THE DEVELOPMENT OF THE PEDIATRIC MOTIVATION SCALE FOR CHILDREN IN REHABILITATION: A PILOT STUDY

by

SANDEEP K. TATLA

B.Sc.Kin, Simon Fraser University, 2004
MOT, University of British Columbia, 2007

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Abstract

BACKGROUND: Motivation, a key factor influencing pediatric rehabilitation outcomes, is rarely measured in clinical settings and limited research has explored this construct. Currently, no scale exists with which to measure motivation during rehabilitation from a child's perspective.

PURPOSE: To review evidence about the effects of motivational interventions in children and youth with acquired brain injury (ABI) and to examine the application of Self Determination Theory (SDT) in the rehabilitation context. Based upon tenets of SDT, the aim of this pilot research was to develop an instrument, the Pediatric Motivation Scale (PMOT), to assess motivation from a child's perspective.

METHODS: This study involved two phases. Phase 1 established the PMOT content validity through: a) literature reviews related to motivation in ABI, SDT, and motivation measures; and b) expert feedback from 12 clinicians providing rehabilitation to children who have sustained either acquired brain injury (ABI) or orthopedic injury (OI). During Phase 2, the PMOT was field tested with 12 children with ABI, 9 children with OI, and 20 healthy children serving as controls. Face validity, response process, test-retest reliability, and internal consistency were examined. In addition, convergent validity was explored by comparing therapists' observations of the child's motivation, using the Pediatric Volitional Questionnaire (PVQ). Pearson Product Moment correlations were used to analyze sub-scale correlations, test-retest reliability, and the relationship between the PMOT and the PVQ; Cronbach's alpha was used to measure internal consistency.

RESULTS: Literature review revealed a need for the development of valid and reliable measures of motivation in rehabilitation. Preliminary psychometric evaluation of the PMOT

indicates strong internal consistency for the scale as a whole (α = .96) and for the subscales (α =.79 to .91). The PMOT was moderately correlated with the PVQ in the rehabilitation subsample (r=.71, p<.01); however, no correlation was found in the healthy subsample (p>.05). Test-retest reliability was excellent (r=.97).

CONCLUSIONS: This study provides strong preliminary evidence for psychometric properties of the PMOT for use with children in rehabilitation post ABI or OI. Future research is recommended to build upon these pilot findings for the ongoing development of this scale.

Preface

Chapters 2 to 4 are written in collaboration with my thesis committee. My role included conceiving the research question and study design, developing the measure, eliciting feedback to refine the measure, coordinating the project, completing the Ethics application and data collection for all participants and drafting written work.

A version of Chapter 2 has been submitted for publication (Tatla, S.K., Sauve,K., Jarus,T., Virji-Babul, N., and Holsti, L. Charlotte Beck, Clinical Librarian provided assistance with developing a search strategy for this review.

A version of Chapter 4 is being submitted for publication (Tatla, S.K., Jarus, T., Virji-Babul, N., and Holsti, L. (manuscript in preparation). Boris Kuzeljevic provided data analysis expertise for the study outlined in Chapter 4. Refer to the first pages of these chapters to see footnotes and prefaces with similar information.

The University of British Columbia/Children's and Women's Research Ethics Board approved this research as per Ethics Certificate number H12-01646. Vancouver Coastal Health Authority granted approval as per Certificate number #V12-01646.
This research was carried out as an independent study. The researchers and members of the graduate committee report no conflict of interest.

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List of Abbreviations

AACPDM: American Academy for Cerebral Palsy and Developmental Medicine

ABI: Acquired brain injury

DMQ: Dimensions of Mastery Questionnaire

EB-PM: Event based prospective memory

IMI: Intrinsic Motivation Inventory

LOC: Level of consciousness

OI: Orthopedic Injury

PEDI: Pediatric Evaluation of Disability Inventory

PMOT: Pediatric Motivation Scale

PVQ: Pediatric Volitional Questionnaire

TBI: Traumatic brain injury

SDT: Self-Determination Theory

VR: Virtual reality

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Dedication

To Kuldeep, my husband, partner, best friend, and #1 fan. You are a developer of ideas, people, and community. Thank you for your support, encouragement, and patience. I am eternally grateful for you.

1. Introduction

An emerging recognition for the need to examine the bio-psycho-social factors that influence rehabilitation outcomes in children with disabilities is apparent (Ronen, Fayed, & Rosenbaum, 2011; Rosenbaum & Gorter, 2012). When providing pediatric neurorehabilitation, therapists design interventions to promote health outcomes in the populations they serve. Motivational factors influencing those health outcomes have received very little attention in the rehabilitation field (Tatla et al., 2013).

Acquired brain injury (ABI), the leading cause of death and disability in children, can result in persistent and debilitating deficits that impact a child's physical, cognitive, and psycho-emotional functioning. Children with ABI remain the largest group seen in inpatient rehabilitation settings and account for 45% of all head trauma related admissions to emergency care and 25% of admissions to acute care (CIHI, 2006). Rehabilitation efforts are focused on improving independence with daily activities and functional participation in a child's home, school and community. Interventions work to reduce impairments within the child or target aspects of the task or factors in the environment to improve a child's performance (Law et al., 1998).

In rehabilitation, repetitive task practice has been identified as a key strategy to optimize neuroplastic changes after a brain injury (Doyon & Benali, 2005; Levac, Wishart, Missiuna, & Wright, 2009). For example, more than 300 daily repetitions of upper limb movement are required to induce permanent neuroplastic changes in the brain after stroke (Birkenmeier, Prager, & Lang, 2010). Over the past ten years, high intensity interventions, which are based upon the principles of neuroplasticity and motor learning, have been introduced and evidence for their effectiveness has been developing

rapidly (Gordon et al., 2011). To facilitate intensive therapy, clinicians must incorporate interventions that are motivating and salient for the child. Indeed, lack of motivation can limit children from realizing their full functional potential (Jennings, Connors, & Stegman, 1988).

Measures of motivation are necessary to determine if children are motivated to participate and to engage in their therapy and to monitor motivation over time. However, few measures exist and no measure is available to determine a child's motivation during therapy *from their perspective*. Therefore, the overarching purpose of this research was to develop and to conduct preliminary psychometric analysis of a motivation scale, the Pediatric Motivation Scale (PMOT), designed to measure a child's motivational experience from their perspective.

Chapter Two of this thesis presents a systematic review of the literature regarding what is known about the effects of motivation-based interventions in children with ABI.

Chapter Three provides an overview of Self Determination Theory to explain its application to rehabilitation and the theoretical underpinnings of the PMOT.

Chapter Four describes the development of the Pediatric Motivation Scale study. The methods used for this study are described, including recruitment strategies, inclusions and exclusion criteria for participants, outcome measures, and procedures. In addition, the analyses used to investigate the study objectives are presented. Finally, the results from this study are reported. Tables are used to summarize study findings.

Lastly, Chapter 5 presents a summary of the findings and implications for future research.

1.1 Study Objectives and Hypotheses:

The objectives of this study were to review evidence regarding the effects of motivational interventions in children and youth with acquired brain injury (ABI), to examine the application of Self Determination Theory (SDT) in the rehabilitation context, and to develop the PMOT based on tenets of SDT. Specifically, preliminary psychometric properties, including test content, face validity, convergent validity, response process, internal consistency, and test-retest reliability of the PMOT was examined.

We hypothesized the following:

1. The internal consistency of the PMOT would meet or exceed $\alpha = .70$.
2. The PMOT would at least moderately correlate with the Pediatric Volitional Questionnaire with a correlation of $r=.40$.
3. Test-reliability of the PMOT would meet or exceed $r=.80$.

2. The Effects of Motivating Interventions on Rehabilitation Outcomes in Children and Youth with Acquired Brain Injury (ABI): Literature Review

2.1 Introduction[1]

Acquired brain injury (ABI) is the leading cause of death and disability in children and can result in persistent and debilitating deficits that impact a child's physical, cognitive, and psycho-emotional functioning (V. Anderson, Spencer-Smith, & Wood, 2011). ABI is damage to the brain occurring after 3 months of age and can be classified as a traumatic brain injury (TBI), caused by trauma to the brain, or a non-traumatic brain injury (NTBI), due to medical pathology, such as stroke, encephalitis, anoxis, etc. (ABIKUS, 2007).

After neurological insult, intensive practice is highlighted as a key component to promote adaptive neuroplasticity. Notably, the dose of repetitive practice required to induce permanent neuroplastic changes is estimated to be in the thousands (Lang et al., 2009). Attaining these intensive dosages of therapy can be emotionally and physically taxing for children with brain injuries. An increasing awareness of the importance of considering factors in addition to practice, including attention, motivation and salience is apparent. Indeed, each of these three factors has been identified as an important modulator of neuroplasticity (Cramer et al., 2011). After childhood brain injury, family support systems and rehabilitation approaches can facilitate factors, such as a child's motivation and attention, to promote levels of intensive practice and adherence to therapy required to produce neuroplastic changes for recovery (B.A. Wilson, 2010). A

[1] A version of Chapter 2 has been submitted for publication (Tatla, S.K., Sauve,K., Jarus,T., Virji-Babul, N., and Holsti, L. Charlotte Beck, Clinical Librarian, provided assistance with developing a search strategy for this review.

survey conducted with 174 physicians, psychologists and therapists working in ABI rehabilitation found that in addition to cognition and awareness deficits, motivation was among the top three most frequently mentioned factors perceived to influence learning in patients (Boosman, Visser-Meily, Winkens, & van Heugten, 2013). Moreover, lack of motivation is cited as a key limitation to children achieving their functional potential in rehabilitation (Jennings et al., 1988; Van den Broeck, 2005)

Recognizing theoretically the critical role of motivation in optimizing rehabilitation outcomes, this review sought to examine what is known in the literature about the effects of motivating interventions on rehabilitation outcomes in children with ABI. The ICF views motivation as a general mental body function, specifically an energy and drive function that causes an individual to move toward satisfying specific needs and general goals in a persistent manner ("International Classification of Functioning, Disability and Health (ICF)," 2013). A motivational rehabilitation intervention is defined as one that promotes the initiation and persistence of goal-directed behaviour. The current state of evidence in the area of motivational interventions is summarized along with recommendations for future research and implications for clinical practice.

2.2 Method

The AACPDM systematic review methodology was applied as a framework through all review phases, as it was developed to address specifically the issues presented by the research literature on interventions for people with complex developmental disabilities (Darrah, Hickman, O'Donnell, Vogtle, & Wiart, 2008). This methodology provides levels of evidence for both group and single subject research design studies and an explicit strategy for examining outcomes from the ICF perspective, including possible linkages of effects across ICF components (Tatla et al., 2013).

2.2.1 Inclusion criteria

Studies were included if: 1) participants were diagnosed with a moderate to severe ABI and were aged 0-18, 2) the intervention included a purportedly motivational component in a rehabilitation setting, and 3) motor, cognitive, and/or motivational outcomes were measured.

Studies were excluded if the participants with ABI comprised less than 30% of the patient population.

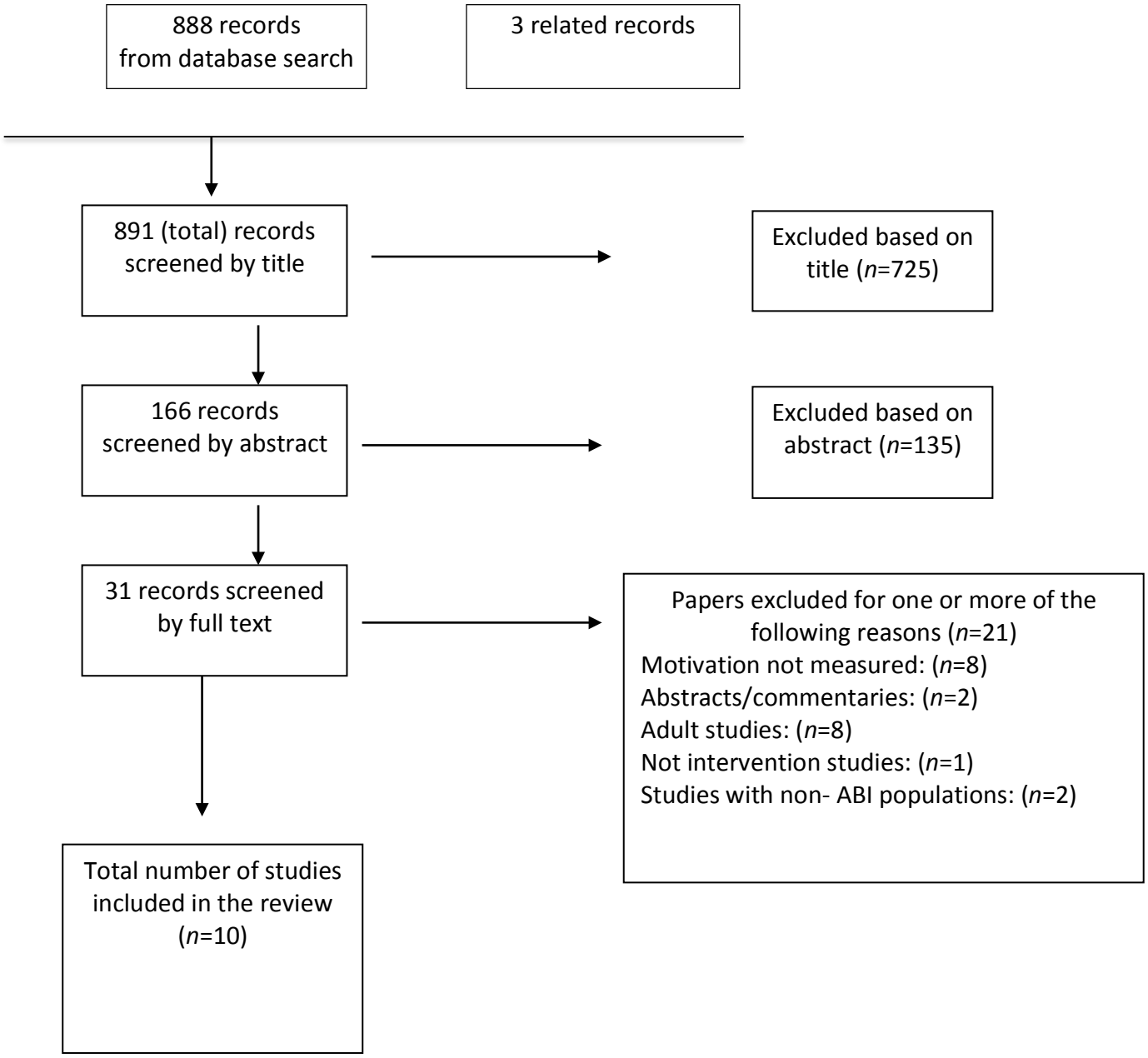
2.2.2 Literature search and results

The literature search only considered studies in or translated to English that were published in peer-reviewed journals and included in the following electronic databases: Cumulative Index to Nursing and Allied Health Literature (CINAHL) 1982 to July 2013, EMBASE 1946 to July 2013 (Ovid) and PsycINFO (EBSCO), MEDLINE 1946 to July 2013 (Ovid), the Cochrane Database of Systematic Reviews, and the Cochrane Central Register of Controlled Trials. Electronic search terms included a combination of "motivation", "achievement", "goals", "volition", "engagement", "success", "brain injury", "brain contusion", "encephalopathy", "stroke", "rehab", "function", "train", with child limits set for all searches. Further literature was obtained by exploring the reference lists of studies and by reviewing articles related to included papers. See Appendix A for a record of the search strategy.

The initial database search yielded 888 articles. All articles were screened by title and three additional articles were added through hand searching. One hundred and sixty-six articles were screened by abstract, with 31 articles examined by full text, and studies were excluded for reasons described in Figure 2.1. Thus, a total of ten studies

remained for analysis.

Figure 2.1: Literature Search Flow Diagram



2.2.3 Data extraction and organization

Two reviewers screened for inclusion, extracted data, rated levels of evidence (Tables 2.1a,b), appraised study quality (Tables 2.1c,d), and classified outcomes according to the ICF. Reviewers independently appraised level of evidence (LoE), study quality for LoE I-III studies, and the classification for ICF, then discussed and resolved in cases of initial differences in classification. When required, authors were contacted to gather additional information not reported in the article.

Table 2.1a: Levels of Evidence for Group Designs

Level	Intervention (Group) Studies
I	Systematic review of randomized controlled trials (RCTs) Large RCT (with narrow confidence intervals) (n >100)
II	Smaller RCT's (with wider confidence intervals) (n<100) Systematic reviews of cohort studies "Outcomes research" (very large ecologic studies)
III	Cohort studies (must have concurrent control group) Systematic reviews of case control studies
IV	Case series Cohort study without concurrent control group (e.g. with historical control group) Case-control Study
V	Expert Opinion Case study or report Bench research Expert opinion based on theory or physiologic research Common sense/anecdotes

Table 2.1b: Levels of Evidence for Single Subject Research Designs

Level	Single Subject Design Studies
I	Randomized controlled N-of-1 (RCT), alternating treatment design (ATD), and concurrent or non-concurrent multiple baseline design (MBDs); generalizability if the ATD is replicated across three or more subjects and the MBD consists of a minimum of three subjects, behaviours, or settings. These designs can provide causal inferences.
II	Non-randomized, controlled, concurrent MBD; generalizability if design consists of a minimum of three subjects, behaviours, or settings. Limited causal inferences.
III	Non-randomized, non-concurrent, controlled MBD; generalizability if design consists of a minimum of three subjects, behaviours or settings. Limited causal inferences.
IV	Non-randomized, controlled SSRDs with at least three phases (ABA, ABAB, BAB, etc.); generalizability if replicated across three or more different subjects. Only hints at causal inferences.
V	Non-randomized controlled AB SSRD; generalizability if replicated across three or more different subjects. Suggests causal inferences allowing for testing of ideas.

Table 2.1c: Conduct questions of Group Design Studies for studies with levels of evidence I, II or III.

1. Were inclusion and exclusion criteria of the study population well described and followed?
2. Was the intervention well described and was there adherence to the intervention assignment? (for 2-group designs, was the control exposure also well described?) Both parts of the question need to be met to score 'yes'.
3. Were the measures used clearly described, valid and reliable for measuring the outcomes of interest?
4. Was the outcome assessor unaware of the intervention status of the participants (i.e., were the assessors masked)?
5. Did the authors conduct and report appropriate statistical evaluation including power calculations? Both parts of the question need to be met to score 'yes'.
6. Were dropout/loss to follow-up reported and less than 20%? For 2-group designs, was dropout balanced?
7. Considering the potential within the study design, were appropriate methods for controlling confounding variables and limiting potential biases used?

Study Quality Rating: Weak (W): 1-3; Moderate (M): 4-5; Strong (S): 6-7

Table 2.1d: Conduct questions of Single Subject Research Design Studies for studies with levels of evidence I, II or III.

