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COMPARING LEVELS OF SUPERVISION ACROSS OCCUPATIONAL THERAPY INTAKE AND DISCHARGE FOR INDIVIDUALS RECEIVING POST-ACUTE TRAUMATIC BRAIN INJURY REHABILITATION

By

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Dedication

To William Hunter, a TBI survivor who represents unconditional love, forgiveness, hard work and dedication in the highest order. You're friendship will always be cherished.

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Abstract

In response to limited outcome-based research, this study aimed to determine how levels of supervision across OT intake and discharge for individuals receiving post-acute traumatic brain injury (TBI) rehabilitation compare to various participant demographic factors and OT treatment protocols. A retrospective pre-post research design and convenience sampling was utilized for observing quantitative data obtained from Origami Brain Injury Rehabilitation Center located in Mason, MI. Forty-two participants met inclusion criteria for various demographic factors and OT treatment protocols (explanatory variables). SPSS statistical analyses were performed using Fisher's exact test for comparing levels of supervision (ordinal response variable) to dichotomous explanatory variables. Results failed to reject all null hypotheses claiming independence between MPAI-4 item-26 for residence score change (response variable mirroring Supervision Rating Scale) across OT intake and discharge for dichotomous explanatory variables. Direction of change was identified via sample statistics. An additional series of independent samples t-tests were performed for extended quantitative outcome data. With the exception of date of injury to admission (DOIA), all independent samples t-test results failed to reject the null hypotheses claiming equal population means between dichotomous explanatory variables for MPAI-4 participation index pre-post standard score differences. Less than three months DOIA and greater than three months DOIA samples produced a two-tailed p-value = 0.000, subsequently rejecting the null hypothesis for equal population means. The principle investigator concluded that additional future research is warranted and that statistical significance did not support the claim that change in levels of supervision depended on specific dichotomous explanatory variable sample representation.

Table of Contents

I. Introduction

This chapter discusses the scope, functional impact, and consequences of traumatic brain injury (TBI). This chapter also reviews the prevailing challenges associated with TBI rehabilitation outcome measures. Background information, problem statement, purpose/aims, significance of problem, research question, hypotheses, and key concepts of this study provide an introduction to TBI rehabilitation, outcome measurement tools, and client-centered treatment within the field of occupational therapy (OT).

Background

Traumatic brain injury (TBI) is a form of acquired brain injury (ABI) occurring when an individual suffers a blow or penetrating force to the head that disrupts regular brain functioning (Centers for Disease Control and Prevention [CDC], 2012). TBI is categorized as either mild, moderate, or severe by the Glasgow Coma Scale (GCS) upon initial medical assessment. The GCS uses eye response, visual response, and motor response tests to rate levels of consciousness within a 15-point scale, with 1 identified as most severe and 15 identified as least severe ("Glasgow Coma Scale," 2013). Mild TBI (mTBI), also known as concussion (GCS 13-15), affects normal brain function and is usually non-life threatening. Characteristics of mTBI include difficulty thinking and remembering, headaches and nausea, mood instability, and problems sleeping (CDC, 2012). Moderate TBI (GCS 9-12) to severe TBI (GCS 3-8) stem from non-fatal trauma resulting in a period of unconsciousness or amnesia following injury. Common symptoms of moderate to severe TBI include increased difficulties with cognitive, motor, sensory, and emotional functioning (CDC, 2012).

An estimated 1.7 million people in the United States experience a TBI each year, 75% of which are classified as mild and 52,000 of which result in fatality. Fatalities from TBI contribute

to approximately one third (30.5%) of all injury-related deaths. Direct and indirect medical costs resulting from TBI totaled an estimated $76.5 billion in the United States in 2000 (CDC, 2013). Advances in medical care have led to increased TBI survival rates resulting in subsequent functional performance deficits across basic activities of daily living (BADLs), instrumental activities of daily living (IADLs), employment, education, leisure activities, socialization, and relationships with family and friends (AOTA, 2008). As a result of clinical expertise within these functional performance areas, OT is an essential element across the rehabilitation process for promoting individual independence within everyday activities needed for survival, health, and quality of life.

Levels of functional independence are primary treatment goals of TBI rehabilitation and therefore represent outcome measures for individual success across the rehabilitation process (Legg et al., 2007). Occupational therapy facilitates higher levels of functional independence across acute care and post-acute brain injury rehabilitation settings. As a means of achieving this, OTs design and implement a wide range of purposeful, client-centered, occupation-based interventions guided by essential information obtained from clinical measurement tools.

One clinical outcome measurement tool used by OTs and other rehabilitation professionals is the Mayo Portland Adaptability Inventory-4 (MPAI-4), a nationally recognized, comprehensive, valid and reliable measure of global functioning for acquired brain injury across post-acute brain injury rehabilitation settings. The MPAI-4 specifically measures individual functioning according to the following indices: Ability, adjustment, and participation. Each index consists of multiple physical and/or psychosocial performance items scored in accordance with tiered ratings that represent levels of function. In short, the sum of MPAI-4 index performance items give rise to index scores, which subsequently give rise to a total score for

determination of global client functioning. As a result, identifying and interpreting MPAI-4 scores serve as a valuable outcome measure for guiding rehabilitation planning, clinical interventions, and community integration for individuals experiencing functional deficits associated with ABI.

MPAI-4 administration and scoring is designed for professional staff, individuals with ABI, and/or their significant others. Research by Zgalijardic, Yancy, Temple, Watford, & Miller (2011) demonstrated satisfactory internal consistency for MPAI-4 scores regardless of rating source. Furthermore, Malec, Kean, Altman, and Swick (2012) identified solid construct validity and internal consistency for individuals with ABI.

Review of the current research literature solely results in articles utilizing MPAI-4 total scores and/or index scores to analyze and compare TBI functional outcomes for client demographic factors and treatment variables, such as date of injury to admission (DOIA), TBI severity, comprehensive day treatment (CDT) program participation, care pathways, therapy duration and intensity, client awareness of deficits, and various client demographic factors (i.e. age, education, vocation, marital status, etc.) (Elcher, Murphy, Murphy, Malec, 2012). Thus, the global impact of client and/or treatment variables on TBI functional outcomes is commonly understood when reviewing and interpreting the research literature. However, limited studies specifically assess how levels of supervision compare across OT intake and discharge via interpretation of MPAI-4 item scores. Furthermore, limited MPAI-4 outcome studies have assessed the impact of OT treatment protocols utilizing occupation-based treatment methods. Analyzing and comparing levels of supervision across OT intake and discharge, as opposed to interdisciplinary post-acute brain injury rehabilitation intake and discharge, would provide valuable evidenced-based information regarding best practice trends specific to occupational

therapy practitioners. As a result, occupational therapists would be equipped with valuable pre-intervention information facilitating client-centered rehabilitation planning and optimal discharge outcomes.

Problem Statement

Limited quantitative data exists within the rehabilitation research literature for comparing levels of supervision across OT intake and discharge for individuals with mild to severe TBI receiving post-acute brain injury rehabilitation.

Purpose/Aims

The purpose of this study was to investigate how levels of supervision compare across OT intake and discharge for clients with mild to severe TBI receiving post-acute brain injury rehabilitation. Levels of supervision were determined by MPAI-4 item-26 for residence (mirroring the Supervision Rating Scale) located within the MPAI-4 participation index and subsequently compared to client demographic factors and OT treatment protocols. For additional investigative purposes, quantitative MPAI-4 participation index scores were assessed in relation to client demographic factors and briefly compared to past research addressing this area of outcome measurement. This allowed thorough clinical interpretation of various treatment variables influencing changes in levels of supervision across the OT process.

Selected study participants included clients who were discharged from outpatient post-acute traumatic brain injury rehabilitation services at Origami Brain Injury Rehabilitation Center (Origami) located near Lansing, Michigan. Participant data was obtained retrospectively and subsequently analyzed for changes in levels of supervision across OT intake and discharge. Further analysis of various treatment variables outlined above sought valuable client-centered therapy trends impacting TBI rehabilitation outcomes.

Significance of Problem

TBI's functional impact on cognitive, emotional, social, BADL, and IADL skills across the rehabilitation process is clearly understood within the medical community (Vitaz, Jenks, Raque, & Shields, 2003). However, little is known, researched, and documented for how levels of supervision compare across OT intake and discharge for individuals with mild to severe TBI receiving post-acute brain injury rehabilitation. This is especially evident for assessing levels of supervision associated with specific client demographic factors and OT treatment protocols. Given the importance of OT's role in maximizing client levels of functional performance and facilitating independent discharge status, practitioners may benefit from additional TBI outcome measures observing trends across the OT process.

Research Question

1. For individuals receiving post-acute brain injury rehabilitation for mild to severe TBI, how do levels of supervision (determined by item-26 for residence within the MPAI-4 participation index) compare across OT intake and discharge?

Hypotheses for levels of supervision. **N**ull and alternative hypotheses are listed below for comparing levels of supervision (response variable represented by MPAI-4 item-26 for residence) to client demographic factors and OT treatment protocols (explanatory variables).

Age range null hypothesis. Change in MPAI-4 item-26 for Residence score across OT intake/discharge is independent to whether or not someone represents a younger or older age group.

Age range alternative hypothesis. Change in MPAI-4 item-26 for Residence score across OT intake/discharge depends on whether or not someone represents a younger or older age group.

Injury source null hypothesis. Change in MPAI-4 item-26 for Residence score across OT intake/discharge is independent to whether or not someone represents a motor vehicle accident injury source or a non-motor vehicle accident injury source.

Injury source alternative hypothesis. Change in MPAI-4 item-26 for Residence score across OT intake/discharge depends on whether or not someone represents a motor vehicle accident injury source or a non-motor vehicle accident injury source.

Marital status null hypothesis. Change in MPAI-4 Item-26 for Residence score across OT intake/discharge is independent to whether or not someone is married or not married.

Martial status alternative hypothesis. Change in MPAI-4 Item-26 for Residence score across OT intake/discharge depends on whether or not someone is married or not married.

Gender null hypothesis. Change in MPAI-4 Item-26 for Residence score across OT intake/discharge is independent to whether or not someone is male or female.

Gender alternative hypothesis. Change in MPAI-4 Item-26 for Residence score across OT intake/discharge depends on whether or not someone is male or female.

Date of injury to admission (DOIA) null hypothesis. Change in MPAI-4 Item-26 for Residence score across OT intake/discharge is independent to whether or not someone entered OT treatment less than 3 months from the date of injury or more than 3 months from the date of injury.

Date of injury to admission (DOIA) alternative hypothesis. Change in MPAI-4 Item-26 for Residence score across OT intake/discharge depends on whether or not someone entered OT treatment less than 3 months from the date of injury or more than 3 months from the date of injury.

Substance abuse null hypothesis. Change in MPAI-4 Item-26 for Residence score across OT intake/discharge is independent to whether or not someone had a prior history of substance abuse.

Substance abuse alternative hypothesis. Change in MPAI-4 Item-26 for Residence score across OT intake/discharge depends on whether or not someone had a prior history of substance abuse.

Vision therapy null hypothesis. Change in MPAI-4 Item-26 for Residence score across OT intake/discharge is independent to whether or not someone receives vision therapy.

Vision therapy alternative hypothesis. Change in MPAI-4 Item-26 for Residence score across OT intake/discharge depends on whether or not someone receives vision therapy.

Vocational rehabilitation null hypothesis. Change in MPAI-4 Item-26 for Residence score across OT intake/discharge is independent to whether or not someone receives vocational rehabilitation.

Vocational rehabilitation null hypothesis. Change in MPAI-4 Item-26 for Residence score across OT intake/discharge depends on whether or not someone receives vocational rehabilitation.

Additional hypotheses for MPAI-4 participation index. A general null and alternative hypothesis for comparing MPAI-4 participation index pre-post score differences to multiple explanatory variables is listed below. Although this investigation observed levels of supervision across OT intake and discharge, conducting analysis using MPAI-4 participation index pre-post score differences revealed valuable information applicable to future follow-up research investigations.

MPAI-4 participation index null hypothesis. Equal population means exist between independent explanatory variable groups for the MPAI-4 participation index pre-post standard score differences.

MPAI-4 participation index alternative hypothesis. Equal population means do not exist between independent explanatory variable groups for the MPAI-4 participation index pre-post standard score differences.

Key Concepts

Key concepts of this study include the following terms and definitions:

- *Occupational Therapy Practice Framework, Domain and Process, 2nd edition*: Official document of the American Occupational Therapy Association (AOTA) serving as a common language for guiding OT practice and articulating OT's role in supporting health and participation through engagement in occupation (American Occupational Therapy Association [AOTA], 2008).
- Occupation: According to Crepeau, Cohn, and Schell (2003), "Daily activities that reflect cultural values, provide structure to living, and meaning to individuals; these activities meet human needs for self-care, enjoyment, and participation in society (as cited in the American Occupational Therapy Association [AOTA], 2008, pp. 628-629).
- Participation: "Engagement in desired occupations in ways that are personally satisfying and congruent with expectations within the culture" (American Occupational Therapy Association [AOTA], 2008, p. 662).
- Basic activities of daily living (BADLs): According to Christiansen and Hammecker (2001), "Activities that are fundamental to living in a social world; they enable basic

survival and wellbeing" (As cited in American Occupational Therapy Association [AOTA], 2008, p. 631).

- Instrumental activities of daily living (IADLs): "Activities that support daily life within the home and community that often require more complex interactions than self-care used in ADL" (American Occupational Therapy Association [AOTA], 2008, p. 631).
- Performance skills: "Abilities clients demonstrate in the actions they perform" (American Occupational Therapy Association [AOTA], 2008, p. 639).
- Client-centered approach: "What the client wants and needs to do in the present and future as well as past experiences and interests that may assist in identifying strengths and limitations" (American Occupational Therapy Association [AOTA], 2008, p. 649).
- Intervention: "The process and skilled actions taken by occupational therapy practitioners in collaboration with the client to facilitate engagement in occupation related to health and participation. The intervention process includes the plan, implementation, and review" (American Occupational Therapy Association [AOTA], 2008, pp. 671-672).
- Assessment: "Tools designed to observe, measure, and inquire about factors that support or hinder occupational performance" (American Occupational Therapy Association [AOTA], 2008, p. 649).
- Mayo-Portland Adaptability Inventory-4 (MPAI-4): "To assist in the clinical evaluation of people during the post-acute (post-hospital) period following acquired brain injury (ABI), and to assist in the evaluation of rehabilitation programs designed to serve these people" (Malec, 2005).

- MPAI-4 Participation Index: "The brief 8-item Participation Index may serve as a particularly useful measure of the final common aim – societal participation – of rehabilitation or other intervention efforts" (Malec, 2005).
- MPAI-4 Participation Index Item-26 for Residence: "Responsibilities of independent living and homemaking (such as, meal preparation, home repairs and maintenance, personal health maintenance beyond basic hygiene including medication management) but not including managing money" (Malec, 2005).
- Supervision Rating Scale (SRS): "The SRS rates level of supervision on a 13-point ordinal scale that can optionally be grouped into five ranked categories (independent, overnight supervision, part-time supervision, full-time indirect supervision, and full-time direct supervision)" (Boake, 2001).
- Precipitously discharged: "Any discharge that allowed less than 1 week of preparation time before discharge or was unanticipated" (Altman, Swick, Parrot, & Malec, 2010).

