of functional independence.

Finally, other treatment-related variables and their impact on functional outcome in PT are worth exploring. Therapeutic alliance is one such example, and is a construct that has been widely researched in the psychotherapy literature. Bordin (1979) defined the three components of alliance as (1) the therapist-patient agreement on treatment goals, (2) the therapist-patient agreement on interventions, and (3) the affective bond between patient and therapist. Psychotherapy research has shown that therapeutic alliance is associated with important psychological treatment outcomes, with effect sizes in the moderate range (e.g., Horvath, 2001; Martin, Garske, & Davis, 2000). Similarly, in medicine, the provider-patient relationship is viewed as vital to cooperation and treatment adherence (Bultman & Svarstad, 2000; Christensen, 2004; Noble, 1998).

Research has recently begun examining the role of alliance in physical rehabilitation outcomes. Hall, Ferreira, Maher, Latimer, and Ferreira (2010) conducted a systematic review of the literature of in physical rehabilitation on the relationship between alliance and outcomes. Patient populations included those with diagnoses of brain injury, cardiac conditions, musculoskeletal conditions, and multiple pathologies such as systemic diseases, trauma, and post-operative conditions. Patients underwent treatment by physical therapists for various time frames (range 4 to 16 weeks). Outcome measures varied, but included for example disability status, functional status, treatment adherence, and treatment attendance. Results indicated that alliance was associated with better functional outcomes. Effect sizes ranged widely (*r*s -.06 to .83), but most were statistically significant and small-to-moderate in magnitude. Among patients with musculoskeletal conditions in particular, alliance was positively associated with improved physical functioning, reduced pain, and better general health status.

Treatment adherence is another variable the future research should explore. Nonadherence is common in medical treatment in general (Christensen, 2004; DiMatteo, 2004;

Meyers & Midence, 1998; Sackett & Snow, 1979), and in PT as well (Campbell et al., 2001; Sluijs et al., 1998). Meichenbaum and Turk, (1987) defined adherence to medical treatment as the active, voluntary, and collaborative involvement between provider and patient in a mutually acceptable course of behavior to produce a desired therapeutic result. Nonadherence takes various forms, such as failing to keep appointments, refusing specific treatment interventions (e.g., medication, surgery) against medical advice, insisting on discharge against medical advice, failing to complete prescribed treatment regimens, failing to reduce or eliminate proscribed behavior (Meichenbaum & Turk, 1987). Research has also shown that psychiatric disorders (e.g., depression) predict nonadherence to medical treatment (DiMatteo, Lepper, & Croghan, 2000). In the current study, treatment was generally well attended, and most patients completed treatment upon meeting or plateauing on their treatment goals. That patients were admitted to the hospital as inpatients, with nurses available to bring patients to and from their therapies, likely led to the observed high rates of treatment attendance compared to PT patients receiving outpatient treatment. However, this study's design did not permit examination of patients' adherence to in-session interventions and between-session prescribed treatment regimens. Future research should look further into the roles of alliance, adherence, and psychiatric diagnosis and symptoms and their roles in functional outcome in PT. A prospective design, with standardized and psychometrically sound measures of these constructs is encouraged given the limitations noted with the retrospective design employed in the current study.

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