1. Was/were the participant(s) sufficiently well described to allow comparison with other studies or with the reader's own patient population?
2. Were the independent variables operationally defined to allow replication?
3. Were intervention conditions operationally defined to allow replication?
4. Were the dependent variables operationally defined as dependent measures?
5. Was inter-rater or intra-rater reliability of the dependent measures assessed before and during each phase of the study?
6. Was the outcome assessor unaware of the phase of the study (intervention vs. control) in which the participant was involved?
7. Was stability of the data demonstrated in baseline, namely lack of variability or a trend opposite to the direction one would expect after application of the intervention?
8. Was the type of SSRD clearly and correctly stated, for example, A-B, multiple baseline across subjects?
9. Were there an adequate number of data points in each phase (minimum of five) for each participant?
10. Were the effects of the intervention replicated across three or more subjects?
11. Did the authors conduct and report appropriate visual analysis, for example, level, trend and variability?
12. Did the graphs used for visual analysis follow standard conventions, for example x- and y-axes labeled clearly and logically, phases clearly labeled (A,B, etc.) and delineated with vertical lines, data paths separated between phases, consistency of scales?
13. Did the authors report tests of statistical analysis, for example celeration line approach, two-standard deviation band method, C-statistic, or other?
14. Were all criteria met for the statistical analyses used?

Study Quality Rating: Weak (W): <7; Moderate (M): 7-10; Strong (S): 11-14

2.3 Summary of Findings

2.3.1 Study Types, Participants, and Interventions (Tables 2.2a,b)

This body of evidence comprises seven group studies and three single subject research studies (SSRDs). Four group research designs capable of producing level I evidence received a weak quality rating and one level II study received a moderate quality rating (Table 2.3a). In addition, one SSRD capable of producing level I evidence received a strong rating (Tables 2.3b). The remaining four studies produced level IV and V evidence, but this level of evidence is insufficiently robust to include in the evidence table for analysis. Nevertheless, these studies provide useful information as pilot data for future research.

Of the 507 children included in the studies, there were 241 children and youth with moderate to severe ABI. Mixed into the samples were 191 children with orthopedic injury (OI), 31 children with attention deficit/hyperactivity disorder (ADHD), 26 children acting as healthy controls, 15 children with mild TBI, and a single child with meningomyelocele or upper plexus paresis or Guillian Barre. Participants' ages ranged from six to 16 years and the sample included 343 males and 164 females. The higher proportion of males represented in this sample is consistent with higher incidence rates of ABI amongst males in the general population (68%) (Faul, Xu, Wald, & Coronado, 2010).

The experimental or motivational interventions are categorized within the environmental component of the ICF. In six of the ten studies, the motivational component was a reward contingency in the form of a product used for play (i.e. small toy), or a financial asset (i.e. products, such as dollars or pennies), or support and relationships through praise from health professionals. The rewards were presented when participants successfully performed the tasks in each respective study. In four studies the motivational condition was manipulated such that either pennies (low motivation) or dollars (high motivation) were given for successful performance during an event-based memory task (McCauley, McDaniel, Pedroza, Chapman, & Levin, 2009; McCauley, Pedroza, et al., 2011; McCauley et al., 2010; McCauley, Wilde, et al., 2011). In another study, toys, sweets or verbal feedback were given to participants for successful response inhibition during a computer task (Konrad, Gauggel, Manz, & Scholl, 2000). Lastly, in an SSRD, points and money were offered to participant's contingent upon their attendance to therapy (Zencius, Wesolowski, & Burke, 1989).

In three studies, the motivational component was a technological product made available, specifically, a virtual reality (VR) component. VR is an interactive computer-based environmental system that presents artificially generated sensory information (Laufer & Weiss, 2011). These studies assessed motivation and other outcomes using a rehabilitation specific system, the pediatric interactive therapy system (PITS) (Wille et al., 2009), or commercially available consoles, including the Nintendo Wii-Fit (Cheung, Maron, Tatla, & Jarus, 2013; Tatla, Radomski, Cheung, Maron, & Jarus, 2012) and the X-Box Kinect (Cheung et al., 2013). Finally, the motivational component in one study consisted of an assistive product for education, a memory and attention training program for children designed to be integrated into school and maintain the child's motivation while improving his/her memory, attention and executive functioning skills (Sjo, Spellerberg, Weidner, & Kihlgren, 2010).

Table 2.2a: Summary of studies- Intervention and participants (group studies)

Citations	*Purpose*	*LOE, Quality & Research Design*	*Participants*	*Total n*	*Ages (years)*	*Intervention*
McCauley et al., 2009[McCauley et al., 2009]	To examine the effect of monetary incentives on event-based prospective memory (EB-PM) in children and adolescents with severe TBI, mild TBI, and OI one year post injury	I-W (3/7) Randomized cross over trial	Children and adolescents 1 year post TBI or OI	*N*=84 Severe TBI (GCS≤ 8): *n*=27 Mild TBI (GCS 13-15): *n*=15 OI: *n*=42	6-19	*Motivating Intervention:* During neuropsychology testing, children were given dollars for remembering to ask for 3 points each time each time the phrase "Let's try something different" was used during the 1 hour assessment. The cue was presented every 15-20 mins. *Control Intervention:* Same as above, except children were given pennies for remembering to ask for 3 points each time the cue was presented.
McCauley et al., 2010[McCauley et al., 2010]	To examine the effect of monetary incentives on EB-PM in children and adolescents during sub-acute recovery after moderate to severe TBI	I-W (3/7) Randomized cross over trial	Children in sub acute phase after moderate or severe brain injury & children with OI	*N*= 119 Severe TBI (GCS≤ 8): *n*=30 Moderate TBI (GCS 9-15): *n*= 28 OI: *n*= 61	7-16	*Motivating Intervention:* Same as above. *Control Intervention:* Same as above.
McCauley et al., 2011[McCauley, Pedroza, et al., 2011]	To examine the effect of monetary incentives on EB-PM in children with TBI at 3 months post-injury	I-W (3/7) Randomized cross over trial	Children 3 months post moderate or severe brain injury & children with orthopedic injuries	*N*=115 Severe TBI: *n*=39 Moderate TBI: *n*=25 OI: *n*= 51	7-16	*Motivating Intervention:* Same as above. *Control Intervention:* Same as above.
McCauley et al., 2011[McCauley, Wilde, et al., 2011]	To examine the neural correlates of EB-PM with high vs. low motivation conditions 3 months post-injury in children and adolescents with moderate to severe TBI using concurrent MRI.	I-M (4/7) Randomized cross over trial	Children 3 months post moderate or severe brain injury & children with orthopedic injuries	*N*= 77 Moderate-to-severe TBI: *n*=40 OI: *n*= 37 **Note subsample from previous study overlapped with this one*	7-16	*Motivating Intervention:* Same as above. *Control Intervention:* Same as above.
Konrad et al., 2000	To investigate the influence of reward on response inhibition in children with Attention	II-W (3/7) Randomized control trial	Children with ADHD, moderate to severe TBI, and healthy controls.	*N*= 94 ADHD: *n*= 31 Moderate to Severe TBI: *n*=	8-12	*Motivating Intervention:* Reward contingencies (such as toys, sweets, and verbal feedback) given as positive reinforcement for successful response inhibition during a UFO computer activity whenever a stop

Citations	Purpose	LOE, Quality & Research Design	Participants	Total n	Ages (years)	Intervention
	deficit/hyperactivity disorder (ADHD) or TBI			37 Healthy controls: *n*= 26		signal (1kHz tone presented through earphones) was given. *Control Intervention:* Same activity as above, but no reward given for successful inhibition responses.
Wille et al., 2009	To evaluate the effect of a virtual reality (VR) based system on upper limb function and motivation.	IV Pilot Case series	Children with congenital or acquired upper limb motor deficits	*N*=5 (Acquired brain injury, meningomyelocele, upper plexis paresis, Guillain-Barre syndrome)	11-15	*Motivating Intervention:* VR based, paediatric interactive therapy system (PITS) containing 3 gaming scenarios provided for 45 mins 3x/week over 3 weeks as part of occupational therapy. *Control Intervention:* None.
Sjo et al., 2010[Sjo et al., 2010]	To determine whether a memory & attention training program could be integrated into the child's school, help maintain motivation & result in changes in memory, attention, and executive functions	IV Pilot Case series	Youth 1+ year post ABI with attention &/or memory sequellae (traumati brain injury, tumour, and stroke)	N=8, with one drop out (TBI, stroke, brain tumour)	11-15 mean: 13.5 (SD 1.5)	*Motivating Intervention:* Amsterdam Memory and Attention Training for Children (AMAT-C) completed 45 min daily over 18-20 wks with one-on-one training sessions. *Control Intervention:* None.

LOE: Level of Evidence; ABI: Acquired brain injury; TBI: Traumatic brain injury, OI: Orthopedic injury, OT: occupational therapy; PT: physiotherapy; VR: Virtual Reality

Table 2.2b: Summary of studies- Intervention and participants (single subject research studies)

Citations	*Purpose*	*LOE, Quality & Research Design*	*Participants*	*Total n*	*Ages (years)*	*Intervention*
Tatla et al., 2012	To evaluate the effectiveness of the Nintendo Wii compared to traditional balance therapy in improving balance, motivation, and functional ability in children with ABI	I-S (11/14) Non-concurrent, Randomized Multiple Baseline Design	Youth within 1 year of ABI undergoing inpatient rehabilitation	*N*= 3 (TBI and stroke)	12-14	*Motivating Intervention:* Wii-Fit balance training 30 min/day with OT or PT for 8, 12 or 15 days depending on protocol assigned (Phase B) *Control Intervention:* Traditional balance therapy 30 min/day with OT or PT for 5, 8, or 12 days depending on protocol assigned. Activities were individualized depending on the clients needs (e.g. throwing/catching beanbags/ balls outside base of support, reaching on unstable surfaces, side stepping, walking up/down stairs, single let stance, and kicking activities) (Phase A)
Zencius et al., 1989[Zencius et al., 1989]	To compare the effectiveness of three motivational systems for therapy attendance: behavioural contracting, a point system that was strictly reinforcing, and a point system plus response costs	IV- A-B-A) Multiple Treatment Design	Adolescents receiving inpatient rehabilitation post ABI	*N*=2 (TBI)	16	*Motivating Intervention:* Adolescents prompted to attend therapy sessions using different types of contingencies: • Behavioural contracting (Phase B) • Point system (Phase C) • Point system plus monetary incentive (Phase D) *Control Intervention: :* Baseline with no contingencies for attending therapy (Phase A)
Cheung et al., 2013	To explore the effect of X-box Kinect on improving balance and motivation in one child with an ABI	V Non-randomized controlled SSRD	Youth within 1 year of ABI undergoing inpatient rehabilitation	*N*= 1 (Stroke)	10 y	*Motivating Intervention:* VR balance training for 30 mins/day with OT or PT, using X-Box Kinect Adventures and Kinect Sport games (8 days) ,and Nintendo Wii Fit games (7 days). *Control Intervention:* Traditional balance therapy 30 min/day with OT or PT for 5 days. Activities included: standing reaches (high/low), throwing/catching beanbags, side stepping, and walking.

LOE: Level of Evidence; ABI: Acquired brain injury; OT: occupational therapy; PT: physiotherapy; VR: Virtual Reality

Table 2.3a: Conduct of Group Design Studies for studies with levels of evidence I, II or III.

Study	Level/Quality	1	2	3	4	5	6	7
McCauley et al.[McCauley et al., 2009]	I-W (3/7)	Yes	No	No	No	No	Yes	Yes
McCauley et al.[McCauley et al., 2010]	I-W (3/7)	Yes	No	No	No	No	Yes	Yes
McCauley et al.[McCauley, Pedroza, et al., 2011]	I-W (3/7)	Yes	No	No	No	No	Yes	Yes
McCauley et al.[McCauley, Wilde, et al., 2011]	I-M (4/7)	Yes	No	Yes	No	No	Yes	Yes
Konrad et al., 2000	II- W (3/7)	Yes	No	No	No	No	Yes	Yes

Weak (W): 1-3; Moderate (M): 4-5; Strong (S): 6-7

Table 2.3b: Conduct of Single Subject Research Design Studies for studies with levels of evidence I, II or III.

Study	Level /Quality	1	2	3	4	5	6	7	8	9	10	11	12	13	14
(Tatla et al., 2012)	I-S (11/14)	Yes	Yes	Yes	Yes	No	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes

Weak (W): <7; Moderate (M): 7-10; Strong (S): 11-14

2.3.2 Outcomes, measures, and results

The outcomes of interest were memory, attention, motor, and energy and drive/motivation outcomes (Tables 2.4a,b). In eight of the 10 studies, outcomes were evaluated in a motivational condition compared to a control condition consisting of traditional therapy or incentives considered to be less motivating. Two studies did not have a comparison intervention, rather evaluated the effects of the motivating intervention alone (Sjo et al., 2010; Wille et al., 2009)

Four of the ten studies were randomized cross over trials measuring event-based prospective memory performance (EB-PM) during two sessions of neuropsychological testing in children at various intervals post mild TBI, moderate to severe TBI, or orthopedic injury (OI) (McCauley et al., 2009; McCauley, Pedroza, et al., 2011; McCauley et al., 2010; McCauley, Wilde, et al., 2011). Participants underwent the same activity in both sessions, receiving either pennies or dollars for correctly remembering to ask for points when an EB-PM cue was given to them during each session. In another randomized control trial, reaction time was measured in children with ADHD, moderate to severe TBI, and healthy children while they underwent two sessions of a computer activity and randomly received either a reward contingency, such as praise, toys, or sweets, or no reward contingency when correctly performing the stopping behaviour upon receiving a stop signal cue (Konrad et al., 2000).

In two SSRD studies, children with ABI underwent varying lengths of Wii Fit, Kinect, or traditional balance therapy during OT or PT for 30 minutes over a four-week intervention (Cheung et al., 2013; Tatla et al., 2012). Motivation to participate in therapy, and dynamic and static balance were measured after each session, with weekly assessment of participants' functional abilities. In a pilot case series study, clients'

motivation to participate in VR-based occupational therapy was measured after every session and upper limb function was assessed before and after the three-week intervention (Wille et al., 2009). Lastly, investigators evaluated participants' memory, attention, and executive function skills in school-aged children with ABI, before and after completing a daily 45-minute attention and memory-training program (Sjo et al., 2010). The child's motivation to participate in therapy was measured daily over the 20-week intervention.

2.3.3 Evidence Table

Table 2.5 aggregates the evidence, which is limited to the results of studies capable of producing Levels I to III evidence, as Level IV and V results are insufficiently robust to inform clinical practice. Results are presented according to ICF categories and indicators based on the strength of the evidence.

Table 2.4a: Summary of studies: outcomes, measures, and results (group studies, levels I-V)

Study	Outcome of Interest	ICF Comp	Measure	Result	Statistics	LOE
McCauley et al., 2009[McCauley et al., 2009]	EB-PM Performance	BF	Total # points collected during session (Exp)	+ OI	p=.00	I+W
		BF	Total # points collected during session (Exp)	+ Mild TBI	p<.02	I+W
		BF	Total # points collected during session (Exp)	+ STBI	p<.00	I+W
		BF	Total # points collected during session (Exp)	OI > STBI	p<.00	I+W
		BF	Total # points collected during session (Exp)	Mild TBI>STBI	p=.00	I+W
		BF	Total # points collected during session (Ctl)	OI > STBI	p<.00	I+W
		BF	Total # points collected during session (Ctl)	Mild TBI>STBI	p<.00	I+W
	Age & EB-PM Performance	PF	Age in years	Older> younger	p=.02	I+W
	Gender & EB-PM Performance	PF	Sex		*NS*	I+W
	Socioeconomic status	EF	Socioeconomic Composite Index		*NS*	I+W
McCauley et al., 2010[McCauley et al., 2010]	EB-PM Performance	BF	Total # points collected during session (Exp)	+ OI	p<.00, d= .59	I+W
		BF	Total # points collected during session (Exp)	+MTBI	p<.03, d= .44	I+W
		BF	Total # points collected during session (Exp)	+STBI	*NS*, d= -.12	I+W
		BF	Total # points collected during session (Exp)	OI>MTBI	p=.08	I+W
		BF	Total # points collected during session (Exp)	OI>STBI	p<.00	I+W
		BF	Total # points collected during session (Exp)	MTBI>STBI	p<.03	I+W
		BF	Total # points collected during session (Ctl)	OI>MTBI	*NS*	I+W
		BF	Total # points collected during session (Ctl)	OI>STBI	p=.00	I+W
		BF	Total # points collected during session (Ctl)	MTBI vs STBI	*NS*	I+W
	Age & EB-PM Performance	PF	Age in years	Older>younger	p<.02	I+W
	Gender & EB-PM Performance	PF	Sex		*NS*	I+W
	Socioeconomic status	EF	Socioeconomic Composite Index		*NS*	I+W
McCauley et al., 2011[McCauley, Pedroza, et al., 2011]	EB-PM Performance	BF	Total # points collected during session (Exp)	+ OI	p=.00, d= .68	I+W
		BF	Total # points collected during session (Exp)	+MTBI	p<.03, d= .69	I+W
		BF	Total # points collected during session (Exp)	+STBI	*NS*, d=.22	I+W
		BF	Total # points collected during session (Exp)	OI>MTBI	*NS*	I+W
		BF	Total # points collected during session (Exp)	OI>STBI	p<.00	I+W
		BF	Total # points collected during session (Exp)	MTBI>STBI	p<.01	I+W
		BF	Total # points collected during session (Ctl)	OI>MTBI	*NS*	I+W
		BF	Total # points collected during session (Ctl)	OI>STBI	p=.00	I+W
		BF	Total # points collected during session (Ctl)	MTBI>STBI	*NS*	I+W
	Age & EB-PM Performance	PF	Age in years	Older> younger	p=.03	I+W
	Gender & EB-PM Performance	PF	Sex		*NS*	I+W
	Socioeconomic status	EF	Socioeconomic Composite Index		*NS*	I+W
McCauley et al.,2011[McC	Neural pathological changes	BF	*DTI using FA in 3 regions of interest	OI>M-STBI	$p\leq$ .00	I+M
	Neural pathological changes	BF	wDTI using ADC in 3 regions of interest	OI<M-STBI	$p\leq$ .00 – p<.04	I+M
	Neural correlates with motivation condition	BF	*DTI using FA in 3 regions of interest (Exp)	+ M-STBI	$p\leq$ .00	I+M

Study	Outcome of Interest	ICF Comp	Measure	Result	Statistics	LOE
auley, Wilde, et al., 2011)		BF	*DTI using FA in 3 regions of interest (Exp)	OI	*NS*	I+M
		BF	◆DTI using ADC in 3 regions of interest (Exp)	- M-STBI	*NS*	I+M
		BF	◆DTI using ADC in 3 regions of interest (Ctl)	- M-STBI	*NS*	I+M
		BF	◆DTI using ADC in 3 regions of interest (Ctl)	OI	*NS*	I+M
Konrad et al., 2000	Response inhibition	BF	Stop signal reaction time (Exp)	+ADHD	ω= .47	II+W
		BF	Stop signal reaction time (Exp)	+TBI	ω= .16	II+W
		BF	Stop signal reaction time (Exp)	+Ctl	ω= .17	II+W
		BF	Stop signal reaction time (Exp)	TBI>ADHD	*p*=.02	II+W
		BF	Stop signal reaction time (Exp)	TBI>Ctl	*p*=.00	II+W
		BF	Stop signal reaction time (Exp)	ADHD>Ctl	*NS*	II+W
		BF	Stop signal reaction time (Ctl)	TBI> ADHD	*NS*	II+W
		BF	Stop signal reaction time (Ctl)	TBI> Ctl	*p*< .00	II+W
		BF	Stop signal reaction time (Ctl)	ADHD> Ctl	*p*= .03	II+W
Wille et al., 2009	Motivation	BF	Unknown	+		V
	Upper limb function	A/P	MUUL	+	*NS*	IV
	Upper limb function	A/P	Box and Block Test	+	*p*=.03	IV
	Fine motor dexterity	A/P	Nine Hole Peg Test	+	*NS*	IV
Sjo et al., 2010(Sjo et al., 2010)	Motivation	BF	Did child want to start training each day?	+		IV
	Cognition	BF	WISC-III	+/-		IV
		BF	NASC	+/-		IV
	Attention	BF	TEA-Ch	+/-		IV
	Executive functioning	BF	BRIEF	+/-		IV