Summary

The purpose of this study is to contribute valuable quantitative data to the OT research literature by retrospectively comparing levels of supervision across OT intake and discharge for clients receiving post-acute brain injury rehabilitation for mild to severe TBI at Origami Brain Injury Rehabilitation Center located near Lansing, MI. MPAI-4 item-26 for residence score (response variable mirroring the SRS) within the MPAI-4 participation index was identified across OT intake and discharge and subsequently compared with client demographic factors and OT treatment protocols (explanatory variables). As a result, client-centered rehabilitation trends were observed within this study and hold potential for enhancing collaboration, information

exchange, and determination of best practice outcomes within occupational therapy treatment of mild to severe TBI.

II. Literature Review

Incidence and Prevalence

Traumatic brain injury (TBI) is a significant public health challenge affecting approximately 1.7 million individuals annually and resulting in medical costs exceeding $76 billion in the United States each year. Thus, TBI poses significant individual and societal health care challenges demanding continued attention and resources within the medical community (Center for Disease Control and Prevention [CDC], 2013).

Severity, Symptoms, and Functional Limitations

TBI is a form of acquired brain injury (ABI) occurring when closed and/or penetrating head trauma damages brain tissue and results in altered brain functioning. Closed TBI is distinguished by violent head trauma in the absence of skull fracture. Penetrating TBI results when an object penetrates the skull and damages brain tissue. TBI location can be either focal, damaging one area of the brain, or diffuse, damaging multiple areas of the brain (National Institute of Neurological Disorders and Stoke [NINDS], 2002).

Functional outcome following TBI depends on severity and location of injury and presents mild, moderate, to severe symptoms. An individual experiencing mild TBI, also known as a concussion, may exhibit brief loss of consciousness, become dazed, and/or experience uncharacteristic feelings for several weeks following injury. Mild TBI symptoms may also include headache, confusion, lightheadedness, dizziness, blurred vision, ringing in the ears, bad taste in mouth, fatigue, changes in sleep patterns, changes in behavior or moods, and trouble with memory, concentration, attention, or thinking (NINDS, 2002). Individuals experiencing moderate to severe TBI exhibit mild TBI symptoms in addition to more severe cognitive and behavioral deficits, repeated and worsening of headaches, repeated vomiting or nausea,

convulsions or seizures, inability to wake from sleep, dilation of one or both pupils, slurred speech, weakness or numbness in extremities, loss of coordination, increased confusion, restlessness, or agitation (NINDS, 2002).

TBI severity is classified by the Glasgow Coma Scale (GCS), a 15-point standardized test of patient consciousness and neurological functioning completed by medical professionals at the site of the injury and/or upon admission to an emergency department. Intensive care units (ICU) may also implement the GCS as a means of monitoring patient status. Combined GCS scores for eye opening, best verbal response, and best motor response yield outcomes representing overall patient condition. GCS scores between 3 to 8 signify severe TBI, 9 to 12 signify moderate TBI, and 13 to 15 signify mild TBI ("Glasgow Coma Scale", 2013). Additionally, five abnormal states of consciousness may result from TBI, which include stupor, coma, persistent vegetative state, locked-in syndrome, and brain death. During a stupor state of consciousness, an individual can be aroused for only a brief period following a strong stimulus. Coma is a state of complete unconsciousness without eye opening. Vegetative state results in unconsciousness with occasional periods of alertness and/or eye opening in addition to reflex responses. Persistent vegetative state results when an individual does not progress beyond a vegetative state within 30 days and locked-in state occurs when an individual is unable to move or communicate despite being aware and awake (NINDS, 2002).

Functional limitations resulting from TBI are significant and pervasive within the areas of cognition, sensory processing, gross and fine motor control, communication, behavior, and mental health. Cognitive deficits for executive functioning, such as planning, organizing, abstract reasoning, problem solving, and making judgments are much more exacerbated for moderate to severe TBI, although individuals experiencing a history of multiple mild TBIs may

also experience significant cognitive deficits (NINDS, 2002). For individuals experiencing severe TBI, memory is the most commonly experienced cognitive deficit. Sensory processing deficits for vision and visual processing are also commonly experienced functional limitations. Thus, TBI frequently results in significant and global functional limitations spanning the areas of cognition, sensory processing, gross and fine motor control, communication, behavior, and mental health, all of which may pose significant consequences for the individual, family, and society (NINDS, 2002).

Treatment Settings

Immediate medical treatment following TBI is critical to individual recovery. Medical treatment and care pathways frequently proceed in sequence from acute, sub-acute, and post-acute rehabilitation. Individuals experiencing moderate to severe TBI often receive acute medical treatment within an intensive care unit (ICU) followed by transfer to a sub-acute department upon medical stabilization (NINDS, 2002). Next, post-acute care pathways emphasizing comprehensive rehabilitation service delivery, such as outpatient rehabilitation, independent comprehensive rehabilitation day programs, and supportive living centers are provided as a means of facilitating maximal independence for individuals experiencing moderate to severe TBI. Within independent comprehensive rehabilitation programs, physical medicine, psychology and psychiatry, social work, treatment coordination, physical therapy, speech-language therapy, and occupational therapy services are frequently incorporated (NINDS, 2002).

Need for OT

Occupational therapy's professional domain is best described as, "supporting health and participation in life through engagement in occupation" (American Occupational Therapy Association [AOTA], p. 626, 2008). Thus, OT plays an evident and highly needed role across

the TBI rehabilitation process beginning in acute care and continuing through post-acute brain injury rehabilitation to community integration. Furthermore, OT's ability to create and target holistic, client-centered therapy goals facilitating maximal independence and engagement in meaningful occupation additionally promotes health and wellbeing across the lifespan (AOTA, 2008). Legg et al. (2007) further supports this notion by demonstrating how levels of independence are a significant component of TBI rehabilitation success. As a result, OT is an essential medical service facilitating maximal functional independence across the TBI rehabilitation process.

OT Application, Evaluation, and TBI Functional Outcomes

Occupation. Occupational therapists utilize the term *occupation* to describe everyday tasks and activities that comprise individual participation within simple to complex daily routines. Therefore, *occupation* and *activity* are often used interchangeably among OT practitioners. Occupational participation of simple to complex skill demand is experienced independently or with others across a variety of environmental contexts. Thus, as a result occupation's embedded nature within every facet of daily life, OT's understand and emphasize the importance of individual engagement in daily occupation as a means of promoting health and wellbeing across the lifespan.

OT application. The American Occupational Therapy Association's Model Practice Act (2011) definition of occupational therapy states, "occupational therapy addresses the physical, cognitive, psychosocial, sensory-perceptual, and other aspects of performance in a variety of contexts and environments to support engagement in occupations that affect physical and mental health, well-being, and quality of life." Moreover, occupation-based interventions within the rehabilitation process, as a means of promoting optimal functional performance and participation

within simple to complex daily occupations, is a unique and dynamic aspect of OT's practice domain (AOTA, 2008). Therefore, as a result of OT's ability to integrate holistic, dynamic, functional, and occupation-based treatment approaches across rehabilitation settings for an array of medical conditions, comparing levels of supervision across OT intake and discharge for individuals receiving post-acute brain injury rehabilitation services within this research investigation provided a highly unique and beneficial perspective for potentially advancing client-center therapy and best practices.

OT's holistic rehabilitation approach and practice domain emphasizes functional remediation and/or accommodation within the occupational areas of basic activities of daily living (BADLs), instrumental activities of daily living (IADLs), work, education, leisure and play activities, rest and sleep, and social participation with friends, family, and in the community (AOTA, 2008). BADLs consist of essential self-care skills such as bathing, showering, bowel and bladder management, dressing, eating, feeding, functional mobility, personal device care, personal hygiene and grooming, sexual activity, and toilet hygiene. IADLs signify more complex skills that support independent functioning at home and in the community. IADL examples include caring and supervising others, caring for pets, child rearing, communication management, community mobility, financial management, health management and maintenance, home establishment and management, meal preparation and cleanup, religious observance, safety and emergency maintenance, and shopping. For work, education, leisure and play, rest and sleep, and social participation, OT emphasizes preparation, quality of participation, and exploration (AOTA, 2008). Therefore, OT's holistic domain and diverse occupational practice areas encompass and overlap with significant functional deficits resulting from mild to severe TBI.

Additional aspects of OT's practice domain include individual client factors, performance skills, performance patterns, context and environmental characteristics, and activity demands. Individual client factors targeted within OT include body structures and functions, values, beliefs, and spirituality. According to the *International Classification of Functioning, Disability, and Health* proposed by the World Health Organization (WHO) within the *Occupational Therapy Practice Framework-II* (OTPF-II), body structures consist of the anatomical parts of the body and body functions are the physiologic functions of body systems. Several key body functions include specific and global mental health functions, sensory functions and pain, neuromusculoskeletal and movement-related functions (AOTA, 2008).

Performance skills targeted within OT are essential for individual performance and include motor and praxis, sensory-perceptual, emotional regulation, cognitive, communication and social skills, in addition to performance patterns of behavior, which include habits, routines, rituals, and roles. Contextual and environmental factors identified within the OTPF-II include cultural, personal, temporal, virtual, physical, and social realms, all of which can additionally impact functional performance. Thus, through the process of addressing psychological, emotional, behavioral, physical, sensory, and environmental aspects of simple to complex functional performance skills, OT's practice domain and holistic treatment approaches incorporating client-centered, occupation-based interventions is highly applicable to TBI recovery across the post-acute brain injury rehabilitation setting (OTPF, 2008).

TBI evaluation. The OTPF-II (2008) states, "supporting health and participation in life through engagement in occupation is the broad, overarching outcome of the occupational therapy intervention process" (p. 660). Therefore, OT's ability to accurately assess and evaluate individual changes across the post-acute brain injury rehabilitation process is critical to

identifying individual levels of functional independence and participation. OT professionals may use a variety of evaluation and assessment tools as a means of achieving accurate outcome measures across the TBI rehabilitation process. Evaluation tools may include, but are not limited to, direct and/or indirect interviews with the client or their significant other, observation of performance and context, medical record review, and direct assessment of specific characteristics of performance (AOTA, 2008). It is important to note that selection and implementation of chosen outcome measurement tools must appropriately address specific client needs, conditions, and service setting needs (AOTA, 2008). Furthermore, outcome measurement tools must be valid, reliable, and sensitive. Effectiveness is also be based on the tool's ability to facilitate prediction of future outcomes, compare progression of goal achievement, and provide insight into rehabilitation planning and future therapy interventions (AOTA, 2008).

TBI evaluation tools. Funded by the National Institute on Disability and Rehabilitation (NIDRR), The Center for Outcome Measurement in Brain Injury's (COMBI) collaboration between 16 brain injury facilities has contributed information on more than 25 brain injury measures (COMBI, 2012). Several examples include, but are not limited to, the Community Integration Questionnaire (CIQ), Disability Rating Scale (DRS), Functional Independence Measure (FIM), Independent Living Scale (ILS), Mayo-Portland Adaptability Inventory-4 (MPAI-4), the Patient Competency Rating Scale (PCRS), Goal Attainment Scaling (GAS), and Supervision Rating Scale (SRS) (COMBI, 2012). Each assessment aims to identify specific and/or comprehensive brain injury outcomes, and vary according to frequency of use, validity, and reliability. Also, assessment tools fluctuate in regards to targeted and/or comprehensive areas of provided measurement. Of the more than 25 brain injury measures presented by the

COMBI, the MPAI-4 is an example of a comprehensive evaluation tool for measuring client functioning in post-acute ABI (COMBI, 2012).

Mayo-Portland Adaptability Inventory-4 (MPAI-4). The Mayo-Portland Adaptability Inventory-4 (MPAI-4) is a comprehensive outcome measure designed to provide post-acute clinical evaluation and rehabilitation planning for individuals experiencing ABI. The MPAI-4 has undergone four successive revisions, with the most recent revision representing ICF domains for body structure, body function, activity, and participation. The MPAI-4 includes three indices for the areas of ability, adjustment, and participation. Each index is comprised of unique functional performance items representing various abilities associated with ABI status independent of other rehabilitation factors. In addition to ability, adjustment, and participation indices, an additional section includes six items for pre-existing and associated conditions and is not included within the MPAI-4 total score. The three MPAI-4 indices can be administered and scored independently and/or together to create an individual and a combined MPAI-4 total score. Independent administration and scoring of the 8-item participation index can provide quick evaluation and insight into social participation and community integration, primary goals of TBI rehabilitation (Malec, 2005). Furthermore, specific items within each index can be individually assessed and provide quick insight into treatment progress for specific functional performance. For instance, MPAI-4 item-26 for residence within the participation index rates levels of client independence and levels of caregiver supervision. Therefore, the MPAI-4 is a valuable and flexible outcome measure providing valuable clinical information across a variety of functional performance skills specific to OT practice.

Twenty-nine items span the MPAI-4 ability, adjustment, and participation indices and are scored on a 5-point rating scale ranging from 0-4. MPAI-4 rating scales are specific to each item

within each index and span the areas of physical, cognitive, emotional and behavioral, participation, and social deficits frequently experienced by individuals with ABI. A rating of 0 represents independence or no interference with activities, 1 represents a mild problem but does not interfere with activities, 2 represents a mild problem that interferes with activities 5-24% of the time, 3 represents a moderate problem that interferes with activities 25-75% of the time, and 4 represents a severe problem that interferes with activities more than 75% of the time.

Raw scores are calculated for each MPAI-4 index and a full-scale score is obtained by summing the raw scores of each index. Full-scale and individual raw scores can be converted to t-scores determined by tables within the MPAI-4 manual. T-scores less than 30 represent relatively good outcomes, 30-40 represents mild limitations, 40-50 represents mild to moderate limitations, 50-60 represents moderate to severe limitations, and t-scores greater than 60 represent severe limitations (Malec, 2005). The MPAI-4 provides worksheets for scoring items within each index. Professional staff, clients experiencing ABI, or their significant others can complete the MPAI-4 item ratings, although a trained professional must complete scoring and interpretation of results (Malec, 2005).

A TBI outcome measurement tool is only useful inasmuch as it demonstrates strong reliability and validity. Kean, Malec, Altman, and Swick (2011) demonstrated that consecutive analyses of the MPAI-4 yielded high construct validity and internal consistency. Furthermore, Zgalijardic, Yancy, Temple, Watford, & Miller (2011) demonstrated satisfactory internal consistency for the MPAI-4 regardless of rating source. Test-retest reliability is reported as excellent for children with ABI, although inter-rater/intra-rater reliability has not been established. Furthermore, research indicators suggest clinical relevance, usability, and psychometric properties for the MPAI-4 (Kean, Malec, Altman, and Swick, 2011). The primary

goal of the MPAI-4 is to provide quick and accurate clinical insight into ABI functional deficits across physical, cognitive, emotional, behavioral, participation, and social abilities (Malec, 2005). As a result, the MPAI-4 is valuable outcome measurement tool used by occupational therapists to identify changes in levels functional independence and participation across intake and discharge within post-acute brain injury rehabilitation facilities.

OT functional outcomes. "Many professions use the process of evaluating, intervening, and targeting intervention outcomes. However, only occupational therapy practitioners focus this process toward the end-goal of supporting health and participation in life through engagement in occupations" (AOTA, 2008, p. 646-647). This is a unique component of OT TBI rehabilitation and represents OT's goal of facilitating remediation, adaptation, and/or accommodation of client functional deficits. Therefore, OT's ability to accurately and efficiently conduct client-centered evaluations while monitoring and predicting therapy progression is an essential component to facilitating more efficient, specialized therapy emphasizing enhanced functional outcomes at discharge.

As a result of the MPAI-4's demonstrated validity and reliability for comprehensive evaluation across a variety of ABI and TBI functional deficits, the MPAI-4 is a solid post-acute brain injury rehabilitation outcome measure across OT intake and discharge. Increased functional performance, independence at discharge, and societal participation are primary goals of TBI rehabilitation. Therefore, the MPAI-4's ability to measure functional performance provides highly pertinent and useful assessment information unique to the scope and domain of OT practice (AOTA, 2008). As a result, the MPAI-4 was specifically chosen as the outcome measurement tool for assessing levels of client supervision across OT intake and discharge for individuals receiving post-acute brain injury rehabilitation at Origami. Origami utilizes the

MPAI-4 as an OT assessment upon intake and discharge evaluation for individuals with mild to severe TBI. Furthermore, Origami provides comprehensive post-acute residential, community-based, outpatient, and post-discharge rehabilitation services to diverse community members and veterans (*Origami Annual Report,* 2011). Therefore, Origami was an excellent resource and community partner for obtaining and comparing MPAI-4 data specific to the research question of this investigation.

Levels of Supervision Across Intake and Discharge

Levels of assistance across OT intake and discharge are determined by MPAI-4 item-29 for residence (mirroring the SRS) within the participation index. Item-29 for residence scores are based on a 5-point rating scale, where 0 represents independent living without assistance, 1 represents living without supervision with concerns about safety or managing responsibilities, 2 represents requiring little assistance or supervision 5-24% of the time, 3 represents requiring moderate assistance and supervision 25-75% of the time, and 4 represents requiring extensive supervision or assistance more than 75% of the time (COMBI, 2012). In addition to levels of supervision, item-29 for residence within the MPAI-4 participation index represents an individual's ability to perform responsibilities of independent living and homemaking with the exclusion of money management (Malec, 2005).

Treatment Variables for BADLs, IADLs, OT Protocols, and Client Demographics

Maximizing functional independence and minimizing the levels of caregiver supervision at discharge is a common aim of OT rehabilitation. Therefore, in addition to identifying levels of supervision across intake and discharge, it is advantageous to identify and recognize changes in BADL and IADL functional performance as potential variables influencing levels of client supervision at discharge. Therefore, this study additionally identified and compared MPAI-4

participation index pre-post standard score differences for client demographic factors and specific OT protocols unique to Origami. Subsequently, this information holds the promise of better equipping occupational therapists and rehabilitation professionals with the necessary information needed to developed more tailored and client-centered treatment protocols (AOTA, 2008). Furthermore, elucidating this information bolsters clinical awareness and potentially aids in facilitating increased client satisfaction, progress, and therapy adherence. What follows is a review of the current research literature assessing TBI and/or ABI outcomes across the rehabilitation process.

TBI Literature Review

Although research investigations assessing MPAI-4 total and/or index scores across the post-acute brain injury rehabilitation settings are available within the published literature, few to no articles exist for specifically demonstrating how levels of supervision compare across OT intake and discharge via assessing MPAI-4 item-26 for residence in relation to client demographic factors and OT treatment protocols. Thus, the following literature review provides a comprehensive overview of research articles demonstrating relevance as close as possible to the aim of this investigation. Emphasis is directed toward TBI outcome measures evaluated by MPAI-4 scores in relation to various treatment variables, although studies using other outcome measurement tools are additionally reviewed. From this detailed review, greater awareness and understanding for the strengths, weaknesses, omissions, and gaps within current research literature are identified, thereby laying the foundation for supporting this study's aim of identifying detail specific knowledge of how changes in levels of supervision across OT intake and discharge compare for client demographic factors and OT treatment protocols. Furthermore,

reliability and trustworthiness of presented research is discussed alongside connections for the need of evidenced-based research to evolve the practicing of occupational therapy.

Research assessing functional changes across TBI rehabilitation via MPAI-4. Malec et al. (1993) assessed outcome evaluation and prediction for 29 individuals with ABI receiving services at the Mayo Brain Injury Outpatient Program, a specialized, post-acute comprehensive day treatment (CDT) center. Client changes in emotional, behavioral, functional, and physical competencies were evaluated across treatment. Social functioning outcomes for independent living and work independence were additionally assessed at discharge and one year follow-up. The Portland Adaptability Inventory (PAI), an earlier version of the MPAI-4, and the GAS were utilized to assess initial and 1-year follow-up results (Malec et al., 1993).

Participant information was acquired from December 1986 to August of 1991 and PAI results suggested mild to moderate ABI for participants. The rehabilitation team included a neuropsychologist, occupational therapist, physical therapist, recreation therapist, speech pathologist, rehabilitation nurse, and social work. Treatment sessions were conducted in a group format with specialized therapy offered in the afternoon (Malec et al., 1993).

Measurements for independent living were categorized into independence with no supervision, 24-hour supervision, or less than 24-hour supervision at admission, program completion, and one-year follow-up. The GAS and various neuropsychological assessments were also administered. Results demonstrated 93% living independently with no supervision at program completion compared to 59% at admission, with p-value < 0.01. Mean PAI total scores declined from 19.3 at initial to 11.9 at program completion, demonstrating less disability with a p-value < 0.001. PAI emotional behavior scores declined with a p-value > 0.05, functional abilities declined with a p-value < 0.001, and physical disabilities declined with a p-value =

0.001. Assessment of client demographic variables demonstrated that time from date of injury to admission (DOIA) in conjunction with initial PAI scores was the most consistent predictors of outcome. Overall conclusion from the research data demonstrated general maintenance and gains within independent living and work (Malec et al., 1993).

Malec et al. (1993) utilized the PAI, an earlier version of the MPAI-4, to compare changes in functional performance outcomes and levels of assistance at program completion. Thus, use of an earlier version of the MPAI-4 alongside a lack of comparing levels of supervision in relation to various treatment variables presented significant limitation within this investigation. Furthermore, although the Mayo Brain Injury Outpatient program indicated occupational therapy as an included mode of specialized treatment, specific OT protocols were not specified and an OT did not solely utilize the PAI for evaluation of rehabilitation changes. Therefore, although a retrospective pre-post research design was implemented, limited outcomes targeted how levels of supervision compare across the rehabilitation process.

Malec (2001) utilized the MPAI-22, a former version of the MPAI-4, for clinical evaluation across rehabilitation and follow-up. Malec (2001) also studied the impact of the Mayo Brain Injury Outpatient Program on social functioning and included a sample of 96 individuals with ABI. Program goals emphasized self-awareness of strengths and weaknesses, coping and compensation skills, personal organization, social skills and effectiveness, emotional and behavioral self-management, participation in social, leisure, and work activities, and health maintenance. MPAI-22, GAS, ILS, and VIS were utilized for outcome data analysis at preadmission and completion of the program. Long-term outcomes for independent living status and vocational independence before, after, and at one-year follow-up were assessed in addition

to demographic variables for age, education, severity of injury, and preadmission MPAI-22 (Malec, 2001).

MPAI-22 preadmission standard scores were compared to program completion standard scores for the last 62 graduates. Paired t-tests demonstrated an average preadmission standard score of 546.3 +/- 57.3. Average standard score upon program completion demonstrated a p-value < 0.0001. Specific changes for individual MPAI-22 item scores were also provided. 69% of participants improved within self-care activities in comparison to 7% worsening. 60% of participants improved within MPAI-22 residence item activities in comparison to 11% worsening. Most salient worsening of symptoms was demonstrated for depression (24%) and irritability (29%). No relationships were identified for the predictors at one-year follow-up, which was represented by a p-value < 0.0001. One-year follow-up demonstrated modestly linear comparison to MPAI-22 preadmission scores and nonlinear comparison to DOIA.

Malec (2001) was also limited by use of an earlier version of the MPAI-4. Additional study limitations resulted from a lack of statistical comparison for levels of supervision for preadmission scores. Although strengths of the study included evaluation of changes across preadmission to discharge and identification of levels of assistance needed at discharge and one-year follow-up, minimal comparisons for levels of assistance were assessed in accordance to various treatment variables.

Altman, Swick, Parrot, and Malec (2010) utilized the MPAI-4 to compare the effectiveness of home and community-based post-acute brain injury rehabilitation (PABIR) for 489 program completers across 7 distinct U.S. cities to those precipitously discharged. Analysis of MPAI-4 ability, adjustment, participation Index scores at 3 and 12 months follow-up demonstrated both statistically significant and positive rehabilitation outcomes for PABIR

program completers when compared to those precipitously discharged. As a result, this study provided valid and targeted research methodology for evaluating changes in levels of MPAI-4 functional performance across the PABIR and post-discharge rehabilitation process (Altman, Swick, Parrot, & Malec, 2010).

Altman, Swick, Parrot, and Malec's (2010) retrospective study was unique from other previously conducted studies utilizing the MPAI-4 and/or previous versions due to assessing treatment outcomes controlling for precipitously discharged post-acute brain injury rehabilitation participants across large U.S. geographic regions. Precipitous discharge designation consisted of any discharge lacking a minimum of one-week preparation prior to leaving and/or an unanticipated rehabilitation leave. The MPAI-4 served as the primary outcome measure at program admission and discharge. No statistically significant differences were identified between the two groups for MPAI-4 admission (p-value = 0.101). However, significant differences were identified at discharge through the use of ANCOVA analysis for MPAI-4 total scores (p-value < 0.001) and all index scores for ability (p-value < 0.001), adaptability (p-value < 0.001), and participation (p-value < 0.001). Length of stay did not account for MPAI-4 variance and MPAI-4 index score differences mirrored differences between the MPAI-4 total score (Altman, Swick, Parrot, & Malec, 2010).

This study demonstrated a solid retrospective design, utilized current MPAI-4 evaluation measures representing functional outcomes across rehabilitation and client treatment variables. However, this article did not provide treatment group comparisons specific MPAI-4 items such as Item-26 for residence. Other study limitations include non-random selection of control groups and MPAI-4 participation index scores at follow-up gathered via phone for participants and/or family members as opposed to professional consensus upon admission. Nonetheless, this study's

overall scope and sound research design identifying valuable retrospective rehabilitation outcomes demonstrates the beneficial potential impact of MPAI-4 retrospective comparison studies assessing changes in functional outcomes across specific client and rehabilitation variables (Altman, Swick, Parrot, & Malec, 2010).

Using a similar design, Micklewright, Yutsis, Smigielski, Brown, & Burgquist (2011) studied and compared TBI functional outcome assessment scores within the Mayo Clinic's Comprehensive Day Treatment (CDT) across points of entry to rehabilitation for 54 individuals experiencing TBI. The MPAI-4, Independent Living Scale (ILS), and Vocational Independence Scale (VIS) were utilized to demonstrate functional rehabilitation outcomes. Most salient rehabilitation outcomes were identified across independent living and vocational participation for individuals entering treatment within six months of DOIA. However, individuals entering CDT six or more months of DOIA also experienced favorable rehabilitation gains (Micklewright, Yutsis, Smigielski, Brown, & Burgquist, 2011).

Chi-square analyses of MPAI-4 index scores were used for comparison between early versus late point of entry to CDT. Early entry was categorized as 0 to 6 months post injury and late entry was categorized as greater than 6 to 24 months post injury. Results concluded that early entry to CDT demonstrated significantly greater independence at discharge (p-value < 0.02) and one-year follow-up (p-value < 0.03) (Micklewright, Yutsis, Smigielski, Brown, & Burgquist, 2011).

This study demonstrated the impact of DOIA for minimizing functional limitation and maximizing functional independence across a variety of client and treatment variables such as independent living and vocational participation. An emphasis was placed on post-discharge functional improvements and society integration as opposed to changes across intake and

discharge. However, levels of supervision were not compared to client demographic factors and/or OT treatment protocols.

Erez, Rothschild, Katz, Tuchner, and Hartman-Maeir (2009) also investigated the effects of TBI on individual participation with an emphasis on IADLs following post-acute brain injury rehabilitation. The researchers conducted a preliminary study with a small sample of 13 participants experiencing mild TBI and analyzed participation in relation to executive functioning and awareness, two common, often lingering and significant deficits of TBI. Participants were recruited from a neurologist or primary care physician and received outpatient rehabilitation from a general hospital in Southern Israel. Mild TBI was defined according to the American Congress of Rehabilitation Medicine, GCS 13-15, loss of consciousness not exceeding 30 minutes, and posttraumatic amnesia lasting less than 24 hours. Mean participant age was 43.4 years, average time since injury was 4.7 months, average years of education were 14.76, and 85% of the participants were married and living with their spouse at the time of injury. Individuals with prior dementia, neurological or psychiatric disorder, and alcohol or drug abuse were excluded from the study (Erez, Rothschild, Katz, Tuchner, and Hartman-Maeir, 2009).

Executive functioning, awareness, and participation were measured using the Behavioral Assessment of Dysexecutive Syndrome (BADS), the Dysexecutive Questionnaire (DEX), the Self-Awareness Deficits Interview (SADI), and the Participation Index of the MPAI-4. Rule Shift Cards, Zoo Map, and Modified Six Elements subtests were used for the BADS. Inter-rater reliability ranges from 0.88 to 1.00 and concurrent and ecological validity was identified in relation to tests of executive functioning. An experienced OT conducted and collected questionnaires within a 1.5-hour window and construct validity was supported for significant

differences distinguishing individuals with TBI and healthy controls (Erez, Rothschild, Katz, Tuchner, and Hartman-Maeir, 2009).

Across the MPAI-4 participation index, 84.6% reported restrictions with initiation, 76.9% for leisure, 76.9% for residence, 61.5% for employment, and 21.3% for transportation. Aside from money management, no significant correlation was found between BADS and MPAI-4 participation index scores. However, significant high correlation was identified between the self-report DEX and total participation index score (p-value < 0.01) and significant moderate correlation was identified between DEX total score and participation total score (p-value < 0.03) (Erez, Rothschild, Katz, Tuchner, and Hartman-Maeir, 2009). TBI deficits were confirmed with significance for executive functioning and associated impact on participation. However, no correlation was found for self-awareness. Although limited by a small sample size and absence of information measuring depression or emotional disturbance, results confirmed prior studies demonstrating that deficits in execution functioning impact individual participation within IADLs.