Legend, Table 2.4a:

ADC, apparent diffusion coefficient; A/P, Activities & Participation; BF, Body Functions; BRIEF, Behaviour Rating Inventory of Executive Function; Comp, Component; DTI, Diffusion tensor imaging; EB-PM, Event based prospective memory; EF, Environmental Factors; FA, fractional anisotropy; MTBI, moderate traumatic brain injury; M-STBI, moderate to severe traumatic brain injury; MUUL, Melbourne Assessment of Unilateral Upper Limb Function; NASC, Neurological Assessment of the School-Aged Child; NS, Not significant; OI, Orthopedic injury; PF, Personal Factors; STBI, severe traumatic brain injury; TEA-Ch, Test of Everyday Attention for Children; WISC-III, Wechsler Intelligence Scale for Children III
*Note: FA ranges from 0 to 1, with lower diffusion indicative of more severe injury. 3 regions of interest include: cingulum bundles, orbitofrontal white matter, and uncinate fasciculi
◆Note: ADC ranges from 0 to 1, and is inversely proportional to FA. Higher diffusion indicative of more severe injury. 3 regions of interest include: cingulum bundles, orbitofrontal white matter, and uncinate fasciculi
(+), improved results; (-), worse results; (+/-), mixed results

Table 2.4b: Summary of studies: outcomes, measures, and results (single subject research studies, levels I-V)

Study	Outcome of Interest	ICF Comp	Measure	Result	Statistics	LOE
Tatla et al., 2012	Motivation	BF	Study-specific VAS (Therapy)	+		I+S
		BF	Study-specific VAS (Wii)	+	*BE 1/3*	I+S
	Dynamic Balance	A/P	Timed Up and Go (Therapy)	+		I+S
		A/P	Timed Up and Go (Wii)	+	*BE 2/3*	I+S
		A/P	MFRT (Therapy)	+/-		I+S
		A/P	MFRT (Wii)	+/-	*BE 1 subtest 3/3*	I+S
	Static Balance	A/P	Centre of Pressure (Therapy)	inconclusive		I+S
		A/P	Centre of Pressure (Wii)	inconclusive		I+S
	Functional Abilities	A/P	PEDI (Therapy)	+		I+S
		A/P	PEDI (Wii)	+		
Zencius, 1989	Motivation to attend therapy	A/P	Therapy Attendance (Regular therapy)	-		IV
		A/P	Therapy Attendance (Points)	+		IV
		A/P	Therapy Attendance (Points + Monetary/Activity)	+		IV
		A/P				
Cheung et al., (in press)	Motivation	BF	Study-specific VAS (Therapy)	+		V
		BF	Study-specific VAS (Kinect)	+/-		V
		BF	Study-specific VAS (Wii)	+	*BE*	V
		A/P	Timed Up and Go (Baseline therapy)	+		V
		A/P	Timed Up and Go (Kinect)	+	*BE*	V
	Dynamic Balance	A/P	Timed Up and Go (Wii)	+	*BE*	V
		A/P	MFRT (Therapy)	-		V
		A/P	MFRT (Kinect)	+	*BE*	V
		A/P	MFRT (Wii)	+	*BE*	V
	Static Balance	A/P	Centre of Pressure (Therapy)	+		V
		A/P	Centre of Pressure (Kinect)	+	*BE*	V
		A/P	Centre of Pressure (Wii)	+	*BE*	V

Legend, Table 2.4,b:

A/P, Activities & Participation; BE, Basic effect BF, Body Functions; Comp, Component; EF, Environmental Factors; MFRT, Modified Functional Reach Test; Pediatric Evaluation of Disability Index (Caregiver Assistance and Modification Scale); PF, Personal Factors; VAS, Visual Analogue Scale; Wii, Nintendo Wii; Kinect, X-Box Kinect

(+), improved results; (-), worse results; (+/-), mixed results

Table 2.5: Evidence table- outcomes of motivational interventions for children and youth with moderate to severe acquired brain injury (level of evidence I, II, or III)

Outcomes by ICF Component of Function and Disability	Improved Results with Motivational Intervention (Statistically Significant)	Improved Results with Motivational Intervention (but not statistically evaluated)	Correlation with Motivational Intervention (Statistically Significant)	Worse Results with Motivational Intervention (Statistically Significant)	Results Unchanged or Not Statistically Significant
Body Functions					
Motivation		◆ I+S (Tatla et al., 2012)			
EB-PM performance	I+W(McCauley et al., 2009); I+W(McCauley et al., 2010); I+W(McCauley et al., 2011)	I+W(McCauley et al., 2010); I+W(McCauley et al., 2011)			
Neural correlates with motivational condition			I+M(McCauley et al., 2011b)		
Response inhibition	II+W (Konrad et al., 2000)				
Activities & Participation					
Dynamic balance		◆ I+S (Tatla et al., 2012)			◆ I+S (Tatla et al., 2012)
Functional Abilities		◆ I+S (Tatla et al., 2012)			

*EB-PM: Event based prospective memory; ◆Denotes SSRD

2.4 Analysis and Discussion of the Evidence

i. What evidence exists about the effects of motivating interventions for children and youth with moderate to severe ABI on outcomes representing components of the ICF?

Body Functions

Memory Functions: In children with moderate TBI, findings from three studies demonstrate that extrinsic motivators in the form of monetary incentives result in significantly greater prospective memory performance during the sub-acute phase of recovery (level I-W) (McCauley et al., 2010) or three months post injury (McCauley, Pedroza, et al., 2011), or one year post injury (McCauley et al., 2009). However, in children with severe TBI, monetary incentives significantly improved prospective memory performance only one year post injury (McCauley et al., 2009), with non-significant improvements during the sub-acute phase (McCauley et al., 2010), and three months post injury (level I-W) (McCauley et al., 2010)b. In addition, findings of a study examining brain behaviour relations suggest that particular white matter structures known to be important in prospective and episodic memory functioning and reward processing (cingulum bundles, orbitofrontal white matter, and uncinate fasciculi), are damaged in individuals with moderate to severe TBI; this outcome was found to correlate with participants' motivation based EB-PM performance, such that greater damage in these white matter structures was associated with poorer performance in highly motivating conditions (level I-M). No significant correlation was found between the extent of damage and performance in less motivating conditions (McCauley, Wilde, et al., 2011).

Response Inhibition: A single RCT indicates that children with moderate to severe TBI significantly improved their performance during a stopping task in the presence of external motivators involving praise, toys, or sweets, with weak to moderate effects (ω^2= .16). However, children with TBI were less responsive to these extrinsic motivators in comparison to children with ADHD, who showed large effects (ω^2= .47) in response to reward reinforcement (level II- W) **(**Konrad et al., 2000)**.**

Energy and drive functions: Motivation. A single SSRD (level I-S) showed that youth were highly motivated during a Wii-Fit balance intervention. However, a basic effect (indicating significantly greater results in the treatment intervention) was observed only in one of three participants, with both of the other participants demonstrating equal levels of motivation during Wii and traditional balance therapy (Tatla et al., 2012).

Although level IV and level V evidence contains too much bias to be confident in the validity of findings, studies comprising these categories provide some indication for outcomes of interest that have not been studied in a more robust manner. With regard to motivation, findings from one level IV study indicate that participants were motivated during rehabilitation using a rehabilitation specific VR system (Wille et al., 2009). Another level IV study reported anecdotal evidence from parents, teachers and children with TBI indicating that the children were motivated to start training each day of a memory and attention program (Sjo et al., 2010). Finally, a level V SSRD demonstrated that a client was consistently highly motivated during Wii-Fit balance therapy but that motivation fluctuated when using the X-Box Kinect for balance rehabilitation (Cheung et al., 2013)

Activity

Dynamic balance: Evidence from a single SSRD (level I –S) indicates mixed results regarding changes in dynamic balance during a Wii-Fit balance intervention compared to traditional therapy (Tatla et al., 2012). Dynamic balance performance measured by the Timed Up and Go assessment (Williams, Carroll, Reddihough, Phillips, & Galea, 2005) was greater for two of three participants, during Wii-Fit therapy in comparison to traditional balance therapy, however, participants demonstrated mixed results when balance was assessed using the Modified Functional Reach Test (MFRT) (Gan, Tung, Tang, & Wang, 2008), with all participants displaying significant improvement on the MFRT subtest involving side reaching using their unaffected arm (Tatla et al., 2012).

Static Balance: Static balance results were inconclusive in the level I (S) SSRD because reliable readings could not be obtained for all participants using a center of pressure measure on the Wii-Fit Balance Board (Tatla et al., 2012).

Given that results in this important area are based on the findings of a single level I SSRD, preliminary findings from the levels IV to V evidence from Table II will also be mentioned. A rehab-specific VR intervention showed significant improvements in upper limb functioning on one of three upper limb measures, the Box and Block Test (Wille et al., 2009). In addition, a level V SSRD showed positive trends for improvements in both static and dynamic balance for both Kinect and Wii-Fit interventions in comparison to traditional balance therapy for one youth with an ABI (Cheung et al., 2013). Finally, extrinsic motivators in the form of points and monetary incentives resulted in higher attendance rates in therapy for two individuals with an ABI (Zencius et al., 1989).

Other components of the ICF

The potential effects of motivational interventions on body structures, and participation, were not investigated in this body evidence. In three of the studies exploring EB-PM, environmental and personal factors were examined to determine if significant differences were present within the sample of participants and none were found (McCauley et al., 2009; McCauley, Pedroza, et al., 2011; McCauley et al., 2010).

ii. What evidence exists for linkages of effects within and between these ICF components?

Investigators did not explicitly study linkages between components of the ICF and this body of evidence is too limited to examine any effects across these categories.

iii. What kinds and magnitude of adverse events have been reported?

Two studies reported the presence of adverse events during the intervention and found none (Cheung et al., 2013; Tatla et al., 2012). All other studies did not report in this area.

iv. What is the strength of the evidence?

The body of evidence exploring the effects of motivational interventions on rehabilitation outcomes in children with ABI is scarce. Nevertheless, it is positive that five out of 10 studies employed rigorous designs representing level I and II evidence. Four group studies were assigned ratings of level I evidence; with weak or moderate quality ratings and one level II study received a weak quality rating (Table 3a). One SSRD received a strong quality rating (Table3b). Methodological shortcomings of studies included (1) insufficient description of adherence to intervention assignment; (2) lack of reporting about outcome

measures, including measures of motivation; (3) lack of use of valid and reliable measures; (4) lack of assessor blinding to intervention status of participants; and (5) with the exception of the studies by McCauley and colleagues (2009, 2010, 2011), sample sizes in studies were notably limited. Further potential areas for improvement include blinded assessors where feasible, and more thorough reporting about outcome measures, including those related to motivation and cognitive outcomes.

While four level IV and V evidence studies offer little to inform evidence-based practice in terms of evaluating intervention effectiveness for balance (Cheung et al., 2013), upper limb function (Wille et al., 2009), therapy attendance (Zencius et al., 1989) and memory and attention (Sjo et al., 2010), this research provides preliminary evidence that can lay the foundation for more robust research designs and can be used to establish treatment or evaluation protocols for larger studies.

2.5 Summary and Directions for Future Research

A paucity of evidence has explored the motivational component of rehabilitation interventions and its effects on rehabilitation outcomes in children and adolescents with ABI. The findings from this review reveal a body of evidence that is comprised of studies which fall into three categories: (1) studies that have applied token economies as extrinsic motivators and measured the impact on outcomes in comparison to a control treatment without incentives (Konrad et al., 2000; McCauley et al., 2009; McCauley, Pedroza, et al., 2011; McCauley et al., 2010; McCauley, Wilde, et al., 2011; Zencius et al., 1989); (2) studies that measured participant motivation during virtual reality interventions alone (Wille et al., 2009), or in comparison to traditional therapy (Cheung et al., 2013; Tatla et al., 2012) to determine effects of the intervention on rehabilitation outcomes; and (3) a single study that

measured participant motivation and other outcomes during a memory and attention intervention (Sjo et al., 2010).

The presence of level I and II evidence exploring the application of token economy systems is promising because it provides a basis for inferring the impact of incentives on rehabilitation outcomes for individuals with ABI. Findings from these studies indicate that while children and adolescents with moderate TBI benefit from the use of incentives to enhance prospective memory performance during the sub-acute phase or one-year post injury, individuals with severe TBI benefit from incentives one-year post injury only. Brain imaging findings also show that damage to brain regions involved in both memory and motivation is greater in those with more severe TBI. In the area of response inhibition, level II (M) evidence from one study indicates that children with moderate to severe TBI benefit from token economies to significantly improve their responsiveness to stopping tasks, when prompted; however, they show less responsiveness to these extrinsic rewards than children with ADHD. Collectively, these findings suggest a potential link between etiology and response to extrinsic motivators and that the effects of motivational incentives may vary based on the severity of brain injury. These findings justify the need for future research to explore links between etiology, brain injury severity, and motivational performance. While the aforementioned studies demonstrate the beneficial effects of incentives on individuals with moderate to severe TBI, each intervention was completed over only two sessions of one-hour duration. Therefore, further research is needed to determine the effects of these types of incentives on sustaining client motivation for tasks carried out over a longer duration. Furthermore, the application of incentives as external motivators is debatable in rehabilitation because this form of motivation does not necessarily promote patients' intrinsic motivation (Deci & Ryan, 2000). However, in certain instances, applying external

reinforcers may be the only way to motivate a client. In these cases, it would be useful to develop a plan to support reinforcement fading so that a child can independently be motivated to promote self-sustaining behaviour (Ziviani, Poulsen, & Cuskelly, 2013).

Three studies evaluated the effects of VR systems, including, the Nintendo Wii, the X-box Kinect, (level V-SSRD), and a rehab specific system (IV-Group study). A pilot SSRD (level I-S) reported about activity outcomes, demonstrating promise for the use of the Nintendo Wii as a motivating treatment for balance rehabilitation in this population. It is important to mention that although all participants were motivated to use the Wii, a basic effect demonstrating more favorable motivation results towards the Wii versus standard balance therapy was only reported in one of three participants. Moreover, the remaining studies examining activity outcomes are represented by level IV and V evidence, thus findings in this important area should be considered preliminary.

Gamification literature, which applies principles of token economies and extrinsic motivators as a mechanism to promote adherence and behaviour change, often includes video game consoles (Schoech, Boyas, Black, & Elias-Lambert, 2013). Some have suggested that promoting sustained behaviour requires intrinsic or internally regulated rather than other forms of extrinsic motivation (Deci & Ryan, 2000), and literature has begun to examine how gaming may promote intrinsic motivation (Schoech et al., 2013). An understanding of intrinsic motivation involves a consideration of factors, such as competence, mastery, self-control, achievement, and self-efficacy, and while these factors may be heightened in healthy individuals during gaming, an understanding of how these factors are influenced during gaming for individuals with impairments, such as those with ABI, is not yet understood. Indeed, applying gamification principles to human services is one of the most challenging areas, particularly when behaviour change in this context is not fun,

and not voluntary (Schoech, 2013). Although the motivating features of gaming systems are cited as a key reason for applying VR in the rehabilitation context (Levac, Rivard, & Missiuna, 2012; Sandlund, McDonough, & Hager-Ross, 2009; Snider, Majnemer, & Darsaklis, 2010), they may not be as motivating as one might presume because factors beyond intrinsic interest, such as sense of competence and self-efficacy may be challenged during gaming in this population, which may hinder levels of motivation.

Brain injuries are a highly individualized disability that can result in a myriad of impairments (Driver, 2006). Consequently, individuals with ABI undergo a process of adjusting to their injury and altered abilities and can face a number of barriers that may limit their motivation for therapy. An exploratory study found that children with TBI have significantly lower self-esteem when compared to non-injured peers (Hawley, 2012). Perceived self-efficacy, which can be described in the context of rehabilitation as a specific belief in one's capacity to meet the demands of treatment (Lequerica & Kortte, 2010), can also be affected in children with ABI, impacting their achievement motivation. The complexity of factors influencing an individual's motivation after ABI makes it pertinent to apply motivation theories when examining this construct in the context of therapeutic interventions. Self Efficacy Theory, Self Determination Theory, the Flow Model, Expectancy-Value Theory and Achievement Goal Theory are examples of theories that can be applied in this context (Bandura, 1977; Deci & Ryan, 2000; Majnemer, 2011; Wentzel & Wigfield, 2009).

Overall, motivation in children with ABI has received very little attention; however, evidence applied to children with other developmental disabilities, such as cerebral palsy, is emerging (Majnemer, 2011, 2012; Majnemer et al., 2008; Majnemer, Shevell, Law, Poulin, & Rosenbaum, 2010; Majnemer, Shikako-Thomas, et al., 2010; Shikako-Thomas, Majnemer,

Law, & Lach, 2008; Shikako-Thomas et al., 2013; Yap, Majnemer, Benaroch, & Cantin, 2010). Studies have shown that children with developmental disabilities tend to have lower levels of mastery motivation compared to their peers and that higher levels of motivation exist in those with higher functional and motor abilities (Majnemer, Shevell, et al., 2010). Furthermore, when compared to typically developing peers, children with developmental disabilities tend to be more passive and avoid complex and challenging activities (Majnemer, 2011).

While all studies included in this review evaluated the impact of motivational components in rehabilitation interventions, studies that applied token economies as extrinsic motivators did not include an explicit measure of motivation to confirm that the incentive was truly motivating. That being said, the therapeutic application of token economies as reinforcers has existed for over a century (Matson & Boisjoli, 2009) and the studies in this review offered rationale for selecting specific types of extrinsic motivators. McCauley and colleagues were the first to explore the impact of monetary incentives on memory performance in children with TBI, and cited the provision of pocket money/allowance for earning income for successful work completion as a common technique for motivating children (McCauley et al., 2009). Nonetheless, the authors acknowledged the arbitrary nature of selecting dollars versus pennies as differential motivators for the EB-PM task. In addition, Konrad and colleagues (2000) cited empirical evidence that supported the use of response contingencies in children with ADHD as a foundation for their response inhibition study involving children with TBI and/or ADHD. Of the studies that included a measure of motivation, none used a valid and reliable measure to evaluate this construct. A visual analogue scale was used in two VR related studies (Cheung et al., 2013; Tatla et al., 2012) and in one study no description was provided about how

motivation findings were obtained (Wille et al., 2009). In another study, motivation was assessed through anecdotal report; caregivers, teachers and the child were each asked how motivated the child was to begin an attention-training program each day (Sjo et al., 2010). Similar to findings in a recent systematic review examining the effects of motivational rehabilitation interventions in children with CP, a lack of use of psychometrically evaluated measures of motivation exists with this population (Tatla et al., 2013).

The implicit and dynamic nature of motivation renders it a difficult construct to measure (Kim, 2013). To that end, it is not surprising that few tools are available to measure child's motivation for therapy. In a recent systematic review of motivation measures in school-aged children with a physical disability or motor delay, Miller and colleagues (2013) found that although numerous abstracts included the word motivation, few studies evaluated motivation with scales that had undergone psychometric testing. Their search revealed two assessments that measure motivation across contexts the Dimensions of Mastery Questionnaire (DMQ) (Morgan, Busch-Rossnagel, Barrett, & Wang, 2009) and the Pediatric Volitional Questionnaire (Basu, Kafkes, Schatz, Kiraly, & Kielhofner, 2008). Although psychometric evidence for these measures is preliminary, conscious application of motivation assessments by therapists can benefit the rehabilitation process by providing a more robust picture of clients' health and wellbeing.