The preceding studies assessed TBI rehabilitation outcome measures as they relate to MPAI-4 score ratings. However, much of this data also included ABI as opposed to TBI samples alone. Furthermore, outcomes were limited from evaluation of earlier versions of the MPAI-4 and the evaluation of changes in functional outcomes for comprehensive rehabilitation program and/or client demographic variables, as opposed to directly identifying and comparing levels of supervision via MPAI-4 item-26 for residence for participant demographic variables and/or OT treatment protocols. It is also important to mention that the majority of MPAI-4 research was conducted by the primary developer of the MPAI-4, James F. Malec, Ph.D., L.P. Furthermore, articles presented within this literature review often emphasized functional

outcome changes within the long-term post-discharge and follow-up phase following rehabilitation.

Research assessing functional changes across rehabilitation via other assessments. Heubner, Johnson, Bennett, and Schneck (2003) assessed community participation and quality of life outcomes following TBI and found that statistically significant improvements in FIM scores during rehabilitation were predictive of long-term disability and community participation among participants. Twenty-five individuals experiencing TBI and receiving inpatient rehabilitation between 1996 and 1997 were subsequently included in the study. Eight participants were female and 17 participants were male. Mean age at time of injury equaled 41.99 and 43.79 at time of follow-up (Heubner, Johnson, Bennett, and Schneck, 2003).

Retrospective chart reviews of FIM scores and demographic data were conducted and university researchers initiated phone interviews including self-reported measures of disability, participation, quality of life, and satisfaction with OT. Chart review was specified for GCS injury status, type of injury (closed vs. open head injury), cause of injury, other injury, or any use of alcohol at the time of injury. Admission and discharge FIM scores were also recorded. The Activity Limitations Survey (ALS), Community Integration Questionnaire (CIQ), Quality of Life Rating (QOLR), and OT satisfaction scale adapted from the Client Satisfaction Questionnaire (CSQ) were each used to determine levels of disability at follow-up (Heubner, Johnson, Bennett, and Schneck, 2003).

The ALS consists of a 41-item assessment with “yes” or “no” responses indicating difficulty within the following seven subscales: Motor, sensory and communication, activities of daily living, emotional, cognitive, social behavior, and medical complications. Scores range from 0 to 82 where higher scores suggest greater activity limitation. The CIQ consists of a 15-

item measure yielding scores within home integration, social integration, productivity, and a total score, which ranges from 0 to 29. Higher scores indicate greater community integration. The QOLR is a 20-item self-report measure with a 5-point rating scale indicating higher quality of life with increased score. QOLR subscales include self-esteem and wellbeing, interpersonal attachment, economics, recreation/leisure, and spirituality (Heubner, Johnson, Bennett, and Schneck, 2003).

The researchers found that over 92% of participants lived at a private residence before and after injury and the mean number of activity limitations equaled 13.88, with each individual indicating at least one activity. Most frequent cognitive limitations reported by participants were memory and decision-making. Depression and withdrawal, difficulty reading and learning new tasks, limitations in bowel and bladder control, and using hands to hold objects were also most often reported. The researchers indicated that CIQ scores were informative but did not highlight restrictions in community integration emphasized within OT. On the QOLR, 50% of the 10 items were rated for dissatisfaction. 87% of clients were satisfied with OT and 91.7% indicated that they would recommend OT to a family member or friend. Although this study did not utilize the MPAI-4 as a means of evaluating levels of functional outcomes, the researchers' unique approach more closely assessing the impact of occupational therapy and independent living across the rehabilitation process (Heubner, Johnson, Bennett, and Schneck, 2003).

Similarly, Powell, Temkin, Machamer, & Dikmen (2007) investigated the home management performance of 164 rehabilitation inpatients with moderate to severe TBI in relation to performance 1 year following TBI when compared to performance before TBI. Frequency of activities, difficulty performing activities, degree of help needed from others for activities, and how bothered individuals were by participating in home activities were additionally assessed

alongside factors associated with level of home management performance for individual demographics, injury severity, neuropsychological functioning, and living situation 1 year following TBI (Powell, Temkin, Machamer, & Dikmen, 2007). Study participants included 164 enrollees in the University of Washington TBI Model System (TBIMS) over a three-year period.

The Functional Status Exam (FSE), consisting of the following 10 performance activity area ratings: physical (personal care, ambulation, travel), social (major activity involving work or school, home management, leisure and recreation, social integration, standard of living, financial independence), and psychological (executive functioning), was utilized to gain insight into patients' perspectives on participation in home management activities before and after TBI. The FSE is administered in a 15-20 minute structured interview format to the patient and/or the patient's significant other. The FSE was administered to the patient 87% of the time, to the participant with confirmation of the significant other 5% of the time, to the significant other alone 7% of the time, and primarily to the significant other with confirmation from the patient less than 1% of the time. The FSE was indicated as possessing good test-retest reliability and agreement for assessments answered between persons with TBI and their significant other (Powell, Temkin, Machamer, & Dikmen, 2007).

An emphasis was placed on assessing home management functional outcomes due to functional independence as a primary aim of OT and an overabundance of research evidence restricting discharge outcomes to global functioning. Therefore, TBI outcomes revealing home management performance sought to identify and more fully reveal specific functional independence measures achieved across individual demographics, injury severity, neuropsychological functioning, and living situation (Powell, Temkin, Machamer, & Dikmen, 2007).

Results from the study indicated 41% of participants returned to previous level of functioning 1 year after TBI, while 16% reported returning to previous level of functioning with difficulty. 9% reported stopping some home management activities, 21% reported getting help, and 13% reported dependence on others for all or most home management activities. Most returning to previous level of functioning reached pre-injury levels by 6 months, and for those not returning to previous levels of functioning, 16% were not bothered by it, 37% were mildly bothered, 21% were moderately bothered, and 26% were severely bothered. 1-8% of participants reported starting an activity following TBI and 8-21% reporting stopping an activity. Most frequently discontinued activities included 38% for yard care, 36% for childcare, and 34% for car care. A significant effect was found for age (p-value = 0.001), living situation (p-value = 0.002), and neuropsychological functioning at 1 year (p-value = 0.001). No significant effect was identified for gender (p-value = 0.103), GCS injury severity (p-value = 0.828), time to follow commands (p-value = 0.485), and other systems injuries (p-value = 0.206) (Powell, Temkin, Machamer, & Dikmen, 2007).

Following the results of this study, the researchers emphasized home management activities as a continual problem following TBI, particularly in relation to rehabilitation's emphasis on ADL functional performance and limited therapy duration. Additional emphasis was placed on the importance of assessing pre-injury home management performance for accurate assessment and comparison of TBI home management functioning. Study limitations resulted from FSE outcome data relying upon participant perspectives of functioning as opposed to objective OT and/or professional assessment of actual participation. Furthermore, participant demographics were restricted to those receiving inpatient rehabilitation upon immediate entry to acute care (Powell, Temkin, Machamer, & Dikmen, 2007).

Additional analysis of ABI outcomes for broader brain injury inclusion provides further insight into rehabilitation and client variable impact on functional outcomes. Jette, Warren, & Wirtalla (2005) concluded that higher therapy intensity was associated with shorter length of stay and higher functional improvements when treated within a skilled nursing setting. Thus, rehabilitation specific variables also demonstrate the ability to influence therapy outcomes and subsequently hold potential therapeutic value when determining treatment interventions for individuals with ABI.

Summary

Integration of occupation-based interventions emphasizing client-centered goals for facilitating individual health, wellness, functional independence, and societal participation is a cornerstone of OT practice and rehabilitation. Similarly, OT's ability to clearly identify and predict functional outcome trends and changes within the post-acute brain injury rehabilitation process signifies a valuable component to increasing practitioner awareness and promoting optimal client outcomes. Given overlap between OT's holistic practice domains and significant, widespread functional limitations and consequences resulting from moderate to severe TBI, OT plays a vital role in minimizing disability and maximizing functional independence and societal participation. Therefore, the aim of this research was to compare levels of supervision across OT intake and discharge for individuals receiving post-acute brain injury rehabilitation for mild to severe TBI. Measuring changes in levels of supervision via MPAI-4 item-26 for residence (mirroring the SRS) located within the MPAI-4 participation index allowed additional insight across the OT process.

This chapter provided a comprehensive introduction to TBI characteristics including incidence and prevalence, functional limitations, treatment pathways, clinical outcome

measurement tools, and specific performance skills associated with OT practice and desired functional outcomes. Review of the published research literature provided very limited articles utilizing MPAI-4 scores for only minimal comparison of levels of supervision across OT intake and discharge for specific participant demographic factors and/or OT treatment protocols. Emphasis was given to articles using the MPAI-4 to measure changes across post-acute brain injury rehabilitation outcomes including BADL and IADL areas of occupation, and research comparing MPAI-4 total, index, and item rating scores were additionally incorporated within the literature review. Overall TBI rehabilitation trends were identified in support of post-acute brain injury rehabilitation, although no studies were found in exact congruence and/or correlation with the proposed research question and design of this research investigation. As a result, this study aimed to increase OT practice and rehabilitation profession awareness for specific treatment variables influencing and/or impacting levels of supervision across intake and discharge with the hope of subsequently advancing the development of more specialized treatment protocols facilitating higher levels of independence and minimal levels of supervision required upon discharge.

III. Methods

Description of Study Setting

Origami Brain Injury Rehabilitation Center (Origami) is a nonprofit organization providing post-acute brain injury rehabilitation services for individuals who experience TBI. Located in Mason, MI, Origami utilizes a holistic treatment approach dedicated to maximizing recovery, quality of life, functional independence, and societal participation by meeting the physical, social, emotional, cognitive, and spiritual needs of clients in a natural and family friendly environment. Origami offers a continuum of comprehensive care across residential, community-based, outpatient, and post-discharge program services incorporating an interdisciplinary medical team consisting of the following professionals: physiatrists, rehabilitation neuro-psychiatrists, psychologists, social workers, care coordinators, licensed nurses, occupational therapists, certified occupational therapy assistants, physical therapists, certified therapeutic recreation specialists, dieticians, patient care technicians, living skills staff, art therapists, vocational services specialists, rehabilitation aides, and therapy dogs ("Professional Services", 2013).

Origami is accredited by the Commission on Accreditation of Rehabilitation Facilities (CARF) and also partners with Michigan State University's College of Osteopathic Medicine and Peckham, Inc. Peckham, Inc. is an award winning non-profit organization providing vocational services, training, and employment for individuals with disabilities. Origami is a leader in cutting edge brain injury rehabilitation services within the Greater Lansing Area and has served over 700 individuals since opening in 1997. 169 individuals were served in 2012 (*Origami Annual Report,* 2012). Origami utilizes evidence-based practice and embraces a culture of scholarly development through ongoing research collaborations with Michigan State

University and additional partners. Origami strives to advance treatment options for individuals experiencing brain injury in addition to providing excellent clinical outcomes and cost effective management for consumers ("Why choose Origami?", 2013). Origami's Service Manager and OT staff was approached regarding research collaboration. A letter of support for this community partnership was obtained (see Appendix A).

Study Design and Participant Selection

A retrospective pre-post study design was utilized to compare levels of supervision across OT intake and discharge for individuals with mild to severe TBI receiving rehabilitation services at Origami. Convenience sampling was chosen for sample selection, a technique that eliminated potential disruptions to therapists and/or clients across the rehabilitation process. Thus no direct contact and/or interaction occurred between the lead investigator and Origami clients. Forty-two participants discharged from Origami outpatient services during 2011, 2012, or 2013 were included in the study sample.

Client demographics and population. Of 139 clients served by Origami in 2011, 68% were male and 32% were female. Ages ranged from 17-88 with an average age of 45 years. 70% of Origami admissions were due to motor vehicle accidents (MVA). Time from date of injury to admission (DOIA) for new clients was 48% for < 6 months, 19% for 6-12 months, and 33% for > 1 year (*Origami Annual Report,* 2011).

Of Origami's 169 clients served in 2012, 67% were male and 33 were female. Ages ranged from 16-71 years and greater. 54% of Origami admissions were due to MVA. Time since date of injury to admission for new clients was 29% for <3months, 14% for 3-6 months, 24% for 6-12 months, 23% for 1-5 years, and 10% for 5+ years (*Origami Annual Report,* 2012).

Client demographics for 2013 have not yet been reported by Origami. However, clients discharged prior to October 2013 were included within this research investigation.

Of the Origami convenience sample, 42 participants were dichotomized into either yes or no representation across explanatory variables for injury source, age range, martial status, gender, date of injury to admission (DOIA), substance abuse history, and type of OT services received across cognitive perceptual motor retraining (CPM), traditional OT, vision therapy, and/or vocational rehabilitation.

Inclusion criteria. Inclusion criteria included:

- Origami clients who were discharged from outpatient services across the years of 2011, 2012, or 2013.
- Origami clients 18 years of age or older diagnosed with very mild to severe TBI as determined by Origami's MPAI-4 total index standard score equivalencies.
- Origami clients who received CPM retraining, functional OT, vision therapy, and/or vocational rehabilitation.
- Origami clients who received residential, community-based, and/or outpatient services
- Origami clients who were administered the MPAI-4 participation index at intake and discharge by an Origami occupational therapist.

Exclusion criteria. Exclusion criteria include:

- Origami clients who were under the age of 18.
- Origami clients who were precipitously discharged from therapy.
- Origami clients who received less than 2 therapy services.
- Origami clients previously diagnosed with moderate to severe TBI.

- Origami clients who were not administered the MPAI-4 participation index at intake and discharge by an Origami occupational therapist.

Rationale for inclusion/exclusion. Functional deficits resulting from mild to severe TBI can produce significant limitations requiring greater levels of supervision following injury (Hart, Millis, Novack, Englander, Fiddler-Sheppard, & Bell, 2003). Furthermore, levels of assistance following mild to severe TBI and/or rehabilitation progress may be influenced by specific OT protocols and/or client demographic factors. Therefore, the rationale for choosing the presented inclusion and exclusion criteria is based on the goal of understanding how MPAI-4 item-26 for residence (mirroring the Supervision Rating Scale and responsibilities of independent living) compares across OT intake and discharge within a post-acute brain injury rehabilitation setting. As a result, this study aimed to reveal an increased understanding for how specific participant demographic factors and OT treatment protocol variables influence rehabilitation outcomes, subsequently allowing the creation of more efficient, client-centered, and cost effective rehabilitation approaches.