While rehabilitation professionals have long recognized that client motivation affects outcomes, little research has been conducted on the nature of motivation (Maclean, 2000). Engagement in therapy has been conceptualized as an overarching construct that is driven by motivation and executed by the directing of energy and effort towards a task (Lequerica & Kortte, 2010). To engage clients in therapy and to achieve the high dosages required to promote neuroplasticity and function, it is necessary to examine the motivational features of

rehabilitation interventions. Clinicians need to attend to the complex and dynamic relationship between task features, environmental features, and client characteristics in order to promote a match between the motivational characteristics of the task and the environment to the child (Tatla et al., 2013).

2.6 Limitations

Keyword, multiple database, and follow up reference searches were conducted to extensively search the literature for articles relevant to motivation. However, some articles that measured motivation but that used different terms may have been missed because the search strategies was limited to studies in which the authors explicitly stated that they were measuring the effects of motivation. In addition, the exclusion of non-English language and grey studies may be a source of bias in this review.

2.7 Conclusions

At the level of body functions, extrinsic motivators in the form of token economies appear to improve performance in children with moderate to severe TBI. Evidence regarding the effects of interventions on client motivation is limited to a single, level I SSRD and a few pilot studies. No studies have used psychometrically sound measures to assess motivation in children with moderate to severe ABI. Furthermore, the effects of motivating interventions at the activity level are limited to a single SSRD, showing mixed findings and no evidence about the effects of motivating interventions on participation outcomes exists in this population.

This review reveals a need for clinicians and researchers to explicitly apply valid and reliable measures of motivation and/or theoretical rationale to understand motivation in the rehabilitation context. In so doing, clinicians and researchers can identify methods to

promote engagement in rehabilitation activities and identify if clients are, indeed, motivated during the particular interventions under study. To that end, the development of instruments to assess motivation in this population is warranted.

3. Motivation in Rehabilitation Through the Lens of Self-Determination Theory

3.1 Introduction

Theories support the development of scientific knowledge by offering a creative and rigorous framework to systematically understand phenomena (Chinn & Kramer, 2007; Jensen, Richter, & Vendelo, 2003). In recent years, the emphasis on theory-based approaches to intervention has increased (Patrick & Williams, 2012) with recognized benefits, such as helping to define the direct or indirect variables associated with treatment outcomes (Patrick & Williams, 2012). When providing rehabilitation, occupational therapists draw upon a variety of theoretical frameworks to inform their specific areas of clinical practice, including motor learning theory, neurodevelopmental theory, cognitive rehabilitation theory, and the International Classification of Functioning, Disability, and Health (ICF), to name a few (Townsend & Polatajko, 2007; Zwicker & Harris, 2009).

Individuals with brain injury are likely to face multiple problems, including cognitive, social, emotional, and behavioural. As such, no one model or group of models is sufficient to deal with all of these issues. In order to improve functioning in the everyday life of these individuals, rehabilitation professionals should not be constrained by a single theoretical framework (Barbara A. Wilson, 2008). For example, theories of motivation can provide therapists with greater insight into the behavioural factors influencing occupational engagement. Research on this construct dates back to the 1930's, and includes Maslow's formative paper entitled: A Theory of Human Motivation (Maslow, 1943). The universal application of motivation on behavioural outcomes has continued to garner pervasive interest across areas, ranging from environmental awareness (Darner, 2009) to education

(Guay, Ratelle, & Chanal, 2008), to physical and mental health (Miquelon & Vallerand, 2008) and sport (Lewthwaite & Wulf, 2012). In rehabilitation, The Model of Human Occupation, Dynamic Systems Theory, the Flow model, and Self-Determination Theory (SDT) are examples of theories through which the role of motivation has been explored (Levac & DeMatteo, 2009; Poulsen, Rodger, & Ziviani, 2006; Reid, 2011; Townsend & Polatajko, 2007).

3.2 Self Determination Theory: A Theory of Motivation

The focus of this thesis is on a specific theory of motivation, Self-Determination Theory (SDT). While SDT has been applied empirically over the past 30 years across diverse areas, its explicit application in rehabilitation of children is sparse, but emerging. Only two studies have applied it as a theoretical frame of reference in children: one using the cognitive orientation to occupational performance (CO-OP) approach and the other using constraint-induced movement therapy (Gilmore, Ziviani, Sakzewski, Shields, & Boyd, 2010; Poulsen et al., 2006). The paucity of rehabilitation research using SDT may be as a result of lack of awareness of the theory and of its ease of integration into practice. A burgeoning interest in the application of SDT and other motivational theories to rehabilitation has emerged over the past ten years (Reid et al., 2004, Majnemer et al., 2012; Gilmore et al., 2010) and more recently, Ziviani and colleagues have penned a book for therapists describing the application of SDT to therapeutic interventions with children (Ziviani, Poulsen, & Cuskelly, 2013). SDT offers a framework for explicitly incorporating the motivational factors that can influence engagement by recognizing the innate human needs of having a sense of connection with others, being autonomous, and feeling a sense of competence.

3.2.1 Tenets of Self-Determination Theory

Self-Determination Theory is described as a macro-theory of human motivation (Deci & Ryan, 2008b). A central assumption of SDT is that people are generally self-motivated, curious, and eager to succeed based on the inherent value of success in and of itself (Deci & Ryan, 2000). SDT differs from other theories of motivation in that it differentiates types of motivation rather than viewing it as a singular concept with additive benefits. Furthermore, in contrast to other theories, SDT posits the type and quality of motivation is more important for predicting behaviours than the total amount of one's motivation (Deci & Ryan, 2008b). SDT is comprised of the following four major concepts: the foundation of basic psychological needs, the types of motivation, the degree of autonomy versus control, and the resulting degree of self-determination.

SDT was chosen specifically to provide the theoretical underpinnings for this thesis because it offers a view of motivation that accounts for the interaction between an individual's interests and values and the social environmental conditions that can influence one's motivation over time. Moreover, SDT has demonstrated generalizability across a range of disciplines and has been studied empirically over three decades, thus providing a strong foundation from which to apply SDT to the rehabilitation context.

3.2.2 The Basic Needs

Thought to influence goal directed activity, competence, relatedness and autonomy are three basic psychological needs forming the foundation of SDT (Deci & Ryan, 2000). Competence is defined as the essential need for humans to demonstrate mastery of challenges within their environment, while relatedness is the need for humans to feel a sense of connection to and understood by important others. Autonomy refers to the organismic need for inner volition to integrate and self organize experience and behaviour

(Deci & Ryan, 2000).

Optimal development and wellbeing will ensue under environmental conditions that facilitate need fulfillment. The fulfillment of these three psychological needs is critical to supporting the process of internalization and the development of optimal motivation and personal wellbeing (Patrick & Williams, 2012). Personal conditions that thwart these basic needs result in negative consequences to growth, development, and wellbeing (Deci & Ryan, 2000). With respect to the application of this theory to occupational therapy, in particular, Poulsen and colleagues applied SDT along with theories of flow to pediatric rehabilitation and showed that the basic needs can be supported using the CO-OP approach for intervention in children with developmental coordination disorder (Poulsen et al., 2006).

3.2.3 Types of Motivation

In SDT, the types of motivation in relation to fulfillment of basic needs will influence goal achievement. Types of motivation, being amotivation, extrinsic motivation, and intrinsic motivation, occur along two separate continuums representing the degree of internal and external regulation, and the degree of self determination (or autonomy).

Amotivation.

Amotivation reflects the lack of intention to act and results from a person not valuing a behaviour or outcome, not believing that a valued outcome is reliably linked to specific behaviours, or believing that there are behaviours instrumental to a valued outcome, but not feeling competent to do those instrumental behaviours (Deci & Ryan, 2008a).

Intrinsic Motivation.

Intrinsic motivation represents a highly self-determined and internally regulated

condition in which an individual feels an innate desire and interest to pursue an activity (Deci & Ryan, 2008a).

Extrinsic Motivation.

SDT proposes that extrinsic motivation occurs along a continuum of external and internal regulation and is differentiated into components that have subtle yet distinct meanings. External extrinsic motivation occurs when individuals perform an activity because it leads to a consequence outside of him or herself, such as a reward or avoidance of punishment (Deci & Ryan, 2008a). Internally regulated extrinsic motivation can occur over a continuum of three degrees of regulation that represent least to most integrated within one's self concept. *Introjected extrinsic motivation* is a form of internal regulation that is thought to be the least effective type of motivation. In this condition, individuals take in an external demand, but do not accept it as their own, thereby leaving them with a perceived lack of control over their actions. As a result, individuals lack a sense of ownership over their behaviour (Deci & Ryan, 2008a). *Identified extrinsic motivation* is a more internalized regulation and entails individuals accepting the behaviour as his/her own and drawing value from it. This internalizing results in individuals feeling a sense of autonomy in the behaviour. *Internal integrated extrinsic motivation* is the most fully internalized extrinsic motivation, and occurs when individuals take ownership of a behaviour and integrate it within their personal being. In this condition, individuals become truly self-determined/autonomous.

When an individual identifies an activity as important to their personal goals, he or she will likely express more choice regarding his/her participation than when introjectied or externally regulatory styles operate (Standage, Duda, & Ntoumanis, 2005). In addition, the importance of selecting activities that children value is clear, as they will fail to integrate the behaviour as an expression of the self if they do not value the activity (Legault, Green-

Demers, & Pelletier, 2006).

Autonomous versus Controlled Motivation

A salient feature of SDT is its extended conceptualization of motivation that includes the dichotomy of autonomy and control, each of which lead to very different outcomes (Deci & Ryan, 2008a). Autonomy and control occur over a continuum representing the degree to which an individual will be self-determined or autonomous. Controlled motivation is correlated with external and introjected regulations. In contrast, autonomous motivation represents the most optimal condition resulting in the most self-determined individual and has been associated with greater long term persistence (Edward L. Deci & Richard M. Ryan, 2008). Identified and integrated forms of internalized extrinsic motivation, along with intrinsic motivation are highly self-determined forms. In studies related to health and sport, autonomous motivation has been linked with greater long-term persistence and more effective performance (Miquelon & Vallerand, 2008). Experienced practitioners haven noted that the art of therapy lies in creating a therapeutic milieu where a child's personal drive for growth is skillfully evoked and consider this more important than technical proficiency alone (Ziviani, Poulsen, & Cuskelly, 2013)(p.39)

Autonomy support has been shown to predict better developmental outcomes in children across contexts, including academics, sport and parent-child relationships (p.63, Cuskelly & Poulsen, 2013). Furthermore, evidence of the benefits of autonomous motivation in therapy is emerging and it is seen as equally important to the therapeutic relationship itself; autonomous motivation is thought to contribute to a child's sense of being understood and feeling valued (p.63, Cuskelly & Poulsen, 2013). Moreover, autonomy support appears to contribute to positive outcomes through its impact on persistence, as

studies have demonstrated greater persistence in children with disabilities and those developing typically (Gilmore et al., 2010).

Researchers have begun to integrate SDT into practical approaches to account for motivational factors when providing interventions. For example, interventions for adults in ABI rehabilitation, obesity prevention and health promotion have begun to use motivational interviewing as a therapeutic technique to treat both the individual and the context to better support motivated behaviour (Medley & Powell, 2010; Patrick & Williams, 2012).

3.3 Discussion: A Critical Reflection of SDT

Chinn and Kramer's framework provides a process to critically reflect upon an empiric theory (Chinn & Kramer, 2007). The clarity, simplicity, generality, accessibility and importance of SDT in rehabilitation will be discussed. By using this process of critical reflection, the strengths and challenges of applying SDT to rehabilitation can be better understood.

3.3.1 Clarity of SDT

SDT offers a relatively clear conceptual framework to elucidate the meaning of motivation. However, clarity can be obscured because the term "motivation" is used so commonly. For example, people may misconstrue the meaning of motivation because it has been applied in so many other contexts, thus failing to recognize its depth as applied in SDT. Furthermore, semantic clarity can be comprised by the numerous terminologies used to describe the concepts and sub-concepts presented in this theory.

When applying SDT, one must consider multiple components: the basic needs, the degree of autonomy versus control, the different types of motivation, along with sub-types

of extrinsic motivation and the type of regulation. Nevertheless, the concepts and sub-concepts within SDT have been defined clearly and used consistently in research for over 30 years (Vallerand, Pelletier, & Koestner, 2008); they have been studied thoroughly and tested empirically to provide compelling evidence of their relationships (Vallerand et al., 2008); Deci & Ryan, 2000; Edward L. Deci & R.M. Ryan, 2008; Edward L. Deci & Richard M. Ryan, 2008; Guay et al., 2008; M & Jacques, 2008).

Chin and Kramer state the necessity of demonstrating the flow of relationships through structural forms in theory (Chinn & Kramer, 2007). SDT is composed of three types of structures, including foundational components (i.e. basic psychological needs), differentiated components (i.e. types of motivation and sub-types of extrinsic motivation), and components along a continuum (i.e. degree of control versus autonomy and degree of self-determination). A clear diagram presenting this theory demonstrates the relationships of major and minor concepts along a continuum of self-determination or autonomy (Deci & Ryan, 2008a). A limitation of this model lies in its failure to illustrate the foundational role of basic psychological needs (See Figure 3.1).

Although this theory is presented fairly clearly, a practicing clinician may have difficulty sorting through the cumbersome terminology that defines each concept in order to understand the impact on motivation. Thus, it may be challenging for a clinician to extract the application of this theory to practice.

3.3.2 Simplicity of SDT

Although the concept of motivation may appear simple initially, SDT reveals the complex interdependence of major concepts with sub-concepts. This complexity is demonstrated by the inter-relationship of type of motivation to the basic psychological needs and the influence of the continuum of control and autonomy on the different forms of

motivation. SDT seeks to explain and to predict behaviour, and does so by accounting for the psychological aspects within the person, and the influences of psychosocial environmental factors on motivation. However, this theory fails to address the impact of physical factors, both within the person and the environment that may influence client's motivation in rehabilitation. This limitation may provide a further rationale for applying SDT with other theories in rehabilitation, such as the Canadian Model of Occupational Performance-Engagement, which examines the person in relation to occupation and the environment. Occupation in this context is defined as everything people do to occupy themselves, including looking after themselves, enjoying life, and contributing to the social and economic aspects of life (McCarthy, Zhang, & Craik, 2008). The ICF is another model that can be used in conjunction with SDT to understand more fully the role of motivation within a rehabilitation context.

3.3.3 Generalizability of SDT

SDT offers itself as a macro-theory of motivation, thus has many widespread applications to a variety of contexts ranging from health and sport to education. As such, this general theory of motivation can be applied to a variety of contexts in which occupational therapy is employed. For example, it can be applied with individuals throughout the age span and across illnesses. The concept of autonomy support has important implications for occupational therapists working in rehabilitation contexts as they play a critical role in supporting clients to become self-initiating and autonomous despite body, structure and function impairments. SDT's emphasis on autonomy may be thought to limit its applicability across cultures, particularly in those that value interdependence. However, cross-cultural research into SDT has demonstrated a universal need for competence, autonomy and relatedness to achieve psychological wellbeing (Deci & Ryan, 2008b).

3.3.4 Accessibility of SDT

The extensive literature on SDT is indicative of the applicability and accessibility of this theory of motivation. The use of SDT has been explored in multiple areas, such as addiction and mental health (Baker, 2011), education and learning (Guay et al., 2008), rehabilitation (Poulsen et al., 2006), communication (Pelletier & Sharp, 2008), physical health and exercise (Miquelon & Vallerand, 2008), and athletic performance (Podlog, Dimmock, & Miller, 2011). However, applying SDT as a supplement to other theories in rehabilitation, such as CMOP-E, can allow therapists to expand knowledge of the role of physical and institutional environmental factors, and body, structure and function impairments on levels of autonomy, competence and relatedness to broaden the application of SDT in disability and rehabilitation.

3.3.5 Importance of SDT

Understanding the psychological undertones that influence behaviour is critical to therapists designing therapeutic interventions. Therapists can be equipped to support clients on their journey to participation in meaningful occupations by understanding and applying SDT as a framework to their practice. This model can expand the lens through which rehabilitation professionals see the process of change and adjustment and help sharpen their understanding of the motivational factors influencing occupational engagement. For example, in the face of disability caused by sudden loss of function or deterioration in function, therapists can use SDT as a framework to consider explicitly how a client's motivation to perform occupations or to engage in daily life may be influenced by factors related to their loss of autonomy, sense of competence and social isolation that may result from such illnesses.

In summary, Self-Determination Theory appears to be a relatively clear and accessible theory that can be applied across rehabilitation practice settings. Addressing the psychosocial factors influencing motivation alone does not appear sufficient in a rehabilitation context. Consequently, supplementing this theory with others that account for the physical factors within the person and environment would be appropriate.

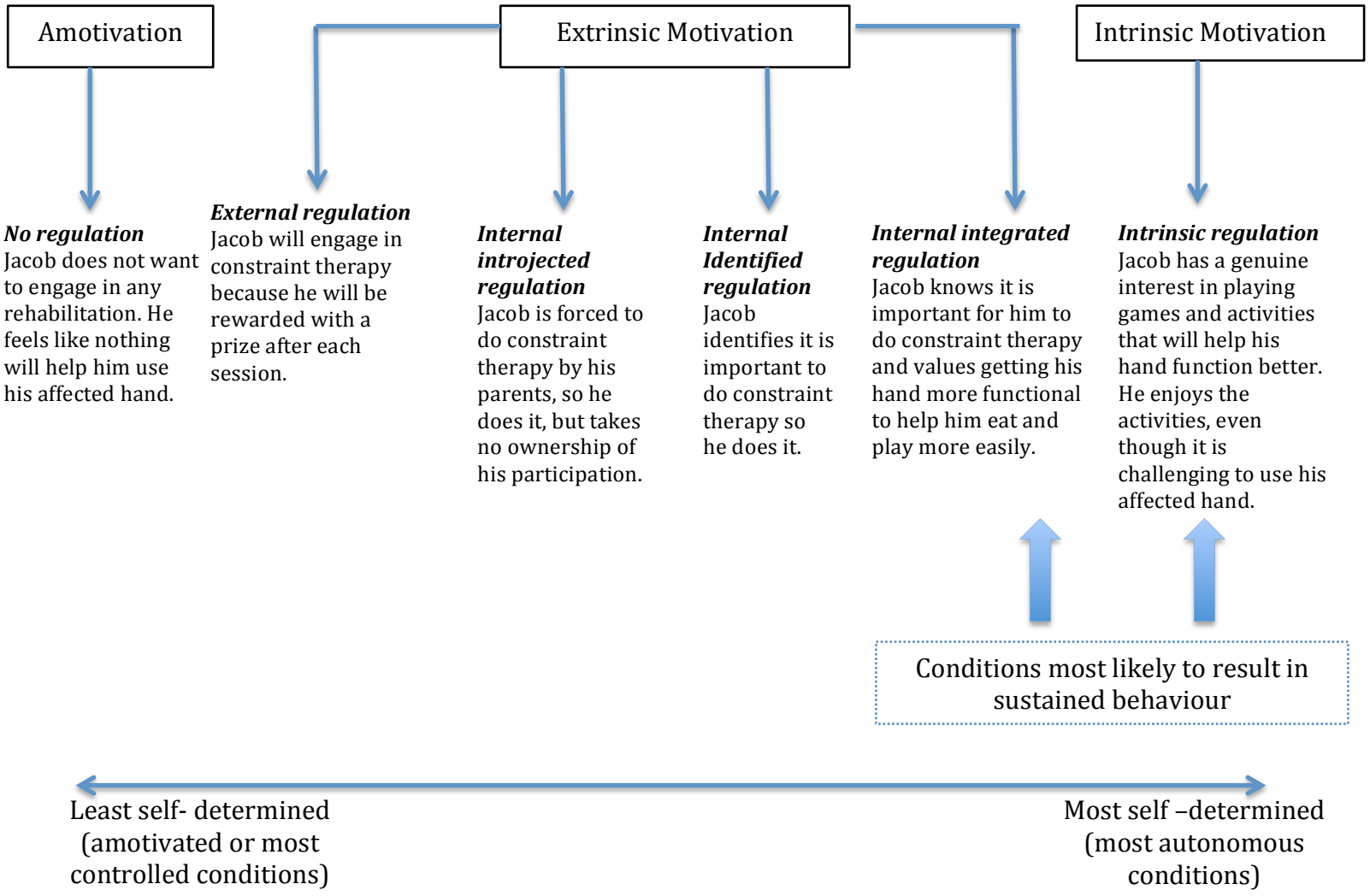
3.4 Conclusion

It is pertinent for therapists to consider motivation when designing and implementing rehabilitation interventions. By considering the basic psychological needs, therapists can emphasize client choice in activity (autonomy); promote group activities (relatedness), and grade tasks such that they are at the level of challenge that is weighed by the client's abilities (competence) in order to enhance client motivation in therapy. While SDT has demonstrated heuristic qualities across other practice areas, empirical testing of this theory independently, or alongside other theoretical frames of reference is needed to identify implications for pediatric rehabilitation.

Currently, generally limited evidence exists linking the role of motivation to treatment outcomes in adult and pediatric rehabilitation, therefore, further research in this area is important. Specific research examining how each motivation progresses from one type to the next and how motivation changes over time is also warranted. Furthermore, SDT researchers within the fields of psychology and health have called for research to assess more thoroughly the role of the environment in determining the content of motivational clusters and their consequences (Vallerand et al., 2008). With an emphasis on client-centered practice and environmental influences on occupational engagement, occupational therapists are positioned optimally to add to this body of knowledge.

Figure 3.1: Application of Self-Determination Theory (adapted from (Deci & Ryan, 2008a))

Case Example: Constraint induced movement therapy for a ten-year old boy, Jacob.



4. The Development of the Pediatric Motivation Scale for Children in Rehabilitation: A Pilot Study[2]

4.1 Introduction

Acquired brain injury (ABI), the single greatest cause of death and disability in children, is caused by damage to the brain occurring after birth and is unrelated to congenital disorders, developmental disability or a progressive disease process (ABIKUS, 2007; CIHI, 2006). Moderate to severe ABI results in a myriad of cognitive, physical, and psycho-social impairments that affect an individual's daily functioning (Johnston, 2009). The dynamic interaction of multiple factors influences recovery after ABI and this process for children is lifelong as they are faced with new and different challenges throughout development (V. Anderson et al., 2011; B.A. Wilson, 2010).

Intensive dosages of therapy are required to induce permanent neuroplastic changes for recovery (Lang et al., 2009). In the sub-acute phase, a minimum of daily, three hours of direct task specific therapy within a multidisciplinary context is recommended (Lindsay et al., 2012). In addition, ongoing rehabilitation well beyond this phase can optimize functional recovery. To engage clients in therapy and to achieve the high dosages required to promote neuroplasticity and function, it is necessary to examine the motivational features of rehabilitation interventions.

Findings demonstrate that low motivation can be a critical obstacle for children with developmental disabilities in trying new roles and engaging in practice and new learning (Majnemer, 2011). In addition, self-efficacy and competence have been identified

[2] A version of Chapter 4 is being submitted for publication (Tatla, S.K., Jarus, T., Virji-Babul, N., and Holsti, L. (manuscript in preparation). Dr. Boris Kuzeljevic provided data analysis expertise for the study outlined in Chapter 4.

as particularly important motivational factors in children with cerebral palsy (Tatla et al., 2013). Consequently, Majnemer (2011) and others (Ziviani, Poulsen, & Cuskelly, 2013) suggest that these findings have important implications for therapists when delivering their interventions. "As therapists we should ensure that the *process* of our interventions is highly motivating, and secondly, we should enhance children's motivation as an *outcome* of our treatment, if it proves to be a barrier to mastery of skills and activities" (Majnemer, 2011, p. 2).

Although rehabilitation professionals have long recognized that client motivation affects outcomes, limited research has been conducted on the nature of motivation and clinicians do little to formally assess it (Bartlett & Palisiano, 2002; Boosman et al., 2013; Maclean, 2000; Tatla et al., 2013). In addition, the implicit and dynamic nature of motivation renders it a difficult construct to measure (Kim, 2013). To that end, it is not surprising that only a few tools are available to measure a child's motivation for therapy. The Dimensions of Mastery Questionnaire (DMQ) (Morgan et al., 2009) and the Pediatric Volitional Questionnaire (Basu et al., 2008) are two assessments that measure motivation across occupational performance areas. The DMQ offers a sense of a child's mastery motivation as a dispositional trait and can be completed by parents, teachers, practitioners or the child themselves. It is being used more commonly in studies of children with cerebral palsy or other physical disabilities; however, its reliability and validity data remain preliminary (Miller, Ziviani, & Boyd, 2013). Secondly, the Pediatric Volitional Questionnaire is a scale that therapists can use to assess children's motivation by observing their behaviours during one or more activities over time.

Currently, no validated measure exists to capture children's motivational experience during a rehabilitation session from their own perspective. For over a

century, researchers have recognized the importance of considering motivation from the vantage point of not only the observer, but of the patient- what he or she thinks and feels whenever possible (Barry, 1964). Enabling children with brain injury to share their motivational experience during therapy can assist therapists in designing client-centered interventions, which can enhance a child's engagement in therapy. Currently, anecdotal reports or unvalidated visual analogue scales are commonly used approaches to motivation assessment in children with ABI. While these approaches provide an indication of a client's motivation, they fail to account for the multidimensional nature of motivation, instead, viewing an individual's motivation solely based upon his or her level of interest. To provide more insight about children's motivation during therapeutic interventions, a need remains for clinicians and researchers to use valid and reliable measures of motivation that are grounded in theory (Miller et al., 2013; Tatla et al., 2013; Ziviani, Poulsen, King, & Johnson, 2013).

Self Determination Theory (SDT) provides a multidimensional perspective of motivation that identifies basic human motivational propensities as foundational to behaviour, including a sense of competency, relatedness, and autonomy. This theory also addresses different types of motivation and the impact of the social environment on motivation (Deci & Ryan, 2008b). SDT is appropriate for investigating client motivation during therapy because this widely researched theory of motivation has been applied across a variety of context to examine how activity relates to well being (Deci & Ryan, 2008a; Ryan, Rigby, & Przybylski, 2006).

The Pediatric Motivation Scale (PMOT), a 21-item motivation scale has been developed to measure motivation from the perspective of children undergoing

rehabilitation after an ABI and is based upon tenets of SDT. As the scale is designed for use after therapeutic activities, it is an event based (state) measure of motivation, rather than a measure of a child's motivation as a trait. Six subscales assess subjective experiences of effort/importance, interest/enjoyment, competence, relatedness, autonomy, and value/usefulness. The present subscales of the PMOT are theorized to relate to three main components of SDT: the subscales of competence, relatedness, and autonomy are expected to relate to the basic psychological needs (competence, relatedness, and autonomy); secondly, the subscale of interest/enjoyment is posited to directly reflect ones intrinsic motivation; finally, subscales related to effort/importance and value/usefulness are hypothesized to relate to the individual's degree of internal regulation and extrinsic motivation (Deci & Ryan, 2000)(Figure 4.1).

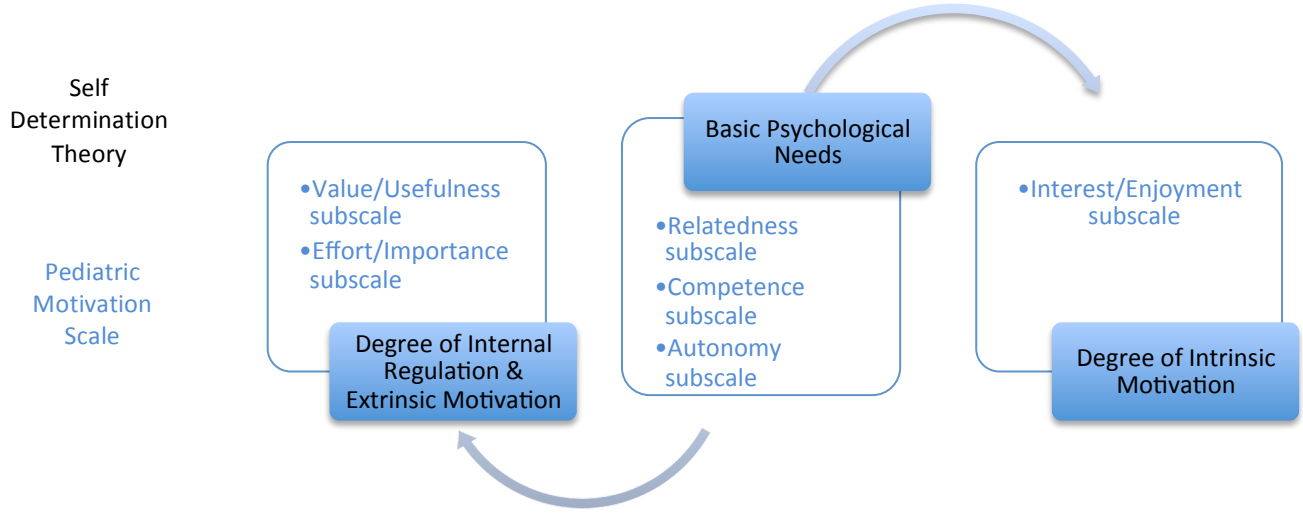
The PMOT subscales were informed by the Intrinsic Motivation Inventory (IMI), developed by Ryan and colleagues from the Rochester Motivation Research Group in the early 1980's (McAuley, Duncan, & Tammen, 1989), and was based upon the view that intrinsic motivation is a multidimensional, rather than a unitary construct (McAuley, Wraith, & Duncan, 1991). Bandura's self efficacy theory, which contended that intrinsic interest is a function of self-efficacy and perceived success (Bandura, 1977), helped to form the theoretical background for the development of this measure and the early theoretical underpinnings of SDT (Deci & Ryan, 2000).

All items of the IMI have undergone factor analysis and have shown stability across a variety of tasks, conditions, and settings, including sports, exercise (McAuley et al., 1989; McAuley et al., 1991), and school (Leng, Ali, Baki, & Mahmud, 2010). Exploratory factor analysis was completed on the items to group them according to meaningful subsets that measure different factors of interest/enjoyment, perceived

competence, effort, value/usefulness, felt pressure and tension, relatedness and perceived choice while performing a given activity, thus yielding seven subscale scores (*Intrinsic motivation inventory (IMI)*, Unknown) (IMI, n.d.). For the purposes of the PMOT, the subscales of felt pressure and tension were not included because research has demonstrated poor reliability and validity of items in this subscale for clinical and non-clinical populations (Choi et al., 2010; Koka & Hein, 2003; Markland, 1997; Leng 2010).

The objective of this study was to examine preliminary psychometric properties of the PMOT. The validity, in terms of the test content, face validity, convergent validity and response process; and the reliability, including internal consistency, and test-retest reliability, were evaluated. We hypothesized that the scale would demonstrate strong internal consistency, meeting or exceeding α =.70, test-retest reliability would be good, exceeding (*r*=.80), and finally, that the PMOT would at least moderately correlate with the Pediatric Volitional Questionnaire (*r*=.40).

Figure 4.1. Self Determination Theory & The Pediatric Motivation Scale



This figure illustrates the hypothesized relationship between the Pediatric Motivation Scale (PMOT) and Self-Determination Theory. The degree to which the basic psychological needs of relatedness, competence, and autonomy are met are posited to influence intrinsic motivation and the degree of internal regulation and type of extrinsic motivation.

4.2 Methods

4.2.1 Design & Rationale

A methodological study design was used for the development of the PMOT, as this type of research is appropriate for the development and testing of measuring instruments for use in research or clinical practice (Portney & Watkins, 2009). Nonetheless, methodological research is considered the first step toward developing an instrument and is not a stand-alone process of instrument validation (Portney & Watkins, 2009).

Though face validity is not considered an strong psychometric property of validity, its clinicometric consequences are of importance, as test administrators and test users may not consider using a test if it is not deemed credible (Furr, 2008; Portney & Watkins, 2009). As such, the following forms of validity were evaluated to establish preliminary psychometrics of the PMOT: a) content validity, informed first by a review of motivation measures in the literature and second by expert review of the PMOT; b) face validity, closely related to content validity, was informed by expert review and field-testing of the PMOT; c) convergent validity, informed by concurrent testing of a motivation scale, the Pediatric Volitional Questionnaire; d) response processes, assessed by observations of and feedback from healthy children and children in rehabilitation during field-testing. Furthermore, preliminary reliability, including internal consistency and test-retest reliability were explored.

4.2.2 Participants

4.2.2.1. Ethics & Recruitment

Ethics approval was obtained through the UBC C&W Behavioural Research Ethics Board and the regional centres where the research study was carried out, BC Children's Hospital (BCCH) and Sunny Hill Health Centre for Children (SHHCC). Ethical approval was

also obtained through the Ethical approval board of Vancouver Coastal Health and G.F. Strong Rehabilitation Centre, additional regional sites where the research was carried out. Consent was obtained from all participants. Parental or guardian consent was obtained for children aged 8 to 16 years and either written or verbal assent was obtained from these participants.

Phase 1: Expert Review

Rehabilitation specialists were recruited through an information session that was held by ST, during a scheduled staff meeting at SHHCC. The department administrative assistant circulated letters of information and consent forms to the staff. Interested participants were asked to contact ST to complete the consent process and were given 48 hours to decide if they would like to participate.

Phase 2: Field Testing

Children in rehabilitation were recruited to participate through the use of posters advertising the study placed at SHHCC and GF Strong. In addition, ST consulted with Occupational and Physical therapists working in the Acute Rehabilitation Program at BCCH and GF Strong to identify participants who were eligible to participate in the study. Treating therapists provided a letter of information to each family admitted to the inpatient ward to inform them of the study and how to contact ST if they were interested in participating. In addition, the parents of past patients of SHHCC who were continuing to receive therapy services in the community were contacted by a social worker during a scheduled follow up phone call. Families were asked to contact ST if they were interested in participating. Healthy children were recruited through posters advertising the study, hung with permission, in recreation centres throughout Vancouver requesting volunteers, and through word of mouth to colleagues, friends and acquaintances. Participants and their families were

asked to contact ST if they were interested in participating. All individuals were given a period of 48 hours to review the consent form, and were then contacted to provide further information and to schedule an appropriate time for the PMOT assessment. Children and guardians provided ST with informed consent and assent before participating in this study. All recruitment and data collection was performed by ST.

4.2.2.2 Participant Inclusion Criteria

Phase 1: Expert Review

To be included for expert review of the PMOT, clinicians required at least two years of experience providing direct therapy to children with acquired brain injuries. Clinicians in the disciplines of Occupational Therapy, Physiotherapy, Therapeutic Recreation, Speech and Language Pathology, Teaching, Neuropsychiatry, and Medicine were included. These criteria increased the assurance that clinicians had both the sufficient training and experience to comment upon the physical, cognitive, perceptual, behavioural and developmental skills of this population and allowed for diverse perspectives from specialists working in pediatric brain injury rehabilitation.

Phase 2: Field-Testing

Children in rehabilitation were included for PMOT field-testing if they were diagnosed with a neuro-motor injury or orthopedic injury, were currently undergoing rehabilitation at BCCH or another rehabilitation center and were between the ages of 8 to 18 years, able to understand English, and for those with an acquired brain injury, at a level VI, VII, or VIII on the Ranchos Los Amigos Level of Cognitive Functioning Scale (Appendix B). Individuals with orthopedic or other neuro-motor injury were included if they were functioning cognitively at the level of an eight year old. Healthy children were included if they were between the ages of 8 to 18 years.

4.2.2.3. Participant Exclusion Criteria

Individuals were excluded if they did not have English language that was sufficient to provide informed consent.

4.2.2.4 Sample

Participants were recruited using non-probability sampling. For Phase I, purposive sampling was used to recruit clinicians with sufficient experience to report upon the abilities of children with acquired brain injury. In Phase 2, convenience sampling was used to recruit healthy participants and consecutive sampling was used to recruit the patient population. Children undergoing orthopedic rehabilitation provided a comparison sample of individuals who did not have an acquired brain injury, but who were also undergoing rehabilitation. The comparison sample included individuals with Cerebral Palsy (CP), developmental delay and typically developing children and youth. Some of the children with orthopedic injuries had comorbidities, such as developmental delay. Though the PMOT was designed to meet the cognitive and physical needs of children with acquired brain injury, it can potentially to be used with a wide range of populations; therefore, field-testing with a similar population provided preliminary information about the generalizability of this scale to other pediatric populations.

4.3 Measures *(Figure 4.2)*

The following measures were used to explore the psychometric properties of the PMOT: the Pediatric Volitional Questionnaire was used to assess convergent validity with the PMOT; the Pediatric Evaluation of Disability Inventory (PEDI) was used to gather information about the functional abilities of the rehabilitation sample; a clinician feedback survey was used to gather clinicians impressions of the PMOT; finally, field notes were used

to capture information about the response processes of both healthy participants and participants in rehabilitation.

4.3.1. The Pediatric Motivation Scale (PMOT)

The PMOT is a self-report scale designed for children to respond to 19 items using a 6-point smiley face scale, and to two open-ended questions either verbally or by writing their responses. The PMOT items were adapted from the IMI to specifically meet the needs of children and youth with ABI. The PMOT is comprised of six subscales and each subscale contains three items, with the exception of the interest/enjoyment subscale, which includes four items because interest/enjoyment is considered a direct indication of intrinsic motivation. The subscales of competence, relatedness and autonomy are theorized to either enhance (indicated by high scores in these subscales) or diminish (indicated by low scores in these subscales) intrinsic motivation. In addition, the value/usefulness and effort/importance subscales are theorized to reflect the degree of extrinsic motivation and internal regulation. Children respond on an ordinal, face scale ranging from 1 (not true at all) to 6 (definitely true). To promote valid responses throughout the PMOT scale, some items are framed negatively and these items should be reverse scored (scoring instructions available in Appendix C). Items in each subscale are totaled and divided by the number of items to obtain an average score per subscale. The total scores in each subscale are added to obtain and overall motivation score. Higher scores within each subscale indicate a higher level of the construct in the subscale, whereas lower scores indicate the opposite. Thus, the scores indicate differences in the quality and type of motivation for the child. In addition, a higher total score indicates greater levels of motivation, overall. See Appendix C for an overview of the PMOT scale, including the scale, administration and scoring instructions and the response categories.