Assessment Tools

The MPAI-4 is an outcome measure designed to facilitate post-acute clinical evaluation and rehabilitation planning following ABI (See Appendix B). The MPAI-4 consists of ability, adaptability, and participation indices representing a range of physical, cognitive, emotional, behavioral, social, and community integration deficits directly resulting from ABI. An additional section of the MPAI-4 assesses pre-existing and associated conditions. The three MPAI-4 indices each consists of multiple items assessing participant performance for scoring on a 0-4 rating scale. Individual items are totaled, raw scores are determined for each of the three indices, and then a full score is determined by summing the index scores. Full-scale score and

index raw scores can be converted to t-scores according to tables referenced within the MPAI-4 manual. T-scores are then utilized to determine level of functional limitation. The MPAI-4 is a valid and reliable outcome tool with national use and recognition (Malec, 2005).

Origami OT Protocols

Origami's rehabilitation team consists of five OTs that provide either cognitive perceptual motor (CPM) retraining, traditional OT, vision therapy, and/or vocational rehabilitation. CPM retraining is a brain injury treatment approach developed by Madhav Kulkarni, Ph.D., O.T.R., that facilitates remediation of sensory-motor, perceptual-motor, and cognitive functioning following mild to severe brain injury. Origami OTs and Michigan State University's Rehabilitation Medicine Clinic utilize CPM retraining as a means of remediating functional deficits associated with TBI ("Outcomes & Research", 2013).

MPAI-4 policies and procedures. Upon Origami intake, clients receive an initial OT evaluation and may also receive CPM evaluation. A determination is then made for clients to either receive a more traditional functional-based OT protocol, a CPM retraining protocol, or both protocols according to need. Following the completion of an OT evaluation, prior to implementation of OT intervention and within 4 weeks of admission to Origami, clients are administered the MPAI-4 ability, adjustment, and participation indices by a professional member of the Origami therapy team. The MPAI-4 is successively administered on an annual basis, upon transition of treatment programs, transition to a single service provider, and upon rehabilitation discharge. Although not an administration requirement, MPAI-4 scores for intake and discharge included within this research investigation were only administered by Origami OTs as a means of ensuring internal consistency across item scores.

Data Collection and Management

Principle investigator, Joseph G. Grubaugh, received a sample data set spreadsheet that was accessed, collected, and de-identified by Origami Service Manager, Tom Judd, as a means of upholding strict client confidentiality and HIPPA requirements. For precautionary measures, the principle investigator signed and completed HIPPA documentation in addition to completing training required by all Origami employees, volunteers, and student interns prior to the research collaboration. Furthermore, all spreadsheet information was stored on an encrypted flash drive by the principle investigator for reference throughout the course of this investigation. Origami's Service Manager de-identified sample participants by assigning a unique study ID to each. Information was obtained for MPAI-4 item scores in addition to participant demographic factors and treatment variables identified within this section. All de-identified spreadsheet information will be saved on an encrypted flash drive for a minimum of 3 years in compliance with federal regulation and for future reference.

Summary

Origami Brain Injury Rehabilitation Center provides comprehensive post-acute brain injury rehabilitation for individuals experiencing mild to severe TBI. A retrospective pre-post design was used to observe, analyze, and compare Origami client MPAI-4 item-26 for residence scores across OT intake and discharge for participant demographic factors and OT treatment protocols following statistical analysis. Strict confidentiality of client demographics was maintained in compliance with HIPPA. The MPAI-4 is a nationally recognized outcome measurement tool providing valuable insight into clinical evaluation and treatment planning. Application of nonparametric statistical analysis across MPAI-4 item-26 for residence scores allowed greater insight across the OT process.

IV. Results

Techniques of Data Analysis

The researcher utilized IBM SPSS Statistics (Statistical Package for Social Sciences) to conduct data analysis. MPAI-4 item-26 for residence scores (response variable) and participant demographic factors (dichotomous explanatory variables) were defined as ordinal. As a result, the data set failed to fully meet all parametric statistical assumptions and required use of nonparametric statistical analyses.

Response and explanatory variable combinations, where each variable represented two levels, were grouped into a total of eight 2x2 contingency tables for subsequent nonparametric analysis (see Appendix C). Contingency table groupings for participant demographic factors (explanatory variables) specified dichotomous levels, and MPAI-4 item-26 for residence scores (response variables) were grouped into either "same" or "change" categories, allowing quick distinction of change versus no change across OT intake and discharge for participant demographic factors and OT treatment protocols. Participants within the "same" grouping did not experience a change in MPAI-4 item-26 for residence scores across intake and discharge; and with the exception of one participant demonstrating a decrease in MPAI-4 item-26 for residence score across OT intake and discharge, all participants within the "change" grouping demonstrated at least a minimal degree of improvement or greater for MPAI-4 residence scores.

Fisher's Exact Test, a test of statistical significance used for the analysis of contingency tables, was conducted on each of the eight 2x2 contingency tables and produced SPSS output for exact one-sided significance p-values. Exact significance p-values were then compared to a significance level of $\alpha = 0.05$ for interpretation of results. In addition, SPSS crosstab output for

2x2 contingency tables produced percentages for determining direction of responses, allowing additional insight into dichotomous explanatory variable comparisons.

Characteristics of Subjects

In accordance with established inclusion and exclusion criteria, two participants within the data set were omitted due to representing an age range of less than 18 years. As a result, a total of 42 participants were represented within the data set for statistical analysis. All participants within data set represented MPAI-4 item scores in addition to the following demographic factors and OT treatment protocol explanatory variables: Year of discharge, date of injury, TBI care pathway, OT services received, substance abuse history, age range, injury source, marital status, gender, and date of injury to admission (DOIA), CPM retraining, traditional OT, vision therapy, and vocational rehabilitation. However, due to discrepancies and/or other inconsistencies identified for demographic and treatment variables, only the following explanatory variables were incorporated within data analysis: Age range, injury source, marital status, gender, date of injury to admission (DOIA), substance abuse history, vision therapy, and vocational rehabilitation. In relation to answering the research question, hypotheses were specifically observed for the MPAI-4 item-26 for residence score response variable. Additional hypotheses were observed for the MPAI-4 participation index pre-post standard score differences response variable for participant demographic factors only.

As a means of more eveningly distributing participants within the data set, participant demographic variables were reorganized into dichotomous groupings. Age range was initially categorized across twelve five-year intervals, with 18-22 representing the lowest age range and 73-77 representing the highest age range. The new dichotomous grouping for participant age range was established for 18-42, represented by16 participants, and 43-77, represented by 26

participants. Forty-two years of age was chosen as the median age group division due its close proximity to the median age of 38 years. Injury source was initially represented by 7 categories. The new dichotomous grouping for injury source was established for motor vehicle accidents (MVA), represented by 34 participants, and other injury source, represented by 8 participants. Other injury sources consisted 1 surgery complication, 1 fall, 1 gunshot, 1 assault, 1 blunt for object at work, and 3 cerebral vascular accidents (CVAs) secondary to TBI. Participant marital status was initially represented by 4 categories for married, divorced, single, and widowed. The new dichotomous grouping for marital status was established for married, represented by 18 participants, and other, represented by 24 participants. The other marital status grouping included 7 divorced, 1 widow, and 16 single participants. The new dichotomous grouping for gender was established for male, represented by 27 participants, and by female, represented by 15 participants. Date of injury to admission (DOIA) was initially categorized across 6 time intervals for <3 months, 3-6 months, 6-12 months, 12-24 months, 24-60 months, and >60 months. New DOIA grouping was established for <3 months, represented by 24 participants, and >3 months, represented by 18 participants. The new dichotomous grouping for substance abuse history was established for prior substance abuse history, represented by 6 participants, and by no prior substance abuse history, represented by 36 participants. The new dichotomous grouping for vision therapy was established for receiving vision therapy, represented by 18 participants, and not receiving vision therapy, represented by 24 participants. Lastly, the new dichotomous grouping for vocational rehabilitation was established for receiving vocational rehabilitation, represented by 20 participants, and not receiving vocational rehabilitation, represented by 22 participants.

Quantitative Data Results for MPAI-4 Item-26 for Residence

Age range group. Significance level of $\alpha = 0.05$ was established for interpretation of SPSS statistical analyses. Fisher's Exact Test SPSS output for new age grouping (age range explanatory variable) and new residence grouping (MPAI-4 item-26 for residence score response variable) 2x2 contingency table computed a one-sided exact significance p-value = 0.300. Since the exact p-value > 0.05, the researcher failed to reject the null hypothesis claiming that change in MPAI-4 item-26 for residence scores across OT intake/discharge is independent to whether or not someone represents the 18-42 age group or 42-77 age group (See Figure 1).

Sample statistics for SPSS 2x2 contingency table crosstab output demonstrated that 56.2% of participants within the 18-42 age group experienced change in MPAI-4 residence scores across OT intake to discharge and that 69.2% of participants within the 43-77 age group experienced change in MPAI-4 item-26 for residence scores across OT intake to discharge (See Figure 1).

Injury source group. Fisher's Exact Test SPSS output for new injury status group (injury source explanatory variable) and new residence grouping (MPAI-4 item-26 for residence score response variable) 2x2 contingency table computed a one-sided exact significance p-value = 0.294. Since the exact p-value > 0.05, the researcher failed to reject the null hypothesis claiming that change in MPAI-4 item-26 residence scores across OT intake/discharge is independent to whether or not someone experienced a motor vehicle accident or the other injury source for brain injury (See Figure 2).

Sample statistics for SPSS 2x2 contingency table crosstab output demonstrated that 67.6% of participants within the MVA group experienced change in MPAI-4 item-26 for residence scores across OT intake and discharge and that 50.0% of participants within the other

injury source group experienced change in MPAI-4 residence scores across OT intake to discharge (See Figure 2).

Marital status group. Fisher's Exact Test SPSS output for new marital status group (explanatory variable) and new residence grouping (MPAI-4 item-26 for residence score response variable) 2x2 contingency table computed a one-sided exact significance p-value = 0.480. Since the exact p-value > 0.05, the researcher failed to reject the null hypothesis claiming that change in MPAI-4 item-26 for residence scores across OT intake/discharge is independent to whether or not someone is married (See Figure 3).

Sample statistics for SPSS 2x2 contingency table crosstab output demonstrated that 61.1% of participants within the married group experienced change in MPAI-4 residence scores across OT intake and discharge and that 66.7% of participants within the other martial status group experienced change in MPAI-4 item-26 for residence scores across OT intake and discharge (See Figure 3).

Gender group. Fisher's Exact Test SPSS output for the male or female group (explanatory variable) and new residence grouping (MPAI-4 item-26 for residence score response variable) 2x2 contingency table computed a one-sided exact significance p-value = 0.458. Since the exact p-value > 0.05, the researcher failed to reject the null hypothesis claiming that change in MPAI-4 item-26 for residence scores across OT intake/discharge is independent to whether or not someone is male or female (See Figure 4).

Sample statistics for SPSS 2x2 contingency table crosstab output demonstrated that 60.0% of participants within the male group experienced change in MPAI-4 residence scores across OT intake and discharge and that 66.7% of participants within the female group

experienced change in MPAI-4 item-26 for residence scores across OT intake and discharge (See Figure 4).

Date of injury to admission (DOIA) group. Fisher's Exact Test SPSS output for new DOIA status group (explanatory variable) and new residence grouping (MPAI-4 item-26 for residence score response variable) 2x2 contingency table computed a one-sided exact significance p-value = 0.480. Since the exact p-value > 0.05, the researcher failed to reject the null hypothesis claiming that change in MPAI-4 item-26 for residence scores across OT intake/discharge is independent to whether or not someone entered OT treatment less than or more than 3 months from the date of injury (See Figure 5).

Sample statistics for SPSS 2x2 contingency table crosstab output demonstrated that 66.7% of participants within the <3 months DOIA injury status group experienced change in MPAI-4 residence scores across OT intake and discharge and that 61.1% of participants within the >3 months new DOIA status group experienced change in MPAI-4 item-26 for residence scores across OT intake and discharge (See Figure 5).

Prior substance abuse history group. Fisher's Exact Test SPSS output for prior substance abuse history group (explanatory variable) and new residence grouping (MPAI-4 item-26 for residence score response variable) 2x2 contingency table computed a one-sided exact significance p-value = 0.587. Since the exact p-value > 0.05, the researcher failed to reject the null hypothesis claiming that change in MPAI-4 item-26 for residence scores across OT intake/discharge is independent to whether or not someone has prior substance abuse history (See Figure 6).

Sample statistics for SPSS 2x2 contingency table crosstab output demonstrated that 66.7% of participants within the prior substance abuse group (n=6) experienced change in

MPAI-4 residence scores across OT intake and discharge and that 61.1% of participants within the no prior substance abuse history group (n=36) experienced change in MPAI-4 item-26 for residence scores across OT intake and discharge (See Figure 6).

Vision therapy group. Fisher's Exact Test SPSS output for prior vision therapy group (explanatory variable) and new residence grouping (MPAI-4 item-26 for residence score response variable) 2x2 contingency table computed a one-sided exact significance p-value = 0.589. Since the exact p-value > 0.05, the researcher failed to reject the null hypothesis claiming that change in MPAI-4 item-26 for residence scores across OT intake/discharge is independent to whether or not someone receives vision therapy (See Figure 7).

Sample statistics for SPSS 2x2 contingency table crosstab output demonstrated that 62.5% of participants within the no vision therapy group experienced change in MPAI-4 residence scores across OT intake and discharge and that 61.1% of participants within the vision therapy group experienced change in MPAI-4 item-26 for residence scores across OT intake and discharge (See Figure 7).

Vocational rehabilitation group. Fisher's Exact Test SPSS output for the vocational rehabilitation group (explanatory variable) and new residence grouping (MPAI-4 item-26 for residence score response variable) 2x2 contingency table computed a one-sided exact significance p-value = 0.116. Since the exact p-value > 0.05, the researcher failed to reject the null hypothesis claiming that change in MPAI-4 item-26 for residence scores across OT intake/discharge is independent to whether or not someone received vocational rehabilitation (See Figure 8).

Sample statistics for SPSS 2x2 contingency table crosstab output demonstrated that 72.7% of participants within the no vocational rehabilitation group experienced change in MPAI-

4 residence scores across OT intake and discharge and that 50.0% of participants within the vocational rehabilitation group experienced change in MPAI-4 item-26 for residence scores across OT intake and discharge (See Figure 8).

Additional Quantitative Findings for MPAI-4 Participation Index

MPAI-4 Participation Index pre-post standard score differences were additionally analyzed in relation to a generalized set of hypotheses for participant demographic factors (explanatory variables). Although slightly deviating from this investigation's primary objective of comparing levels of supervision across OT intake and discharge, MPAI-4 participation index measures an individual's ability to socially participate and reintegrate within society. Therefore, observing this specific MPAI-4 outcome measure holds potential value within follow-up studies and/or future MPAI-4 research. Furthermore, MPAI-4 participant index contains item-26 for residence in addition to items for self-care, transportation, money management, paid employment, and other employment, all of which coincide with OT practice domains (AOTA, 2008).