4.3.2 Pediatric Volitional Questionnaire

The Pediatric Volitional Questionnaire (PVQ) is a 15-item scale that was used to rate volitional behaviours of children with a range of functional and cognitive skills. Motivation for occupation is described by the construct of volition, referring to thoughts and feelings about doing that include values, interests, and personal causation (S. Anderson, Kielhofner, & Lai, 2005). The PVQ provides an indication of the child's inner motives, motivational strengths and weakness and their impact on behaviour, the child's reaction to the environment, environmental features that support or hinder volition, information about activities that maximize motivation, and information about the efficacy of different motivation strategies (Basu et al., 2008). The PVQ is divided into three subscales of achievement, competency and exploration. Items are scored on an ordinal scale describing the amount of external support required for a child to exhibit each volitional behaviour, ranging from not observed, passive, hesitant, involved, to spontaneous. In addition, the PVQ environmental scan provides information about the physical and social environment that could impact volitional behaviours. The PVQ was originally designed for children between 2 to 7 years of age; however, it has been studied in children with and without disabilities between the ages of 2 to 18 years (Anderson et al., 2005; Reid 2004; Reid 2005).

Psychometric evidence for the PVQ is mixed. The PVQ has demonstrated excellent content validity, construct validity ranging between poor to adequate, good ability to discriminate between typical and atypical populations, and moderate concurrent validity between the PVQ and the Test of Playfulness. (Miller, et al., 2013). With regard to reliability, the PVQ scores quite poorly, with poor internal consistency and inter-rater reliability (Miller et al., 2013; Anderson et al., 2005). However, this may be related to the small sample sizes used in studies (Miller et al., 2013). Nevertheless, the PVQ demonstrates good clinical

utility with clear, concise, and comprehensive instruction manuals, simple administration procedures within acceptable time frames and online availability (Miller et al., 2013).

4.3.3 Pediatric Evaluation of Disability Inventory (PEDI) (Appendix D)

The Caregiver Assistance and Modification Scale of the PEDI was used to describe the participants functional capacity in activities of daily living, transfers, locomotion, social and functional communication. A total of 20 items are divided into three subscales, including self-care, mobility, and social function. This assessment provides an indication of the level of assistance a child requires, on a scale ranging from zero (dependent) to five (completely independent). The PEDI was standardized for typically developing children aged six months to seven and a half- years and has also been validated for use in older children whose physical function is that of a seven and a half-year old or younger child. This measure is commonly used with children 1–19 years of age who have an ABI and are in an inpatient rehabilitation center (Tokan G, 2003). Reliability studies of the PEDI have determined good inter-observer reliability (Nichols D, 1996). Concurrent validity of the PEDI has been established with other pediatric functional measures such as the WeeFim and Gross Motor Function Measure (Hawley, Ward, Long, Owen, & Magnay, 2003; Tokan et al., 2003; Ziviani, Ottenbacher, Shephard, Foreman, Atsbury, & Ireland, 2002).

4.3.4 Clinician Feedback Survey (Appendix E)

The Clinician Feedback Survey was designed by ST to obtain feedback from expert clinicians upon review of the PMOT. Questions on this survey include Likert scale and open-ended questions related to the scale's face validity, clarity (conciseness, grammar, readability, layout, reading level, and redundancy of the questions), and clinical utility (i.e. ease of administration, time to administer, and challenges).

4.3.5 Field Notes: Response Process (Appendix F)

Participants' response processes were observed and recorded while they completed the PMOT. Items on the PMOT that appeared confusing or difficult to answer for participants were observed and participants were also queried once the assessment was complete. In addition, they were asked to explain the rationale for their response selections to determine if children were interpreting the items as intended.

4.4 Procedures

Phase 1 Procedures: Clinician Review

During Phase 1, 12 clinicians with expertise in brain injury and acute rehabilitation were recruited from SHHCC to participate through an information session held by ST during a scheduled staff meeting. After consent was obtained, each participant took part in two sessions. During the first session, ST educated therapists regarding the administration of the PVQ and presented the findings of a systematic review on motivation in rehabilitation in order to provide participants with an up-to-date overview of the literature on the topic (Tatla et al., 2013). During the second session, clinicians met independently with ST to review the PMOT, to complete the Clinician Feedback Survey, and to offer verbal feedback through a semi-structured interview to follow up with responses given on the Clinician Feedback Survey. All clinicians completed a demographic questionnaire to provide information about the sample (Appendix G). Based upon clinician feedback, the PMOT was revised and refined.

Phase 2 Procedures: Field Testing (Figure 4.3)

Rehabilitation Participant Field Testing

During Phase 2, the PMOT (Appendix C) was field tested with twenty healthy children and twenty-one children in rehabilitation between the ages of 8 to 18 years old.

Children in rehabilitation underwent a 60-minute therapy session (Occupational, Physical, Speech or Recreation Therapy), of which 45 minutes involved regular therapy activities. Fifteen minutes before the end of the session, participants completed the PMOT with the assistance of ST. In addition, each child or parent completed a demographic questionnaire to provide basic information about the child, such as their age, sex and type of injury (Appendix H). In order to minimize the effects of social desirability bias, the treating therapist was not present during this assessment. ST administered the scale to the child and followed by recording the child's response process. The PMOT was administered to each child in one of two formats, either in its full form or by presenting each question individually using laminated cue cards. Each child's treating therapist was consulted to determine the most appropriate format to meet his or her physical and cognitive needs.

To garner the therapist's perception of the child's motivation, the therapist treating the child completed the PVQ immediately after the session. The treating therapist also completed the Caregiver Assistance and Modification Scale of the PEDI to capture the functional abilities of the child in the areas of self-care, mobility and social functioning.

After completing the first session, each child underwent a one-hour break, in which no therapy was administered in order to minimize the confounding effects of other therapies, which could potentially influence participants' memory and fatigue levels. After the one-hour break, each participant underwent a second 15-minute session with ST to

examine the stability of the measure. Conditions remained as similar as possible to the previous session (i.e. same room and test administrator).

Healthy Participant Field Testing

Field-testing with healthy children was completed with ST, and a research assistant, which included one of three Master of Occupational Therapy students from the University of British Columbia. As recommended by the scale developers, the research assistants were each provided with manuals of the PVQ and given an information session on scale administration and scoring guidelines to help promote inter-rater reliability (S. Anderson et al., 2005).

The 60-minute session was carried out at either the participant's home or at a park near their home, depending on what location was most convenient for the child and family. Activities during the session were offered to the child, including badminton, basketball, volleyball, Frisbee, videogames, iPad games, board games (Jenga, Monopoly, Scattegories, Angry Birds), cards, drawing, coloring, or beading. Fifteen minutes prior to the end of session, each participant completed the PMOT with ST. Again, in order to minimize the effects of social desirability bias, the research assistant was not present during PMOT administration. Once the PMOT was administered, each child had a one hour break, and then underwent a second 15-minute session with ST to complete the PMOT for the second time. Conditions were kept as similar as possible to the previous session (i.e. same location and test administrator). In addition, children completed a demographic questionnaire to provide basic information about their age, sex and grade (Appendix I).

4.4.1 Confidentiality

All collected data were labeled with non-identifying information and each participant was given a participant number to ensure accurate tracking and confidentiality.

4.4.2 Participant Remuneration

All participants received an iTunes gift card as a small token of appreciation for their participation in this study.

4.5 Data Synthesis & Analysis

4.5.1 Statistical Analysis

Data analysis was conducted using descriptive and correlational statistics using SPSS (Statistical Package for the Social Sciences; PASW Statistics version 17.0). Cronbach's coefficient alpha was used to assess internal consistency and Pearson's Product Moment Correlation Coefficient was used for all remaining validity analyses. The Mann-Whitney test was used as a non-parametric test to measure within-group differences.

4.6 Results

4.6.1 Phase 1 Results: Clinician Feedback Survey & Semi-structured interview

Twelve clinicians with expertise in brain injury rehabilitation reviewed the PMOT. Participants represented the disciplines of occupational therapy (*n*= 4), physiotherapy (*n*=3), teaching (*n*=1), recreation therapy (*n*=2), physiatry (*n*=1), and neuropsychology (*n*=1) with a range of two to 19 years and a mean of 9.6 years of experience working with this population. All clinicians agreed or strongly agreed regarding the scale's utility and applicability to the ABI population (Tables 4.1 and 4.2). Because of mental fatigue and attention impairments in the patient population for whom the test was developed, clinicians reported that an 11 to 15-item scale requiring between 10 to 15 minutes would be appropriate and tolerable. When given the choice of either a smiley face or star response format, clinicians preferred the smiley face because they perceived this approach presented visual information in a simplified and familiar format for children and it would eliminate the additional cognitive load caused by counting stars. Finally, some clinicians queried whether

children with ABI would be able to comprehend concepts, such as choice and usefulness, and whether participants would require assistance to answer the negatively framed items. In response to clinicians' feedback, the wording of some items was revised and the smiley face response categories were used on the scale. In addition, two positively and negatively framed sample items were added to help participants understand the types of items comprising the scale.

Table 4.1: Clinician Feedback Survey Results

Question	Mean Rating (SD) *N*= 12
The items on the PMOT represent motivation.	1.64 (.50)
The instructions to administer the PMOT are easy to follow.	2.64 (1.86)
The items on the PMOT are clear and easy to follow.	1.73 (.79)
Children with brain injury would be able to understand and select an appropriate response on the PMOT (with moderate assistance).	2.18 (.75)
The layout of the scale is attractive.	1.45 (.69)
The PMOT is at a reading level appropriate for an 8-year-old.	1.55 (.52)
A child with a brain injury would not object to answering items on the PMOT.	2.27 (.90)

Note: 1= strongly agree; 2= agree; 3= neutral; 4= somewhat disagree; 5= disagree; 6= disagree; and 7= strongly disagree

Table 4.2: Clinician Qualitative Feedback

Clinician Comments
"It would be helpful to understand what a child is thinking about a therapy session- if they like it or not, which would impact how much effort they will put forward." (P5)
"Although, I can pretty much tell if a client is not interested in an activity, I think this scale will provide the opportunity to figure out why and help with future programming." (P7)
"Insight into child. Feedback on whether the session is meeting his/her needs. This can help bring the child into planning so that they take more ownership of their rehabilitation." (P2)
"Lack of meaningfulness and motivation is one of the main reasons for therapeutic failure in rehabilitation, especially after brain injury. This scale helps us remain focused, and relevant to the child's needs." (P10)
"You can use the child's responses to indicate a preferred activity, to highlight areas that require additional patient education or a different approach" (P6)
"This can create a "safe" place for a child to share his/her thoughts and understanding about therapy" (P1) " Sometimes it can be difficult to tell if a child is enjoying what they are doing. This scale could help to identify a key item that provides motivation for them." (P9)

4.6.2 Phase 2 Results: Field Testing

4.6.2.1 Sample Characteristics

Overall, the field-testing sample contained 20 healthy and 21 rehabilitation participants (*N*=41). The healthy control group and the rehabilitation group did not differ significantly on demographic characteristics, such as age or sex (see Table 3). Participants' functional ability scores were normally distributed.

Table 4.3: Demographic Characteristics of Study Sample

Characteristics	Healthy Control Sample *n*= 20	Rehabilitation Sample *n*= 21	Statistical value	Significance (*P* -value)
Age (*y*)				
Mean (SD)	11.8 (2.29)	13.1 (2.77)	t (2, 41) =	.25
Median	12.0	13.0	1.69	
Range	8.0-18.0	8.0-18.0		
Gender				
Male (*n*)	9	14	X^2 (2)=	.16
Female (*n*)	11	7	1.95	
ABI (*n*)	-			
Stroke	-	7		
TBI	-	4		
Brain Tumour	-	1		
Orthopedic Injury (*n*)	-			
CP (GMFCS 1-3)	-	3		
Developmental Delay	-	2		
Typically developing	-	4		
*Functional Abilities (PEDI)	-			
Self Care, mean (SD), range	-	29.43 (9.92), 7-40		
Mobility, mean (SD), range	-	23.67 (9.77), 0-35		
Social Functioning, mean (SD), range	-	17.95 (4.88), 10-25		
Total PEDI, mean (SD), range	-	71.05 (21.48), 32-100		
LOC (ABI only)	-	6 (*n*=4) 7 (*n*=3) 8 (*n*= 5)		
Time Post Injury (months)	-			
Mean (SD)	-	9.01 (12.90)		
Median	-	3.8		
Range	-	.67 -47.97		

*PEDI: Caregiver assistance and modification scale of the Pediatric Evaluation of Disability Index

4.6.2.2 Response Process

PMOT Administration:

Both healthy participants and participants in rehabilitation were able to complete the PMOT within 15 minutes. Children either circled or pointed to their responses, depending on their fine motor, visual and cognitive skills. While healthy participants completed the scale in its entirety and circled answers independently, the treating therapist of each child in rehabilitation was consulted to determine the most appropriate format to meet each client's physical and cognitive needs. Eleven rehabilitation participants completed the scale in its

entirety. For participants using the laminated cue card format, two options were provided for participants to select their responses. Nine rehabilitation participants used an option that allowed the child to select from all six smiley faces on a cardstock and one participant used a second option, which reduced the number of response categories the child had to select from at one time by using a two-step approach. First, the child was asked to respond by selecting either true or not true at all on the index card. Next, depending on which option the child selected, he/she was asked to then choose the degree to which the statement was true or not true by selecting between three smiley faces. Regardless of the format used to present the PMOT, each item was read aloud to the participants.

Comprehension of Scale Items

Participants required minimum to moderate assistance to complete the scale. They were encouraged to ask question if they did not understand an item and participants frequently asked questions related to items in the autonomy subscale. The choice items particularly confused younger children in rehabilitation, such as item three, "I had no choice during the activities" and item nine, "I was offered choices". Most were able to comprehend these items once a further explanation was given; however, one eight year old and one 11 year old with a brain injury did not appear to understand the notion of "choice" despite further explanation. The 11-year old's data was excluded in the final analysis because he was unable to answer item #12 (I was able to choose activities).

Comprehension of Response Format

All participants reported that they were able to understand the smiley face response format. Many of the older healthy (*n*= 8) and orthopedic rehabilitation (*n*=7) participants and three ABI participants reported that they read the words under each smiley face to

select their response, whereas one eight year old healthy child and five participants with ABI reported that they relied mostly on the smiley faces; other healthy (*n*= 11) and rehabilitation (*n*=8) participants reported that they relied on both the smiley faces and the words to select their responses. Participants reported that they had to attend to the negatively worded items carefully in order to ensure they selected the response they intended. Participants found the presence of example items that were framed both positively and negatively as helpful for informing them about the items on the rest of the scale. In general, all participants' response selections were consistent with their explanations with respect to why they selected a particular response (Table 4.4).

Table 4.4: Participant response selections with representative quotes

Subscale	Item	Response	Representative Quote
Effort/ Importance	The activities I did in therapy today are important to me	Definitely true	*"I've always found physio not to my liking but after this surgery, I finally see the benefit. When you find a reason to do it, you want to do it. But if you don't see a reason, you don't want to do it" (OI, 14 y)* *"It will get me walking again and it's very important for me to get back to dancing!" (ABI, 11 y)* *"I learned how to cut so that I could make my grandma's card, which is REALLY important!" (ABI, 13 y)* *"The activities we did today relate to my bicycling. I want to bike independently again" (ABI, 18 y)*
	In today's session, I didn't try at all	Not true at all	*"It's not like I was just going through the motions. I really tried to pull all my power together" (ABI, 14 y)*
Relatedness	I felt my therapist helped me	Definitely true	*"She helps me by putting her hands on my hips so I don't lose my balance and tells me what I need to do to fix it and how I can do the exercises better"(P33, OI, 14 y)* *"He helped me with my card by giving me scissors and stuff and he helped me cut stuff" (ABI, 13 y)* *"When I did a bad shot, she said "you'll get it next time" to encourage me" (ABI, 13 y)*
Autonomy	I had no choice during the activities	True	*"Didn't have a choice, If I could choose I would have picked Wii games. This could help me to strengthen my arms." (ABI, 11y)*
		Not true at all	*"She let me play whatever I want and if we were playing mid-way during a game, she was like, it's fine if you want to switch at anytime" (healthy, 12 y)*
Interest/ Enjoyment	In today's session I had fun	Definitely true	*"I had fun. Kicking the ball and dribbling around the cones was more fun than Wii." (ABI, 13 y)*
		Sort of true	*"Activities with balls are not that interesting" (ABI, 13 y)*
	I was bored	Sort of true	*"Some of the exercises were fun and others were boring. More conversation would have made it more interesting." (OI, 15 y)*
Competence	In today's session I did well	Definitely true	*"She was smiling, so I know I did well." (ABI, 14 y)*
	In today's session I didn't do a good job	Not true	*"I didn't pick not true at all for this one because I didn't want to seem cocky" (Healthy, 12 y)*
Value/ Usefulness	The activities we did in therapy today are useful for me	Sort of true	*"Monopoly isn't really something that helps you in life. It's more for fun. But maybe with managing money" (Healthy,12y)*
		Not really true	*"Not really useful for me. I mean I didn't really learn useful skills" (Healthy, 11 y)*
Open Ended Items	In what way could this therapy session have been better?	n/a	*"We could have played soccer or something. That's what I used to play before the accident" (ABI, 9 years)* *"We could have put more things down on the obstacle course and we could have done another puzzle" (ABI, 8 years)* *"Nothing. It was fun" (OI, 14 years)*
	Do you have any other thoughts about today?	n/a	*"Using my right hand is hard" (ABI, 12 years)*

ABI: Acquired brain injury, OI: Orthopedic injury, P: Participant

4.6.2.3 Internal consistency

Cronbach alpha indicated good internal consistency for the PMOT total score (α=.96) and subscale scores when all participants were included in the analysis. Internal consistency in the rehabilitation subsample was also good. When analyzing internal consistency of the scale with the healthy subsample only, internal consistency ratings were moderate to good (Table 4.5).

Table 4.5: PMOT Internal Consistency

Subscales	Total Sample (*N*=41) Cronbach's alpha (α)	Healthy Participants (*n*=20) Cronbach's alpha (α)	Rehabilitation Participants (*n*= 21) Cronbach's alpha (α)
Effort/Importance	.81	.66	.89
Interest/Enjoyment	.87	.81	.87
Competence	.91	.84	.94
Relatedness	.79	.65	.86
Autonomy	.90	.71	.88
Value/Usefulness	.90	.81	.92
Total	.96	.86	.99

Note: Low internal consistency = α >.70, moderate= α= .70-.90, high= α>.90 (Portney & Watkins, 2009)

4.6.2.4 Test-retest reliability

Test-retest reliability was assessed with all participants by correlating PMOT total and subscale scores between the first and second scale administration (taken after a one hour break). The PMOT demonstrates very strong test-retest reliability with a Pearson Correlation of *r*= .97 for the total scale and subscale correlations ranging from *r*=.82 to *r*=.97 (*p*=.01) for the entire sample. For healthy participants, the autonomy subscale appears inconsistent with the rest of the findings. Examining participant scores in this category reveals that participant scores often shifted by one in either direction between the first and second assessment (e.g. shifting from 4 to 5 or 5 to 4), which may have contributed to the low correlation (See Table 4.6).

Table 4.6: Test-Retest Reliability Results of the PMOT

Subscales	Total Sample (*N*= 41) Pearson Correlation (*r*)	Healthy Participants (*n*= 20) Pearson Correlation (*r*)	Rehabilitation Participants (*n*=21) Pearson Correlation (*r*)
Effort/Importance	.92**	.79**	.97**
Interest/Enjoyment	.96**	.85**	.98**
Competence	.96**	.91**	.98**
Relatedness	.82**	.73**	.86**
Autonomy	.87**	.31	.84**
Value/Usefulness	.94**	.88**	.96**
PMOT total score	.97**	.90**	.99**

**. Correlation is significant at the 0.01 level (2-tailed).

4.6.2.5 Convergent validity

PMOT total scores demonstrated a significant, moderate correlation with the PVQ (*r*=.50, *p*=.01) for the entire sample. Separate analysis for each subsample demonstrated a moderately-good correlation between the PVQ and the PMOT for the rehabilitation subsample (*r*= .71, p<.01); however, no correlation between these two measures was found for the healthy subsample (*r*=-.03, p>.05).

4.6.2.6 Mean Motivation Ratings

The mean PMOT score for all participants was 97.35 (*SD*=15.23), out of a total 120 points, indicating a relatively high motivation score. Healthy participants rated themselves slightly higher on the PMOT (*mean*=99.30, *SD*=7.53) than rehabilitation participants (*mean*=95.40, *SD*= 20.28). As the data was skewed positively, it was not normally distributed. Therefore, the Mann- Whitney was used as a non-parametric test to determine if significant differences existed between healthy and rehabilitation participants on PMOT total and subscale scores. The findings indicate no significant difference between groups on the total PMOT score (*Z*= -2.71, *p*=.79), two tailed significance test. However, healthy participants demonstrated significantly higher mean scores in the autonomy subscale (*Z*= -

3.95,p=.00) and significantly lower scores on the value/usefulness subscale (Z= -2.79, p<.01). No significant difference was found between the groups on all other subscales. In addition, therapists rated healthy participants on the PVQ significantly higher than the rehabilitation participants (Z= -4.52, p<.01), with a mean score of 49.95 (SD=3.56) compared to a mean score of 39.52 (SD=8.42) for the rehabilitation participants.

4.7 Discussion

This study sought to assess preliminary psychometric evidence for the PMOT, a scale designed to measure motivation from the perspective of a child in rehabilitation for ABI. Findings indicate promising results for the use of the PMOT as a tool to assess a child's motivation during therapeutic activities. Review by experts in the field of brain injury rehabilitation helped to inform the content and face validity of the scale. Clinicians perceived this scale as a clinically useful tool to garner a clients' perspective of therapy. They identified lack of meaningfulness and motivation as key contributors to failure in achieving successful therapeutic outcomes and perceived this scale as a useful tool to identify factors that may hinder or enhance a client's motivation.

In this study, each of the hypotheses was confirmed with findings demonstrating the PMOT is a stable measure with strong internal consistency and moderate convergent validity with the PVQ, an existing measure of motivation. Psychometric properties for the scale are stronger within the rehabilitation subsample than in the healthy subsample, likely due in part to the fact that that the PMOT was designed for a rehabilitation population in the context of a rehabilitation session. As such, the PMOT content and the nature of the activity session with healthy participants may have lacked relevancy.

Participants reported high levels of motivation during their respective therapy or activity session, indicating positively skewed results. Self-report scales of motivation reveal

information about an individual's perception of their motivation, however, they are limited in that they do not actually tell us *what they do* (Perry & Winne, 2006). Some threats to the validity of self-report scales include poor calibration and positive response bias, factors that may have contributed to the high scores on the PMOT scale (Perry & Winne, 2006; Whitebread et al., 2008). In light of both the strengths and limitations of self-report scales, the application of the PVQ as a measure of motivation was useful for triangulating the data.

No statistically significant differences in total motivation scores were observed on the PMOT between groups; however, healthy participants had significantly higher ratings on the autonomy subscale and significantly lower ratings on the value/usefulness subscale. These findings are consistent with participants' reports during response process assessment, indicating that the scale was sensitive to detect what appear to be true differences between the groups. Healthy participants lower ratings on the value/usefulness subscale may be explained by their perceptions that the activities weren't generally useful for their daily lives, rather they were about having fun; whereas, many rehabilitation participants identified that the activities were valuable for helping them to regain function, to return to the activities they enjoy (i.e. dancing, walking, running), and to return home. Perhaps the healthy participants would have rated this subscale differently if the activity session had been designed to target specific and relevant goals. In relation to SDT, the findings from this study suggest that the rehabilitation subsample identified a higher degree of value and importance for the session, thereby internally regulating their drive for therapy. Alternatively, the healthy subsample may have been driven by interest and enjoyment of the activities and in volunteering and helping, rather than from a sense of personal value and importance for the activities. This supposition would correspond to their higher scores in the

interest/enjoyment subscale and lower scores in the value/usefulness subscale.

Higher autonomy ratings by the healthy subsample corroborated with their reports of being able to select which activities they did and switch activities when they wanted to, while many rehabilitation participants reported far less autonomy in selecting activities or how activities were completed during therapy sessions. With high scores in each of the autonomy, competence, and relatedness subscales, the healthy participants appear to have had their basic needs met, thus providing a social environment that enhanced their motivation. In comparison, the lower autonomy ratings for the rehabilitation participants suggest that this may have somewhat decreased their levels of motivation. Although lower autonomy scores did not appear to significantly reduce the rehabilitation subsample's overall motivation in this study, this factor may impact client motivation in conditions that are challenging or less interesting. Finding opportunities to incorporate autonomy support for rehabilitation participants has been identified as a factor that can promote persistence in therapy, particularly in conditions when clients need to be able to continue to engage in activities that are challenging or unpleasant, in pursuit of their goals (Ziviani, Poulsen, & Cuskelly, 2013).

While both the healthy and rehabilitation subsamples perceived their motivation levels similarly on the PMOT, therapists rated the healthy subsample significantly higher than the rehabilitation subsample on the PVQ. Furthermore, the lack of correlation between the PVQ and PMOT scores amongst healthy participants and presence of a moderate correlation amongst the rehabilitation participants was an unanticipated finding. Given that lack of insight is a recognized limitation in the ABI population (Dijkers, 2004), one may have expected the findings to be reversed. The lack of correlation by healthy participants and the

research assistants may be a consequence of the focus of the PVQ compared to the PMOT. The PVQ is designed to measure motivational performance based on therapists' ratings of the level of assistance an individual requires to demonstrate volitional behaviour, whereas the PMOT is designed to measure an individual's perception of their motivation, rather than their performance. Thus, the lack of correlation between healthy participants PVQ and PMOT scores may exist because those children did not require any assistance to demonstrate volitional behaviours, whereas rehabilitation participants may have needed the assistance, as demonstrated by their higher PVQ scores. An alternative or concurrent explanation may relate to the poor inter-rater reliability of the PVQ, which is a recognized limitation of the scale (S. Anderson et al., 2005; Miller et al., 2013). Specifically, differences in severity/leniency ratings have been shown to influence scoring on this scale. In this study, Master of Occupational Therapy students were research assistants who rated healthy participants and practicing therapists rated the rehabilitation subsample; it is possible that the discrepancy in rating scores may be related to students having a more lenient rating style and/or the therapists having a more severe rating style. In addition, the rehabilitation assistants had a different level of acquaintance with the healthy participants, as they were meeting them for the first time in their session. In contrast, therapists were more familiar with their clients. Nevertheless, these preliminary findings are interesting and indicate that children in rehabilitation can perceive their motivational experiences congruently with therapists and that level of acquaintance between therapists and clients may influence the degree of congruence. Further research is needed to determine if the findings from this pilot study generalize to the rehabilitation population.

Response process findings suggest that items on the autonomy subscale may not fit with the scale as a whole. The concept of choice may be too abstract for younger children

with an ABI and it may be useful to remove or revise item 9, "I was offered choices", and item 12, "I was able to choose activities". The single eight year old with an ABI participant appeared to struggle with understanding the choice questions, which queries its suitability for young children. Further studies including a larger sample of participants representing this age are needed.

4.7.1 Implications

Preliminary findings indicate that the PMOT scale can help therapists in their client-centered practice by assessing children's perceptions of therapeutic activities and that therapist and client ratings of motivation may be similar. The scale may also be used to identify areas in which therapists may want to intervene directly to support children's competence or autonomy if they are scoring consistently low in these areas across different activities. The PMOT may be a particularly useful tool to identify areas that may influence motivation in children who appear to have a lack of motivation during therapy. In addition, therapists can assess how children's motivation levels vary between different activities, such as self-directed or social interaction based activities, in order to guide their intervention planning to optimize children's performance in rehabilitation. Finally, the PMOT may be useful as an intervention tool when a child's perception of their motivation levels does not match their motivational performance. In these situations, therapists could use the PMOT as a tool to improve a client's metacognitive awareness and dialogue with clients about these discrepancies.

While motivation and changes in motivation can be considered a universal human experience, it is important to recognize potential motivational changes that are particularly relevant to individuals with an ABI. Low motivation can result from a primary motivational

deficit associated with the brain insult, from a secondary problem arising from lack of insight to deficits, or from a tertiary problem subsequent to depression, learned helplessness, or loss of self-esteem (Oddy, Cattran, & Wood, 2008). In addition, disorders of diminished motivation result from complex mechanical and physiological processes affecting the neural systems that mediate motivation; between 5 to 67% of patients with TBI experience these disorders (Marin & Wilkosz, 2005). The PMOT is not designed to identify these types of disorders, however, this tool may be useful as an indication of a child's motivation over a period of time. For example, if a child's motivation scores remain consistently low across therapies, it may serve as an indication that more thorough assessment of motivation/apathy is needed.

4.7.2 Future Directions

Findings from this pilot study demonstrate similarity between therapist and client reports of motivation for rehabilitation participants; however, findings are limited, as the PMOT and the PVQ examine motivation using different theoretical constructs and behaviours. To compare more directly therapist and children's ratings of motivation, it would be useful in future studies to apply an observational scale based on the same theoretical underpinnings of the PMOT to record therapist observations of both the child's behaviours and environmental factors. This strategy would provide more information regarding the context of the motivational behaviours and allow for a more direct comparison.

4.7.3 Limitations

The mixed rehabilitation sub-sample is a limitation of this pilot study. In addition, applying a one-hour timeframe between PMOT testing may be considered too brief for

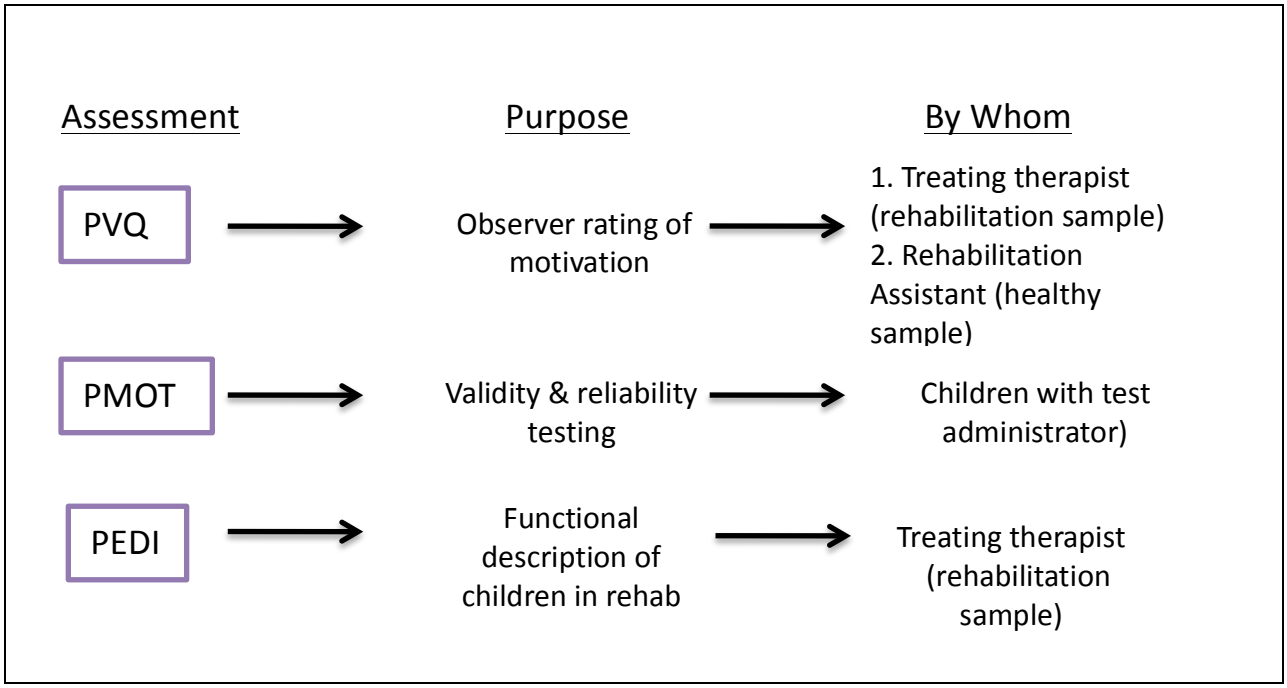
assessing test-retest reliability, however, this timeframe was deemed appropriate because of the common occurrence of memory and fatigue deficits in the ABI population. The use of Pearson Product moment correlation coefficient for reliability testing is also a limitation of this study because systematic differences are not accounted for. However, this method provides preliminary reliability information for pilot testing, which can be used as a basis for more robust research. A further limitation of this study is the use of different types of raters (clinicians versus research assistants) for healthy participants compared to rehabilitation participants. Although all raters were given an introduction to the PVQ, they may have differed in their rating styles and level of acqaintence with the child. Furthermore, as the findings in this study demonstrated positively skewed scores, indicating the potential for ceiling effects, evaluation of the responsivity of the PMOT in highly motivating versus less motivating conditions is needed to determine if this scale can reflect accurately when a child is not motivated during therapy. Finally, the small sample size is a notable limitation and findings should be interpreted with caution. Nonetheless, pilot studies are advantageous, as findings can indicate if more robust research is necessary.

4.8 Conclusion

Gathering children's perceptions, though challenging, is critical to helping them achieve optimal rehabilitation outcomes (Majnemer, 2011; Ronen et al., 2011). To be effective, researchers and clinicians recognize that rehabilitation after brain injury must address patients' attitudes and beliefs (Cicerone, 2012). Based on a small sample of healthy children, and children with acquired brain injury or orthopedic injury, these findings

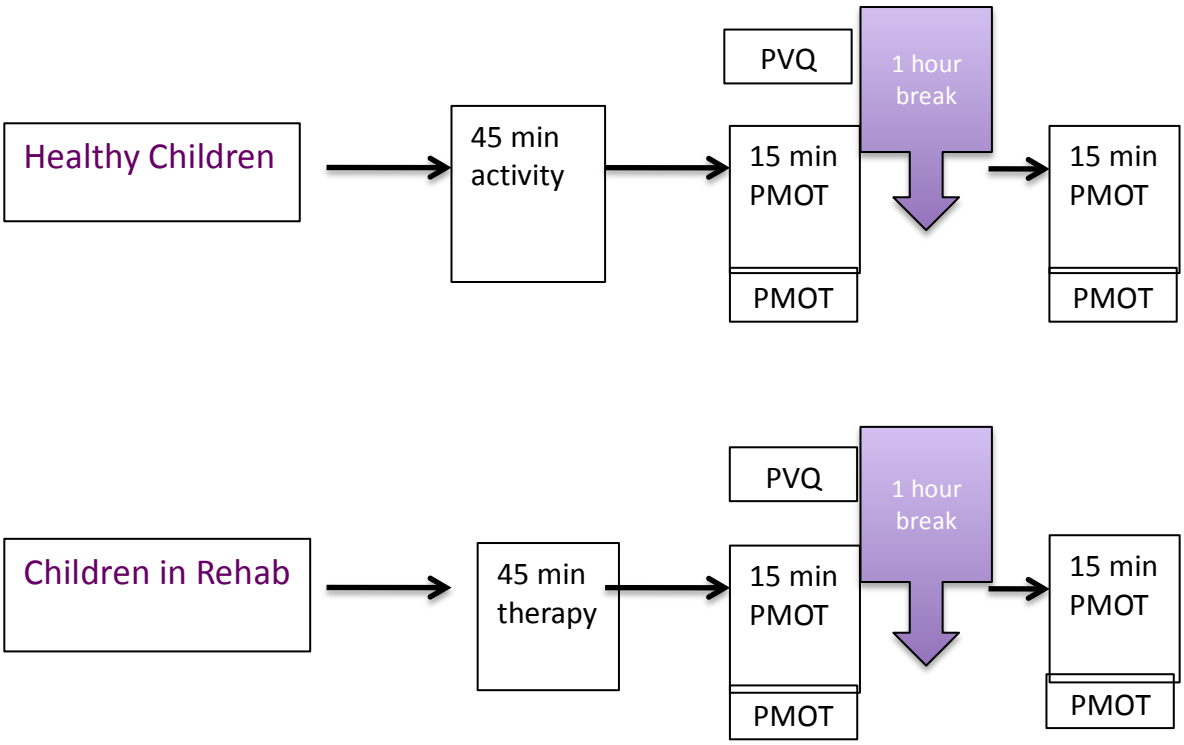
demonstrate generally strong pilot evidence for the use of the PMOT. These positive preliminary findings indicate field-testing this measure with a larger population of children with disabilities to evaluate the dimensionality and conceptual homogeneity of the test items within each subscale is warranted and can provide further refinement and more extensive construct validation.

Figure 4.2: Assessments



*PMOT: Pediatric Motivation Scale; PVQ: Pediatric Volitional Questionnaire; PEDI: Pediatric Evaluation of Disability Inventory

Figure 4.3: Phase 2 Procedures



5. Summary

Although motivation has often been described as an important variable influencing rehabilitation outcomes in children, limited research has explored this construct in the rehabilitation context. Therapists can apply a number of different approaches and tools in their treatment influencing client motivation. For example, token economy systems or technology-based interventions may have differing motivational effects. Furthermore, these effects may differ from one client to the next. As such, tools to explicitly examine factors that may influence a child's motivation are needed to assist clinicians in their client-centred practice by helping them to shape their interventions in a manner that supports each client's motivational needs.

This thesis has added unique information regarding motivation in rehabilitation by revealing what is known about the effects of motivating interventions in children with ABI, identifying the need for valid and reliable measures of motivation, and exploring the application of an existing theory of motivation, SDT, in the rehabilitation context. Finally, a motivation scale has been developed based upon tenets of SDT to assess motivation from the perspective of children with ABI and OI, in a format designed to meet the complex cognitive and physical needs of these populations. The Pediatric Motivation Scale is the first scale to measure the motivational experience from the perspective of children with or without brain injuries undergoing rehabilitation. The PMOT can potentially assist therapists in identifying elements of interventions that can influence and sustain client motivation. Preliminary psychometric evidence is promising and warrants future research for the ongoing development of this scale.