Prior to performing statistical analysis, Q-Q plots demonstrated normal sample distributions (See Figure 9 and Figure 10). Additional parametric assumptions were met and therefore warranted statistical analysis. Independent samples t-tests, a parametric test providing statistical significance for whether or not two independent samples have similar population means, were chosen for SPSS analysis. Thus, the population mean of each dichotomous explanatory variable for MPAI-4 participation index pre-post standard score differences were compared to each other, allowing subsequent interpretation and comparison for whether or not each dichotomous variable arose from the same population. Results are presented below and additionally elaborated upon within the discussion section.

Age range group. Independent samples t-test were performed using SPSS for $\alpha = 0.05$. Equal variances were assumed due to Levene's test of equality of variance producing a p-value = 0.387 > 0.05. Independent samples t-test produced a 2-sided significance p-value = 0.497. Since 0.497 > 0.05, the principle investigator failed to reject the null hypothesis claiming equal population means between the 18-42 age range and 43-77 age range for the MPAI-4 participation index pre-post standard score differences (See Figure 11). As a result, there is not statistically significant evidence to support the alternative hypothesis that population means are not equal between the 42 age range and 42-77 age range for MPAI-4 participation index pre-post standard score differences, which would otherwise signal differences between dichotomous explanatory variable interaction on outcome measure response variable.

Injury source group. Independent samples t-test were performed using SPSS for $\alpha = 0.05$. Equal variances werer assumed due to Levene's test of equality of variance significance p-value = 0.258 > 0.05. Independent samples t-test produced a 2-sided significance p-value = 0.161. Since 0.161 > 0.05, the principle investigator failed to reject the null hypothesis claiming equal population means between MVA injuries and other injury sources for the MPAI-4 participation index pre-post standard score differences (See Figure 12). As a result, there is not statistically significant evidence to support the alternative hypothesis that population means are not equal between MVA injuries and other injury sources for MPAI-4 participation index pre-post standard score differences, which would otherwise signal differences between dichotomous explanatory variable interaction on outcome measure response variable.

Marital status group. Independent samples t-test were performed using SPSS for $\alpha = 0.05$. Equal variances were assumed due to Levene's test of equality of variance significance p-value = 0.549 > 0.05. Independent samples t-test produced a 2-sided significance p-value =

0.203. Since 0.203 > 0.05, the principle investigator failed to reject the null hypothesis claiming equal population means between being married and not married for the MPAI-4 participation index pre-post standard score differences (See Figure 13). As a result, there is not statistically significant evidence to support the alternative hypothesis that the population means are not equal between being married and not married for MPAI-4 participation index pre-post standard score differences, which would otherwise signal differences between dichotomous explanatory variable interaction on outcome measure response variable.

Gender group. Independent samples t-test were performed using SPSS for $\alpha = 0.05$. Equal variances were assumed due to Levene's test of equality of variance significance p-value = 0.384 > 0.05. Independent samples t-test produced a 2-sided significance p-value = 0.114. Since 0.114 > 0.05, the principle investigator failed to reject the null hypothesis claiming equal means between males and females for the MPAI-4 participation index pre-post standard score differences (See Figure 14). As a result, there is not statistically significant evidence to support the alternative hypothesis that the population means are not equal between males and females for MPAI-4 participation index pre-post standard score differences, which would otherwise signal differences between dichotomous explanatory variable interaction on outcome measure response variable.

Date of injury to admission (DOIA) group. Independent samples t-tests were performed using SPSS for $\alpha = 0.05$. Equal variances were not assumed due to Levene's test of equality of variance significance p-value = 0.011 > 0.05. Independent samples t-test produced a 2-sided significance p-value = 0.000. Since 0.000 < 0.05, the principle investigator rejected the null hypothesis claiming equal population means between the < 3 months DOIA and > 3 months DOIA for the MPAI-4 participation index pre-post standard score differences (See Figure 15).

As a result, statistically significant evidence supports the alternative hypothesis that population means are not equal between < 3 months DOIA and > 3 months DOIA for MPAI-4 participation index pre-post standard score differences. This analysis provided a very significant p-value = 0.000, which signals a statistically significant difference between < 3 months DOIA and > 3 months DOIA dichotomous explanatory variable interaction on the outcome measure response variable. This result will be further discussed within the suggestions for future research section.

Summary

Quantitative data analysis derived from eight distinct 2x2 contingency tables and Fisher's Exact Tests within SPSS failed to reject the null hypotheses claiming independence between levels of supervision response for dichotomous explanatory variables. All one-sided exact significance p-values were equal to 0.294 or higher. As a result, there is sufficient evidence to support the overarching claim that changes in levels of supervision (represented by MPAI-4 item-26 for residence scores) across OT intake and discharge do not depend on specific participant demographic factors and/or OT treatment protocols received.

Furthermore, SPSS crosstab output for the eight 2x2 contingency tables revealed sample statistic percentages identifying direction of change between each dichotomous explanatory variable grouping. Aside from one participant within the "change" group that did worse across OT intake and discharge, all other participants within the "change" group improved by at least a minimal degree or more. Thus, this allowed a general comparison of the sample between groups that stayed the same versus groups that changed for MPAI-4 item-26 for residence scores within a specified demographic factor sublevel. Although not statistically significant, generalized trends within the sample were observed for levels of supervision across OT intake and discharge in relation to various participant demographic factors and OT treatment protocols.

Additional statistical analyses for independent t-tests were conducted using the MPAI-4 participation index pre-post standard score differences (response variable) across two independent samples represented by dichotomous participant demographic factors. Aside for date of injury to admission (DOIA), all other series of independent t-tests failed to reject the null hypothesis claiming equal population means. For DOIA, a very low p-value = 0.000 rejected the null hypothesis for equal population means, and subsequently supported the alternative hypothesis claim that equal population means do not exist between < 3 months DOIA and > 3 months DOIA. The MPAI-4 participation index represents an individual's performance for societal functioning and therefore holds significant value within follow-up studies and future OT practice research.

V. Discussion

Limited outcome-based studies exist within the research literature as a means of better understanding how levels of supervision compare across OT intake and discharge within post-acute brain injury rehabilitation settings. Clinical pursuit of advancing this knowledge is critical for identifying specific client and/or rehabilitation trends promoting the highest level of functional independence and lowest level of required supervision upon OT discharge. In response to these effects, OT practice approaches will continually evolve and align with OTPF-II guidelines emphasizing health and wellness through participation in occupation across the lifespan (AOTA, 2008). This research investigation aimed to compare levels of supervision across OT intake and discharge for individuals receiving post-acute brain injury rehabilitation at Origami Brain Injury Rehabilitation Center located in Mason, MI. What follows is a discussion of the findings, implications and how they apply to OT practice, limitations identified, recommendations for future research, and an overall conclusion of this research investigation.

Review of the Research Question, Hypotheses, and Conclusions

Research question: For individuals receiving post-acute brain injury rehabilitation for mild to severe TBI, how do levels of supervision (determined by item-26 for residence within the MPAI-4 participation index) compare across OT intake and discharge? The broad nature of this research question provided an opportunity for open-ended comparison while offering flexibility for potential variable constraints presented within the data set. More specifically, this research investigation sought to compare levels of supervision across OT intake and discharge in relation to specific participant demographic factors and OT treatment protocols represented at Origami. The principle investigator determined that the nature of the data set would be most efficiently utilized via statistical analysis of MPAI-4 item-26 for residence score comparisons across OT

intake and discharge for participant demographic factors and Origami OT protocols for vision therapy and vocational rehabilitation. Although performing statistical analyses in relation to all four Origami OT treatment protocols would have been ideal, the predominance of nearly all participants having received cognitive perceptual motor retraining (CPM) and traditional OT treatment contraindicated analyses via limited comparison to an intra-sample grouping that did not receive CPM retraining and traditional OT. Thus, only vision therapy and vocational rehabilitation OT treatment protocols were included within statistical analysis.

Six demographic factors and two OT treatment protocols were chosen as explanatory variables and subsequently grouped into dichotomous levels for statistical analysis. Null hypotheses were tested for statistical significance via formation of 2x2 contingency tables and calculation of Fisher's Exact Test within SPSS. Fisher's Exact Test provided a one-way exact significance p-value, allowing comparison to an established $\alpha = 0.05$ and determination that there was not statistically significant evidence to reject the null hypotheses claiming that changes in levels of supervision across OT intake/discharge were independent to dichotomous explanatory variable groupings. Despite this lack of statistical significance, SPSS 2x2 contingency table crosstab output provided sample statistic percentages for MPAI-4 residence item scores that stayed the same versus those that demonstrated change within a specific dichotomous explanatory variable, which allowed sample comparisons for direction of change across OT intake and discharge.

Implications and OT Practice Application

As mentioned within the introduction, an estimated 1.7 million people experience a TBI in the United States each year, and increased survival rates due to medical advancements results in increasing numbers of Americans currently living with a TBI related disability (CDC, 2013).

Occupational therapists are clinical experts in addressing rehabilitation of functional performance across basic activities of daily living, instrumental activities of daily living, and client-centered occupations vital to achieving best possible outcomes upon discharge. Monitoring changes in client levels of supervision across OT intake and discharge serves as a valuable clinical evaluation tool for identifying treatment progression, individual readiness for discharge, and overall achievement of health and wellbeing.

The MPAI-4 item-26 for residence is scored in relation to the Supervision Rating Scale (SRS) and further represents an individual's ability to perform responsibilities of independent daily living and homemaking (i.e. meal prep, home repairs, medication management, and personal health maintenance beyond basic hygiene). Thus, outcomes reported from MPAI-4 item-26 for residence scores within this research investigation directly pertain to the domain of OT practice and a clinician's ability to better understand how the potential independent/dependent relationships between demographic factors and OT treatment protocols impact a client's ability to achieve optimal levels of supervision upon discharge. Results identified within this research investigation did not provide statistically significant evidence supporting the alternative hypotheses that change in MPAI-4 item-26 for residence scores are dependent of participant demographic factors, vision therapy, or vocational rehabilitation.

A series of independent t-tests performed for the MPAI-4 participation index pre-post standard score differences in relation to participant demographic factors (not including substance abuse history) revealed statistical significance for unequal population means (p-value = 0.000) between < 3 months for DOIA and > 3 months for DOIA. It can therefore be inferred that the DOIA dichotomous explanatory variables did not come from the same population and therefore influence MPAI-4 participation index outcomes differently from one another. Although not

directly related to levels of supervision as addressed within the research question, this finding is of considerable interest via congruency between the MPAI-4 participation index, which represents an individual's performance and adaptation within societal functioning, and OT's practice domain. In addition to item-26 for residence, the MPAI-4 participation index contains performance item measures for self-care, transportation, paid employment, other employment, and money management amongst other performance measures, all of which directly relate to the field of OT practice.

Limitations

Despite precautionary measures taken to maximize control and minimize limitations across this research investigation, limitations were identified and warrant explanation. First, the inability to identify exact duration of OT services received by each participant within the sample presented significant limitation upon interpreting how changes in levels of supervision across OT intake and discharge are impacted as a function of time. Having this information would have allowed an additional explanatory variable and more precise outcome measurement comparisons in relation to the research question.

Next, lack of grouping sample participants into levels of TBI severity (i.e. mild, mild to moderate, moderate to severe, and severe) according to MPAI-4 total index standard score equivalencies presented limitation in regards to delineating and/or attributing changes across OT treatment in relation to TBI severity level. Furthermore, allowing the one participant who decreased for MPAI-4 item-26 for residence score across OT intake and discharge to remain within the MPAI-4 new residence item "change" group presented a limitation. Had this participant been removed from the "change" group and transferred to the "same" group or a newly created grouping for "worse", the "change" group would have only represented

participants who improved their MPAI-4 residence score, and therefore allow statistical comparisons in regards to “improvement” as opposed to “change”.

An additional limitation of this research investigation may be attributed to the inability of analyzing all Origami OT treatment protocols in relation MPAI-4 item-26 for residence scores. Aside from vision therapy and vocational rehabilitation, CPM retraining and traditional Origami OT treatment protocols were not suitable to statistical analysis due to the majority of sample participants having received the protocol treatment. Furthermore, given the degree of potential variability and/or unidentified confounding variables when analyzing human participant data, this research investigation may have benefitted from a larger sample size via obtaining convenience samples across multiple post-acute brain injury rehabilitation facilities using the MPAI-4 as an outcome measure.

Suggestions for Future Research/Modifications

Although this research investigation answered the research question via providing demographic factor and OT treatment protocol comparisons for levels of supervision across OT intake and discharge, recommendations have been identified for future studies of similar design. First, performing alternative strategies discussed within the limitations section would enhance the control and precision of outcome measurements. Alternative strategies include identification of OT service duration received by each participant within the data set. This recommendation could be facilitated by providing additional time and support to the partnering community organization while accessing and adequately searching through client electronic medical records for specific intake and discharge dates, which is often a time extensive process.

Furthermore, grouping sample participants into TBI severity upon OT intake and discharge is recommended within future research. This could be achieved by utilizing the

MPAI-4's total index standard scores and grouping each participant into one of five distinct levels of functioning derived from MPAI-4 standard score equivalences. Additionally, grouping participant response variable scores according to "better", "same" and/or "worse" groupings, as opposed the "same" or "change" grouping utilized within this study, would allow more specific results interpretation in relation to participant improvement across OT intake and discharge for sample statistics.

Additional recommendations for future research using a similar design directly stem from independent t-tests performed for the MPAI-4 participation index pre-post standard score differences in relation various explanatory variables. For example, this research investigation did not provide statistical significance supporting MPAI-4 item-26 for residence score dependency to DOIA. However, MPAI-4 item-26 for residence resides within the MPAI-4 participation index, yet statistical significance (p-value = 0.000) for unequal population means was identified between MPAI-4 participation index pre-post standard score differences for DOIA. This interesting result warrants future research exploring the impact of other MPAI-4 participation index items on DOIA and/or other explanatory variables addressed within this investigation. Of the MPAI-4 participation index's eight total items, self-care, transportation, and money management reside within the OTPF-II and therefore represent potential OT targets within future investigations (AOTA, 2008). Additional MPAI-4 item OT targets include attention/concentration, visuospatial abilities, and use of hands. Thus, broadening the scope of MPAI-4 items investigated beyond item-26 for residence will likely reveal valuable information for determining specific items of the participation index impacted by DOIA and/or additional explanatory variables.

Lastly, increasing sample size by expanding community partnerships and/or inclusion of precipitously discharged participants would allow for an expanded research investigation while potentially providing essential information regarding MPAI-4 item response outcomes. Likewise, expanded community partnerships might allow incorporation of other assessment and/or evaluation tools such as the Functional Independence Measure (FIM), which would provide an alternative means of gauging treatment progress across OT intake and discharge through the use of a widely accepted and administered rehabilitation outcome measure.

Conclusion

Limited studies exist within the research literature for demonstrating how levels of supervision compare across OT intake and discharge for individuals receiving post-acute brain injury rehabilitation. Through the use of MPAI-4 item-26 for residence scores as a response variable indicator for comparing levels of supervision across OT intake and discharge, this research investigation targeted the research question while filling a valuable gap in the literature.

Upon conducting data analysis using 2x2 contingency tables and performing Fisher's Exact Test within SPSS, this research investigation failed to reject all null hypotheses claiming that MPAI-4 item-26 for residence score changes (response variable) across OT intake and discharge are independent to whether or not someone represented one demographic factor or OT treatment protocol over another. Therefore, data analysis did not provide statistical significance to support the alternative hypotheses claiming dependence between change in levels of supervision and explanatory variables.

In addition to failing to reject all null hypotheses directly related to the research question, additional sample statistic generalizations were gleaned through percentages demonstrating directional change via participant groups that stayed the same across OT intake and discharge

and participant groups that changed across OT intake and discharge within the sample. All but one participant in the "change" group demonstrated improvement across OT intake and discharge. Thus, sample statistics allowed additional insight into demographic factor treatment trends.

The professional practice of occupational therapy promotes health and wellbeing through engagement in meaningful occupation (AOTA, 2008). According to Legg et al. (2007), level of functional independence is a primary treatment target and a prominent measure of rehabilitation outcome. Therefore, by more thoroughly understanding the unique relationships and/or trends between levels of supervision, functional independence, and client demographic factors across the OT process, clinicians will be better equipped with valuable knowledge and skills for providing optimal client-centered care and OT best practices. This research investigation revealed greater insight into this phenomenon, discussed how quantitative results applied to OT practice, identified limitations within this study, provided recommendations for future research, and emphasized the overall importance and impact of comparing levels of supervision across post-acute traumatic brain injury rehabilitation.

Appendix A

May 24, 2013

Origami Brain Injury Rehabilitation Center
3181 Sandhill Road
Mason, MI 48854
(517) 336-6060
Letter of Support

Dear Origami Staff & Administration,

As a Master of Science in Occupational Therapy (MSOT) student at Grand Valley State University (GVSU), I am writing with sincere interest for your signed consent and approval regarding direct collaboration with Origami Brain Injury Rehabilitation Center for my traditional thesis "Comparing Mayo-Portland Adaptability Inventory-4 (MPAI-4) scores across occupational therapy (OT) intake and discharge for individuals receiving post-acute traumatic brain injury (TBI) rehabilitation" proposed at your facility on May 24, 2013. I am enthusiastic for this potential community partnership and eager for an opportunity to contribute evidenced-based practice data to your professional organization.

As detailed within my thesis proposal and chapters 1-3, this research aims to identify and analyze changes across pre-existing MPAI-4 intake and discharge scores for clients with mild to severe TBI who received post-acute occupational therapy services from Origami. Additional analysis will seek cross-comparisons between MPAI-4 scores and treatment variables including, but not limited to, type of Origami OT treatment protocol administered (cognitive perceptual motor (CPM) retraining, traditional OT, vision therapy, and vocational rehabilitation) and specific client demographics/factors. This retrospective cohort study will not require any type of Origami client participation and will fully comply with HIPPA law. All confidential client information will be accessed by Origami staff and assigned anonymous client identification prior to transferring to principle investigator, Joseph G. Grubaugh, for data analysis.

I sincerely thank you for your time and commitment regarding ongoing correspondence for the development and focus of this research thesis. Your signature below will provide final consent for me to move forward with submitting this thesis proposal to GVSU's Institutional Review Board (IRB). Please contact me regarding any questions and/or concerns at grubaujo@mail.gvsu.edu and I look forward to future collaboration.

Sincerely,

Joseph G. Grubaugh

Joseph G. Grubaugh
Occupational Therapy Student
Grand Valley State University
grubaujo@mail.gvsu.edu

MS, OTR/L, CBIS 7/15/13

Origami Staff Signature & Date

Appendix B

Mayo-Portland Adaptability Inventory-4

Muriel D. Lezak, PhD, ABPP & James F. Malec, PhD, ABPP

Name: _____ Clinic # _____ Date _____

Person reporting (circle one): Single Professional Professional Consensus Person with brain injury Significant other: _____

Below each item, circle the number that best describes the level at which the person being evaluated experiences problems. Mark the greatest level of problem that is appropriate. Problems that interfere rarely with daily or valued activities, that is, less than 5% of the time, should be considered not to interfere. Write comments about specific items at the end of the rating scale.

For Items 1-20, please use the rating scale below.

0 None	**1** Mild problem but does not interfere with activities; may use assistive device or medication	**2** Mild problem; interferes with activities 5-24% of the time	**3** Moderate problem; interferes with activities 25-75% of the time	**4** Severe problem; interferes with activities more than 75% of the time

Part A. Abilities
1. Mobility: Problems walking or moving; balance problems that interfere with moving about **0 1 2 3 4**
2. Use of hands: Impaired strength or coordination in one or both hands **0 1 2 3 4**
3. Vision: Problems seeing; double vision; eye, brain, or nerve injuries that interfere with seeing **0 1 2 3 4**
4. *Audition: Problems hearing; ringing in the ears **0 1 2 3 4**
5. Dizziness: Feeling unsteady, dizzy, light-headed **0 1 2 3 4**
6. Motor speech: Abnormal clearness or rate of speech; stuttering **0 1 2 3 4**
7A. Verbal communication: Problems expressing or understanding language **0 1 2 3 4**
7B. Nonverbal communication: Restricted or unusual gestures or facial expressions; talking too much or not enough; missing nonverbal cues from others **0 1 2 3 4**
8. Attention/Concentration: Problems ignoring distractions, shifting attention, keeping more than one thing in mind at a time **0 1 2 3 4**
9. Memory: Problems learning and recalling new information **0 1 2 3 4**
10. Fund of Information: Problems remembering information learned in school or on the job; difficulty remembering information about self and family from years ago **0 1 2 3 4**
11. Novel problem-solving: Problems thinking up solutions or picking the best solution to new problems **0 1 2 3 4**
12. Visuospatial abilities: Problems drawing, assembling things, route-finding, being visually aware on both the left and right sides **0 1 2 3 4**

Part B. Adiustment
13. Anxiety: Tense, nervous, fearful, phobias, nightmares, flashbacks of stressful events **0 1 2 3 4**
14. Depression: Sad, blue, hopeless, poor appetite, poor sleep, worry, self-criticism **0 1 2 3 4**
15. Irritability, anger, aggression: Verbal or physical expressions of anger **0 1 2 3 4**
16. *Pain and headache: Verbal and nonverbal expressions of pain; activities limited by pain **0 1 2 3 4**
17. Fatigue: Feeling tired; lack of energy; tiring easily **0 1 2 3 4**
18. Sensitivity to mild symptoms: Focusing on thinking, physical or emotional problems attributed to brain injury; rate only how concern or worry about these symptoms affects current functioning over and above the effects of the symptoms themselves **0 1 2 3 4**
19. Inappropriate social interaction: Acting childish, silly, rude, behavior not fitting for time and place **0 1 2 3 4**
20. Impaired self-awareness: Lack of recognition of personal limitations and disabilities and how they interfere with everyday activities and work or school **0 1 2 3 4**

Use scale at the bottom of the page to rate item #21

21. Family/significant relationships: Interactions with close others; describe stress within the family or those closest to the person with brain injury; "family functioning" means cooperating to accomplish those tasks that need to be done to keep the household running

0 Normal stress within family or other close network of relationships	**1** Mild stress that does not interfere with family functioning	**2** Mild stress that interferes with family functioning 5-24% of the time	**3** Moderate stress that interferes with family functioning 25-75% of the time	**4** Severe stress that interferes with family functioning more than 75% of the time

MPAI-4 3/31/03

Part C. Participation

22. Initiation: Problems getting started on activities without prompting

0 None	**1** Mild problem but does not interfere with activities; may use assistive device or medication	**2** Mild problem; interferes with activities 5-24% of the time	**3** Moderate problem; interferes with activities 25-75% of the time	**4** Severe problem; interferes with activities more than 75% of the time

23. Social contact with friends, work associates, and other people who are not family, significant others, or professionals

0 Normal involvement with others	**1** Mild difficulty in social situations but maintains normal involvement with others	**2** Mildly limited involvement with others (75-95% of normal interaction for age)	**3** Moderately limited involvement with others (25-74% of normal interaction for age)	**4** No or rare involvement with others (less than 25% of normal interaction for age)

24. Leisure and recreational activities

0 Normal participation in leisure activities for age	**1** Mild difficulty in these activities but maintains normal participation	**2** Mildly limited participation (75-95% of normal participation for age)	**3** Moderately limited participation (25-74% of normal participation for age)	**4** No or rare participation (less than 25% of normal participation for age)

25. Self-care: Eating, dressing, bathing, hygiene

0 Independent completion of self-care activities	**1** Mild difficulty, occasional omissions or mildly slowed completion of self-care; may use assistive device or require occasional prompting	**2** Requires a little assistance or supervision from others (5-24% of the time) including frequent prompting	**3** Requires moderate assistance or supervision from others (25-75% of the time)	**4** Requires extensive assistance or supervision from others (more than 75% of the time)

26. Residence: Responsibilities of independent living and homemaking (such as, meal preparation, home repairs and maintenance, personal health maintenance beyond basic hygiene including medication management) but not including managing money (see #29)

0 Independent; living without supervision or concern from others	**1** Living without supervision but others have concerns about safety or managing responsibilities	**2** Requires a little assistance or supervision from others (5-24% of the time)	**3** Requires moderate assistance or supervision from others (25-75% of the time)	**4** Requires extensive assistance or supervision from others (more than 75% of the time)

27. *Transportation

0 Independent in all modes of transportation including independent ability to operate a personal motor vehicle	**1** Independent in all modes of transportation, but others have concerns about safety	**2** Requires a little assistance or supervision from others (5-24% of the time); cannot drive	**3** Requires moderate assistance or supervision from others (25-75% of the time); cannot drive	**4** Requires extensive assistance or supervision from others (more than 75% of the time); cannot drive

28A. *Paid Employment: Rate either item 28A or 28B to reflect the primary desired social role. Do not rate both. Rate 28A if the primary social role is paid employment. If another social role is primary, rate only 28B. For both 28A and 28B, "support" means special help from another person with responsibilities (such as, a job coach or shadow, tutor, helper) or reduced responsibilities. Modifications to the physical environment that facilitate employment are not considered as support.

0 Full-time (more than 30 hrs/wk) without support	**1** Part-time (3 to 30 hrs/ wk) without support	**2** Full-time or part-time with support	**3** Sheltered work	**4** Unemployed; employed less than 3 hours per week

28B. *Other employment: Involved in constructive, role-appropriate activity other than paid employment.
Check only one to indicate primary desired social role: Childrearing/care-giving Homemaker, no childrearing or care-giving Student Volunteer Retired (Check retired only if over age 60; if unemployed, retired as disabled and under age 60, indicate "Unemployed" for item 28A.

0 Full-time (more than 30 hrs/wk) without support; full-time course load for students	**1** Part-time (3 to 30 hrs/ wk) without support	**2** Full-time or part-time with support	**3** Activities in a supervised environment other than a sheltered workshop	**4** Inactive; involved in role-appropriate activities less than 3 hours per week

29. Managing money and finances: Shopping, keeping a check book or other bank account, managing personal income and investments; if independent with small purchases but not able to manage larger personal finances or investments, rate 3 or 4.

0 Independent, manages small purchases and personal finances without supervision or concern from others	**1** Manages money independently but others have concerns about larger financial decisions	**2** Requires a little help or supervision (5-24% of the time) with large finances; independent with small purchases	**3** Requires moderate help or supervision (25-75% of the time) with large finances; some help with small purchases	**4** Requires extensive help or supervision (more than 75% of the time) with large finances; frequent help with small purchases

Part D: Pre-existing and associated conditions. The items below do not contribute to the total score but are used to identify special needs and circumstances. For each rate, pre-injury and post-injury status.

30. Alcohol use: Use of alcoholic beverages.

Pre-injury _____ Post-injury _____

0	No or socially acceptable use	**1**	Occasionally exceeds socially acceptable use but does not interfere with everyday functioning; current problem under treatment or in remission	**2**	Frequent excessive use that occasionally interferes with everyday functioning; possible dependence	**3**	Use or dependence interferes with everyday functioning; additional treatment recommended	**4**	Inpatient or residential treatment required

31. Drug use: Use of illegal drugs or abuse of prescription drugs.

Pre-injury _____ Post-injury _____

0	No or occasional use	**1**	Occasional use does not interfere with everyday functioning; current problem under treatment or in remission	**2**	Frequent use that occasionally interferes with everyday functioning; possible dependence	**3**	Use or dependence interferes with everyday functioning; additional treatment recommended	**4**	Inpatient or residential treatment required

32. Psychotic Symptoms: Hallucinations, delusions, other persistent severely distorted perceptions of reality.

Pre-injury _____ Post-injury _____

0	None	**1**	Current problem under treatment or in remission; symptoms do not interfere with everyday functioning	**2**	Symptoms occasionally interfere with everyday functioning but no additional evaluation or treatment recommended	**3**	Symptoms interfere with everyday functioning; additional treatment recommended	**4**	Inpatient or residential treatment required

33. Law violations: History before and after injury.

Pre-injury _____ Post-injury _____

0	None or minor traffic violations only	**1**	Conviction on one or two misdemeanors other than minor traffic violations	**2**	History of more than two misdeameanors other than minor traffic violations	**3**	Single felony conviction	**4**	Repeat felony convictions

34. Other condition causing physical impairment: Physical disability due to medical conditions other than brain injury, such as, spinal cord injury, amputation. Use scale below #35.

Pre-injury _____ Post-injury _____

35. Other condition causing cognitive impairment: Cognitive disability due to nonpsychiatric medical conditions other than brain injury, such as, dementia, stroke, developmental disability.

Pre-injury _____ Post-injury _____

0	None	**1**	Mild problem but does <u>not</u> interfere with activities; may use assistive device or medication	**2**	Mild problem; interferes with activities 5-24% of the time	**3**	Moderate problem; interferes with activities 25-75% of the time	**4**	Severe problem; interferes with activities more than 75% of the time

Comments:

Item #

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

Scoring Worksheet

Items with an asterisk (4, 16, 27, 28/28A) require rescoring as specified below before Raw Scores are summed and referred to Reference Tables to obtain Standard Scores. Because items 22-24 contribute to both the Adjustment Subscale and the Participation Subscale, the Total Score will be less than the sum of the three subscales.

Abilities Subscale

Rescore item 4. Original score = _____
If original score = 0, new score = 0
If original score = 1, 2, or 3, new score = 1
If original score = 4, new score = 3

A. New score for item 4 = _____
B. Sum of scores for items 1-3 and 5-12 = _____
(use highest score for 7A or 7B)

Sum of A and B = Raw Score for Abilities subscale = _____ (place in Table below)

Adjustment Subscale

Rescore item 16. Original score = _____
If original score = 0, new score = 0
If original score = 1 or 2, new score = 1.
If original score = 3 or 4, new score = 2

C. New score for item 16 = _____
D. Sum of scores for items 13-15 and 17-24 _____

Sum of C and D = Raw Score for Adjustment Subscale _____ (place in Table below)

Participation Subscale

Rescore item 27. Original score = _____
If original score = 0 or 1, new score = 0
If original score = 2 or 3, new score = 1
If original score = 4, new score = 3

Rescore item 28A or 28B. Original score = _____
If original score = 0, new score = 0
If original score = 1 or 2, new score = 1
If original score = 3 or 4, new score = 3

E. New score for item 27 = _____
F. New score for item 28Aor 28B = _____
G. Sum of scores for items 22-24 = _____ (place in Table below)
H. Sum of scores for items 25, 26, 29 = _____

Sum of E through H = Raw Score for Participation Subscale = _____ (place in Table below)

Use Reference Tables to Convert Raw Scores to Standard Scores

	Raw Scores (from worksheet above)	**Standard** (Obtain from appropriate reference Table)
I. Ability Subscale (Items 1-12)	_____	_____
II. Adjustment Subscale (Items 13-24)	_____	_____
III. Participation Subscale (Items 22-29)	_____	_____
IV. Subtotal of Subscale Raw Scores (I-III)	_____	
V. Sum of scores for items 22-24	_____	
VI. Subtract from V. from IV = Total Score	_____	_____

Appendix C

Crosstab

			New Residence Grouping		Total
			Same	Change	
New Age Groups	18-42	Count	7	9	16
		% within New Age Groups	43.8%	56.2%	100.0%
	42+	Count	8	18	26
		% within New Age Groups	30.8%	69.2%	100.0%
Total		Count	15	27	42
		% within New Age Groups	35.7%	64.3%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.727[a]	1	.394		
Continuity Correction[b]	.271	1	.602		
Likelihood Ratio	.721	1	.396		
Fisher's Exact Test				.511	.300
Linear-by-Linear Association	.710	1	.400		
N of Valid Cases	42				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 5.71.

b. Computed only for a 2x2 table

Figure 1.

Crosstab

			New Residence Grouping		Total
			Same	Change	
New Injury Status	MVA	Count	11	23	34
		% within New Injury Status	32.4%	67.6%	100.0%
	Other	Count	4	4	8
		% within New Injury Status	50.0%	50.0%	100.0%
Total		Count	15	27	42
		% within New Injury Status	35.7%	64.3%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.878[a]	1	.349		
Continuity Correction[b]	.278	1	.598		
Likelihood Ratio	.851	1	.356		
Fisher's Exact Test				.425	.294
Linear-by-Linear Association	.858	1	.354		
N of Valid Cases	42				

a. 1 cells (25.0%) have expected count less than 5. The minimum expected count is 2.86.

b. Computed only for a 2x2 table

Figure 2.

Crosstab

			New Residence Grouping		Total
			Same	Change	
New Marital Status	Married	Count	7	11	18
		% within New Marital Status	38.9%	61.1%	100.0%
	Other	Count	8	16	24
		% within New Marital Status	33.3%	66.7%	100.0%
Total		Count	15	27	42
		% within New Marital Status	35.7%	64.3%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.138[a]	1	.710		
Continuity Correction[b]	.002	1	.963		
Likelihood Ratio	.138	1	.710		
Fisher's Exact Test				.754	.480
Linear-by-Linear Association	.135	1	.713		
N of Valid Cases	42				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 6.43.

b. Computed only for a 2x2 table

Figure 3.

Crosstab

			New Residence Grouping		Total
			Same	Change	
Male or Female	Female	Count	6	9	15
		% within Male or Female	40.0%	60.0%	100.0%
	Male	Count	9	18	27
		% within Male or Female	33.3%	66.7%	100.0%
Total		Count	15	27	42
		% within Male or Female	35.7%	64.3%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.187[a]	1	.666		
Continuity Correction[b]	.009	1	.924		
Likelihood Ratio	.185	1	.667		
Fisher's Exact Test				.743	.458
N of Valid Cases	42				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 5.36.

b. Computed only for a 2x2 table

Figure 4.

Crosstab

			New Residence Grouping		Total
			Same	Change	
New DOIA Status	Less than 3 months	Count	8	16	24
		% within New DOIA Status	33.3%	66.7%	100.0%
	More than 3 months	Count	7	11	18
		% within New DOIA Status	38.9%	61.1%	100.0%
Total		Count	15	27	42
		% within New DOIA Status	35.7%	64.3%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.138[a]	1	.710		
Continuity Correction[b]	.002	1	.963		
Likelihood Ratio	.138	1	.710		
Fisher's Exact Test				.754	.480
Linear-by-Linear Association	.135	1	.713		
N of Valid Cases	42				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 6.43.

b. Computed only for a 2x2 table

Figure 5.

Crosstab

Count

		New Residence Grouping		
		Same	Change	Total
Prior Substance Abuse History	No	14	22	36
	Yes	2	4	6
Total		16	26	42

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.067[a]	1	.795		
Continuity Correction[b]	.000	1	1.000		
Likelihood Ratio	.068	1	.794		
Fisher's Exact Test				1.000	.587
Linear-by-Linear Association	.066	1	.798		
N of Valid Cases	42				

a. 2 cells (50.0%) have expected count less than 5. The minimum expected count is 2.29.

b. Computed only for a 2x2 table

Figure 6.

Crosstab

Count

		New Residence Grouping		
		Same	Change	Total
Vision Therapy	No	9	15	24
	Yes	7	11	18
Total		16	26	42

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.008[a]	1	.927		
Continuity Correction[b]	.000	1	1.000		
Likelihood Ratio	.008	1	.927		
Fisher's Exact Test				1.000	.589
Linear-by-Linear Association	.008	1	.928		
N of Valid Cases	42				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 6.86.

b. Computed only for a 2x2 table

Figure 7.

Crosstab

Count

		New Residence Grouping		
		Same	Change	Total
Vocational	No	6	16	22
	Yes	10	10	20
Total		16	26	42

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	2.295[a]	1	.130		
Continuity Correction[b]	1.432	1	.231		
Likelihood Ratio	2.313	1	.128		
Fisher's Exact Test				.204	.116
Linear-by-Linear Association	2.240	1	.134		
N of Valid Cases	42				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 7.62.

b. Computed only for a 2x2 table

Figure 8.

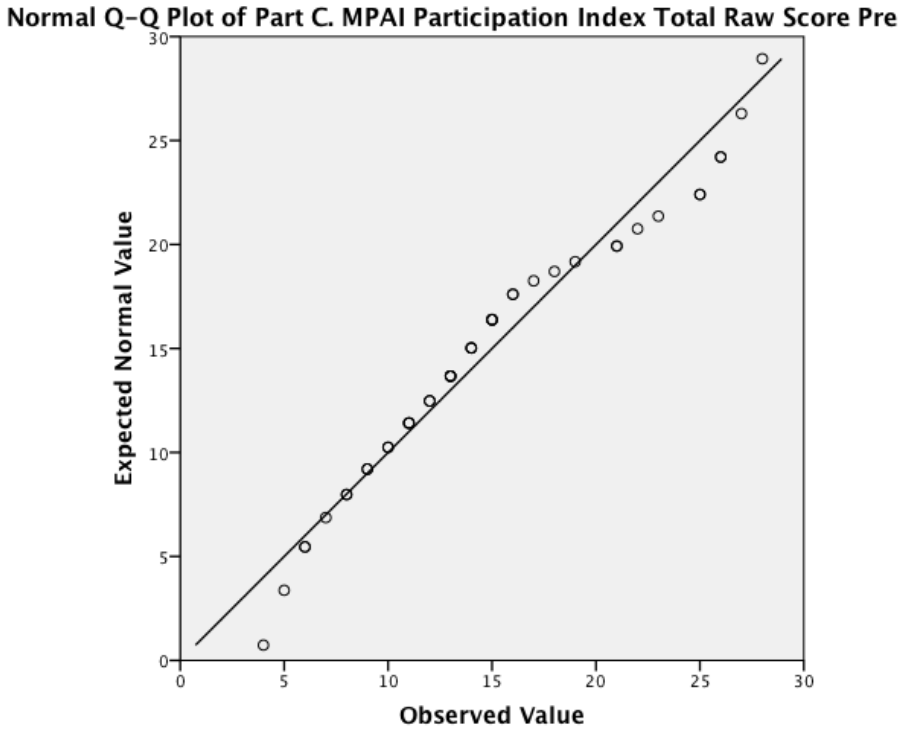

Figure 9.

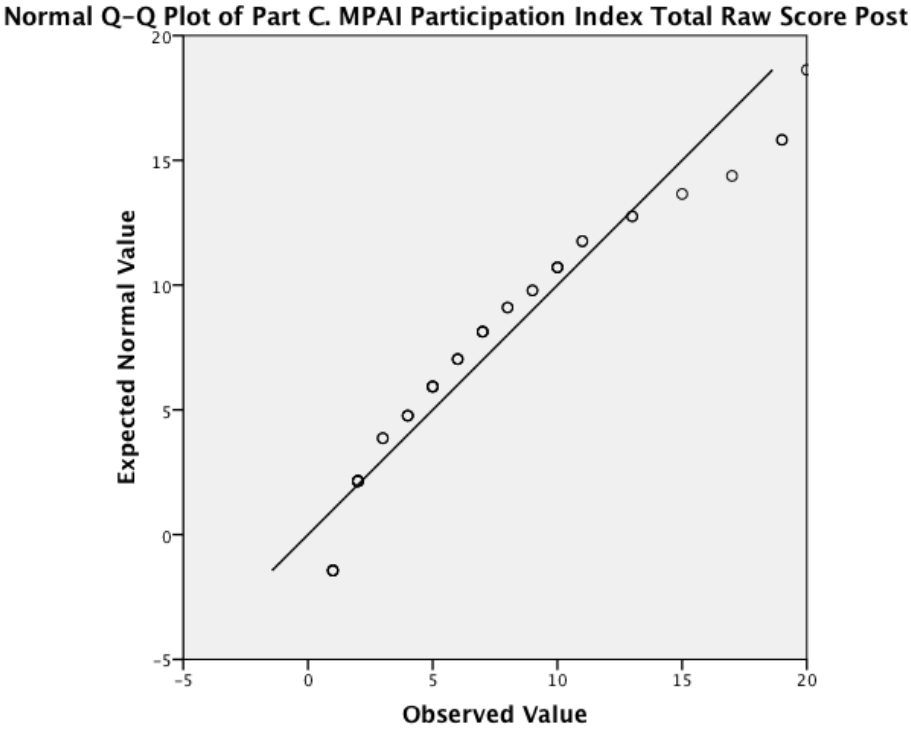

Figure 10.

Group Statistics

	New Age Groups	N	Mean	Std. Deviation	Std. Error Mean
Index C Diff	18-42	16	9.6875	6.83831	1.70958
	42+	26	11.3077	7.76541	1.52292
Total Diff	18-42	16	14.7500	7.72442	1.93111
	42+	26	16.0769	6.42447	1.25994

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Index C Diff	Equal variances assumed	.766	.387	-.686	40	.497	-1.62019	2.36126	-6.39247	3.15209
	Equal variances not assumed			-.708	35.021	.484	-1.62019	2.28953	-6.26809	3.02770
Total Diff	Equal variances assumed	.215	.645	-.602	40	.551	-1.32692	2.20532	-5.78404	3.13019
	Equal variances not assumed			-.575	27.499	.570	-1.32692	2.30578	-6.05398	3.40013

Figure 11.

Group Statistics

	New Injury Status	N	Mean	Std. Deviation	Std. Error Mean
Index C Diff	MVA	34	11.4706	7.60476	1.30421
	Other	8	7.3750	5.57898	1.97247
Total Diff	MVA	34	16.4118	6.99401	1.19946
	Other	8	12.0000	5.39841	1.90863

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Index C Diff	Equal variances assumed	1.318	.258	1.430	40	.161	4.09559	2.86502	-1.69483	9.88600
	Equal variances not assumed			1.732	13.895	.105	4.09559	2.36465	-.97967	9.17085
Total Diff	Equal variances assumed	1.474	.232	1.665	40	.104	4.41176	2.64933	-.94272	9.76625
	Equal variances not assumed			1.957	13.185	.072	4.41176	2.25423	-.45128	9.27481

Figure 12.

Group Statistics

	New Marital Status	N	Mean	Std. Deviation	Std. Error Mean
Index C Diff	Married	18	9.0000	7.73837	1.82395
	Other	24	11.9583	6.99987	1.42884
Total Diff	Married	18	15.1667	6.86209	1.61741
	Other	24	15.8750	7.03601	1.43622

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Index C Diff	Equal variances assumed	.365	.549	-1.296	40	.203	-2.95833	2.28330	-7.57305	1.65638
	Equal variances not assumed			-1.277	34.628	.210	-2.95833	2.31698	-7.66385	1.74719
Total Diff	Equal variances assumed	.004	.951	-.326	40	.746	-.70833	2.17098	-5.09605	3.67938
	Equal variances not assumed			-.327	37.257	.745	-.70833	2.16304	-5.09005	3.67338

Figure 13.

Group Statistics

	Male or Female	N	Mean	Std. Deviation	Std. Error Mean
Index C Diff	Male	27	12.0370	7.30375	1.40561
	Female	15	8.2667	7.12608	1.83994
Total Diff	Male	27	15.4444	7.19152	1.38401
	Female	15	15.8000	6.53780	1.68805

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Index C Diff	Equal variances assumed	.776	.384	1.617	40	.114	3.77037	2.33216	-.94311	8.48385
	Equal variances not assumed			1.628	29.668	.114	3.77037	2.31541	-.96055	8.50129
Total Diff	Equal variances assumed	.028	.868	-.158	40	.875	-.35556	2.24446	-4.89177	4.18066
	Equal variances not assumed			-.163	31.487	.872	-.35556	2.18289	-4.80480	4.09369

Figure 14.

Group Statistics

	New DOIA Status	N	Mean	Std. Deviation	Std. Error Mean
Index C Diff	Less than 3 months	24	13.7917	7.60423	1.55221
	More than 3 months	18	6.5556	4.64280	1.09432
Total Diff	Less than 3 months	24	17.1667	7.92172	1.61701
	More than 3 months	18	13.4444	4.59184	1.08231

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Index C Diff	Equal variances assumed	7.120	.011	3.564	40	.001	7.23611	2.03057	3.13218	11.34004
	Equal variances not assumed			3.810	38.633	.000	7.23611	1.89918	3.39349	11.07873
Total Diff	Equal variances assumed	6.367	.016	1.779	40	.083	3.72222	2.09268	-.50725	7.95169
	Equal variances not assumed			1.913	37.926	.063	3.72222	1.94580	-.21709	7.66153

Figure 15.

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