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APPENDIX A: MEDLINE Search Strategy

1 motivation/ or achievement/ or goals/ or intention/ or volition/ or engagement.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept, rare disease supplementary concept, unique identifier] (100537)
2 (motivation or achieve* or goal setting or success or volition or engage*).mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept, rare disease supplementary concept, unique identifier] (865043)
3 exp Brain injuries/rh (4561)
4 (brain injur* or brain contusion* or encephalopath* or stroke).mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept, rare disease supplementary concept, unique identifier] (266545)
5 exp Stroke/rh (7494)
6 ((brain$ or cerebr$ or cerebell$ or intracran$ or intracerebral) adj5 (isch?emi$ or infarct$ or thrombo$ or emoboli$ or occlus$ or stroke or accident*)).tw. (82318)
7 1 or 2 (877106) [Motivation]
8 3 or 4 (266668) [Brain injuries]
9 5 or 6 (89041) [Stroke]
10 8 or 9 (314180) [Combines brain injuries with stroke to give both]
11 7 and 10 (13748) [Motivation combined with brain injuries and stroke]
12 rh.fs. (162193) [Rehab]
13 11 and 12 (1614)
14 limit 13 to "all child (0 to 18 years)" (243) this limits set 13 to those about children
15 child*.mp. (1872848) [anything with child or children]
16 13 and 15 (116) [anything with child or children is combined with motivation and brain injuries and stroke]
17 16 or 14
18 Child/ or Volition/ or pediatric volitional questionnaire.mp. or Motivation/ (1400753)
19 Motivation/ or dimensions of mastery questionnaire.mp. (49586)
20 17 or 18 (1400754)
21 17and 19 (109)

Appendix B: Rancho Los Amigos Level of Cognitive Functioning Scale
AKA Level of Cognitive Functioning Scale (LCFS)

____ (1) Level I - No Response.
Patient does not respond to external stimuli and appears asleep.

____ (2) Level II - Generalized Response.
Patient reacts to external stimuli in nonspecific, inconsistent, and nonpurposeful manner with stereotypic and limited responses.

____ (3) Level III - Localized Response.
Patient responds specifically and inconsistently with delays to stimuli, but may follow simple commands for motor action.

____ (4) Level IV - Confused, Agitated Response.
Patient exhibits bizarre, nonpurposeful, incoherent or inappropriate behaviors, has no shortterm recall, attention is short and nonselective.

____ (5) Level V - Confused, Inappropriate, Nonagitated Response.
Patient gives random, fragmented, and nonpurposeful responses to complex or unstructured stimuli - Simple commands are followed consistently, memory and selective attention are impaired, and new information is not retained.

____ (6) Level VI - Confused, Appropriate Response.
Patient gives context appropriate, goal-directed responses, dependent upon external input for direction. There is carry-over for relearned, but not for new tasks, and recent memory problems persist.

____ (7) Level VII - Automatic, Appropriate Response.
Patient behaves appropriately in familiar settings, performs daily routines automatically, and shows carry-over for new learning at lower than normal rates. Patient initiates social interactions, but judgment remains impaired.

____ (8) Level VIII - Purposeful, Appropriate Response.
Patient oriented and responds to the environment but abstract reasoning abilities are decreased relative to premorbid levels.

Appendix C: The Pediatric Motivation Scale Manual

PMOT

Pediatric Motivation Scale

Sandy Tatla
Tal Jarus
Naznin Virji-Babul
Liisa Holsti

Overview of the Pediatric Motivation Scale (PMOT)

Although motivation is considered an important factor that influences rehabilitation outcomes, limited research has been conducted on the nature of motivation and clinicians do little to formally assess it (Bartlett & Palisiano, 2002; Boosman et al., 2013; Maclean, 2000; Tatla et al., 2013). Enabling children to share their motivational experiences during therapy can assist therapists in designing client-centred interventions, which can enhance a child's engagement in therapy. Ultimately, lack of motivation can limit children from realizing their full functional potential (Jennings, 1988).

The PMOT is a 21-item scale that has been developed to help understand a child's motivation for engaging in rehabilitation activities from their perspective. This scale is designed for use with children ages 8 to 19 years undergoing rehabilitation with brain injuries and without brain injuries[1].

This measure can be used for clinical and research purposes to identify a child's self-perceived level of motivation during therapy. This scale has been designed for use after therapeutic activities; therefore, it is an event based measure of motivation, rather than a measure of a child's motivation as a trait.

Purpose

The PMOT was designed to assess motivation from the perspective of children undergoing rehabilitation. Service providers can use the PMOT to gather children's perceptions of therapeutic activities to inform future treatment planning. This tool may also be useful for clinical research to assess children's motivation during specific interventions under study.

Theoretical Background

This scale is designed based on tenets of Self Determination Theory (SDT). This theory provides a multidimensional perspective of motivation that identifies basic human motivational needs as foundational to behavior, including a sense of competency, relatedness, and autonomy. This theory also addresses different types of motivation and the impact of the social environment on motivation (Edward L Deci & Richard M Ryan, 2008). SDT is a widely researched theory of motivation that has been applied across a variety of context to examine how activity relates to well being (Edward L. Deci & Richard M. Ryan, 2008; Ryan, Rigby, & Przybylski, 2006).

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[1] The PMOT can also be used with children without a brain injury undergoing rehabilitation (i.e. children recovering from orthopedic surgeries). These children would not require categorization on the Ranchos Los Amigos Level of Cognitive Functioning Scale. Field-testing of the measure was completed with children who are functioning cognitively at the level of an 8-year old child.

The PMOT subscales were informed by the Intrinsic Motivation Inventory (IMI), developed by Ryan and colleagues from the Rochester Motivation Research Group (McAuley, Duncan, & Tammen, 1989). The PMOT is comprised of six-subcales and each subscale contains three items, with the exception of the interest/enjoyment subscale, which includes four items because interest/enjoyment is considered a direct indication of intrinsic motivation. The subscales of competence, relatedness and autonomy are theorized to either enhance (indicated by high scores in these subscales) or diminish (indicated by low scores in these subscales) intrinsic motivation. In addition, the value/usefulness and effort/importance subscales are theorized to reflect the degree of extrinsic motivation and internal regulation.

Who can you use it with?

The PMOT can be used with children with brain injuries who are 8 years and older and functioning at a level VI, VII, or VIII on the Adult Ranchos Los Amigos Level of Cognitive Functioning Scale.

Ranchos Los Amigos Level of Cognitive Functioning Scale

Level	Description
VI: Confused, Appropriate Response	Client gives context appropriate, goal-directed responses, dependent upon external input for direction. There is carryover for re-learned but not for new tasks, and recent memory problems persist.
VII: Automatic, Appropriate Response	Client behaves appropriately in familiar settings, performs daily routines automatically, and shows carryover for new learning at lower than normal rates. Client initiates social interactions, but judgment remains impaired.
VII: Purposeful, Appropriate Response	Client oriented and responds to the environment but abstract reasoning abilities are decreased relative to premorbid status.

[1]The PMOT can also be used with children without a brain injury undergoing rehabilitation (i.e. children recovering from orthopedic surgeries). These children would not require categorization on the Ranchos Los Amigos Level of Cognitive Functioning Scale. This scale has been field-tested with children who are functioning cognitively at the level of 8 years.

Scale Components

1. PMOT scale with 21 questions, examples, and response categories
2. 21 question cards & 2 example cards
3. Visual response cards using 1 step or 2 step visual response categories
4. PMOT Summary Score sheet

Administration Time

The PMOT takes generally between 10 to 15 minutes to complete. It may take a little longer if the Service Provider chooses to ask the child any follow up questions or use his or her responses to work with the child to design a future therapy session.

User Qualifications

The PMOT is designed for use by professionals in the health sciences. This includes, but is not limited to, occupational therapists, physiotherapists, recreation therapists, speech and language pathologists, educators, nurses, and social workers. The administration of the PMOT requires the individual to have skills in developing rapport with and interviewing children with disabilities and their parents/caregivers.

Scoring

Children respond on an ordinal, face scale ranging from 1 (not true at all) to 6 (definitely true). Items in each subscale are totaled and divided by the number of items to obtain an average score per subscale. The total scores in each subscale are added to obtain and overall motivation score. Higher scores within each subscale indicate a higher level of the concept in the subscale, whereas lower scores indicate the opposite. Thus, the scores indicate differences in the quality and type of motivation for the child. In addition, a higher total score indicates greater levels of motivation, overall.

Sample Script

Hello (child's name), I'm (your name). I'm here today to ask you about your therapy session.

If the child is self-administering:
I'm going to ask you to complete some questions about the activities you did in session today on this sheet (Show them the Pediatric motivation scale). There are two sections of questions on this scale (Point to the first section of questions). The first set of questions starts with the sentence: In today's session I….You will answer questions 1 to14 with this phrase starting each question. Next you will answer questions 15 to 19 starting with "What we did in therapy today…". (Point to the next set of questions). You will answer how true each of these statements is for you using these response categories from not true at all to definitely true (Point to each response option on the page as you say it). If you have any questions or need any help, you can ask me. Please answer each question as honestly as you can. There is no right or wrong answer to these questions. You will not get in trouble for your answers.

If therapist is administering:
I'm going to ask you some questions about your therapy session today. Using these cards (point to the question cards or question sheet), I'm going to ask you how true each of these statements are for you.
Each of these cards has a statement on it (point to the question cards). I'm going to show you each statement and then ask you to respond by selecting a response on the smiley face response card (point to the Visual Response Page). You might find that the statements are not true at all for you (point to the first smiley face), not true, not really true, sort of true, true, or definitively true for you (Point to each response option on the page as you say it). Please answer each question as honestly as you can. There is no right or wrong answer to these questions. You will not get in trouble for your answers.

It is important while reading these response options aloud to the child to maintain a pleasant but neutral tone (e.g. not overly emphasizing specific responses). This will help to avoid leading the child or influencing their response choice.

After completing the assessment the PMOT is finished.
We are all done! I have asked you quite a few questions about your therapy session today. Thank you for spending time with me today.

Instructions to complete the Pediatric Motivation Scale (PMOT)

All administration and scoring procedures should be followed to maintain test reliability and to ensure that interpretation of results is based on the standards used to develop the instrument. It will be helpful to practice administering the PMOT to help familiarize yourself with the test procedures before administering it to a child for the first time.

Methods of Administration
There are two methods of administration for the PMOT.

Self-Administered: Allow the child to complete the PMOT using the PMOT record form independently or with assistance of the therapist, a caregiver, or parent as needed. The child completes the PMOT record form by recording his or her responses directly in the booklet (pages 12-20). Once you have received the completed record form, you can transfer the responses to the Summary Score Sheet to calculate the scores. Note: If deemed appropriate, the child can also complete the full PMOT and record his/her answers directly in the booklet with a therapist present to help read each item to the client.

Interviewer-Administered: Administer the PMOT to the child using the Question Cards (pages 24-37) and Visual Response Page (pages 21-23). This administration method enables you to clarify responses, and facilitate further discussion, as needed. During administration, the child's responses can be recorded directly onto the PMOT Summary Score Sheet (pages 38-39).

Testing Environment
Both methods of PMOT administration should be completed in a quiet location with minimal distractions.

Child and Parent/Caregiver/Interviewer Involvement
The intention of the assessment is to elicit a child's own response about their experience of therapy that day. For example, how much they enjoyed therapy, how competent they felt, how easy or difficult the tasks were, etc. It is the child's role to answer all of the questions as accurately as possible. The role of the interviewer or parent is to assist the child in answering the questions if needed, but **not to answer for the child**. All of the questions contained on the PMOT are quite subjective in nature, therefore the interviewer/parent can read or explain the item, but **should not choose the response**. In all situations, the child should be encouraged to answer independently prior to having the interviewer/parent offer assistance. In addition, having the child record his or her own responses (within their capacity) can help keep the child engaged in the assessment.

If you are administering the PMOT to the child using the Question Cards and Visual Response Pages, it is important to obtain the child's responses to the questions. Depending on the age and abilities of the child, it may be preferable that the parent be present to clarify with the child or not be present to avoid influences on the child's responses and to allow the child to answer all questions independently.

Materials required for Administration

Record Forms

The PMOT record form contains 19 questions about the child's experience in therapy that day. They are asked to select from a series of 6 facial expressions to indicate how true each statement is for them: (1) Not true at all (2) Not true (3) Not really true (4) Sort of true (5) True (6) Definitely true. The child can complete this measure alone or with assistance of the researcher, as needed. They will also be asked 2 open-ended questions to gather any additional feedback that the child may have.

Question Cards

If the clinician/researcher is going to administer the PMOT directly to the child in an interview format, he or she will use the Question Cards, Visual Response Pages and the Summary Score Sheet to record the child's responses. Each Question Card contains a short phrase to describe the subjective experience of the child. There are 19 Question Cards and 2 Example Cards.

Prompts

The test administrator can provide prompts to help the child understand an item. For example, the items related to choice can be re-framed.
Item 3: I had no choice during the activities and
Item 9: I was offered choices
Prompt:

- I was not able to pick how we did the activities
- I was given choices
- I was able to change how we did the activities or what we did in therapy
- I was able to pick activities or how we did activities

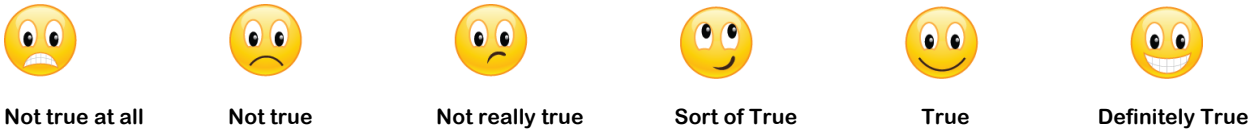
Item 15: The activities we did in therapy today are useful for me
Prompt:

- The activities we did will help me (to get better)

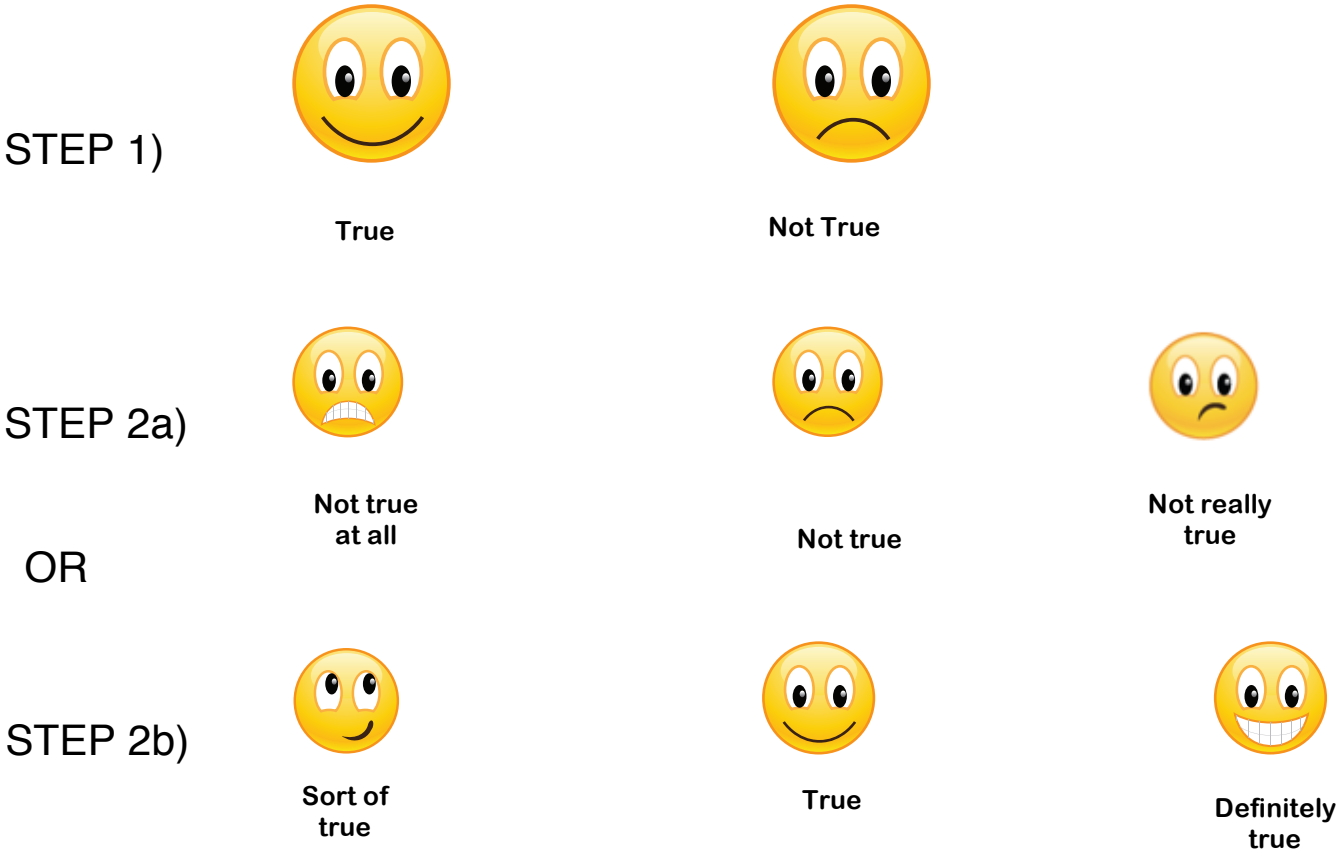
Visual Response Pages
To meet the needs of children with a range of abilities, there are two Visual Response Page options, provided on pages 23-24. They are designed to help children decide their responses to the PMOT items. The enlarged formats are especially helpful for children with visual and/or cognitive impairments. The responses are presented with a facial expression and descriptions to offer an alternative with children who are not readers. The order of the facial expression for each Visual Response Page will remain the same for each question.

The Visual Response Pages looks like this:

a) 1 step response (p.21)



b) 2-step response (p.22,23)



Summary Score Sheets

The Summary Score Sheet is used to calculate the overall motivation score for each child. The ratings given by the child, either on the completed Record Form or through his or her responses using the Question Cards, are recorded on the Summary Score Sheets (pages 38-39)

PMOT Administration Procedures

When administering the PMOT in an interview format, you will need the following materials:

- 21 Question Cards and the 2 Example Cards
- Visual Response Page
- PMOT Summary Score Sheet

Follow the steps outlined below to administer the PMOT in an interview format. A sample script of suggested wording to use when administering the PMOT is provided for your review on page 5.

1. Prior to administering the PMOT, insert the Question Cards into the stack according to the sequence of numbered questions.
2. Arrange the PMOT Visual Response Pages in front of the child so they are easily visible.
3. Begin with the two Example Items (I like playing basketball, I don't like playing basketball) to give the child practice answering the questions.
4. After completing the PMOT Example Items, proceed to the first Question Card.
5. Using the Visual Response Page to cue the child, ask the child to tell you how true the statement is for them, ranging from "not true at all" to "definitely true".
6. Proceed through all of the Question Cards reading the statements on each card as you progress through to the end.
7. Based on the child's responses, record the corresponding score in each (row/column) of the Summary Score Sheet.
8. Score the measure as directed in the Scoring Procedures section.

Scoring Procedures (using summary score sheet)

Children respond on an ordinal, face scale ranging from 1 (not true at all) to 6 (definitely true). Items #3,4,6,8, and 18 have an (R) after them to indicate that these items should be reverse scored. You can do this by subtracting the item response from 7, and use the result as the item score for that item.

Items in each subscale are totaled and divided by the number of items to obtain an average score per subscale. The total scores in each subscale are added to obtain and overall motivation score. Higher scores within each subscale indicate a higher level of the concept in the subscale, whereas lower scores indicate the opposite. Thus, the scores indicate differences in the quality and type of motivation for the child. In addition, a higher total score indicates greater levels of motivation, overall.

Adaptations to Assessment of Motivation using the PMOT

Children with Motor Impairments:
If a motor impairment limits the childs' ability to complete the response selections of the PMOT scale, the child can indicate their response and the therapist/researcher can transcribe his or her response onto the form. In these instances, more time may be needed to complete the task.

Children with Visual Impairments:
If a visual impairment limits the childs' ability to view the questions and response items on the PMOT scale, the questions can be read to the child and the responses will be enlarged on an index card, as an option. In these instances, more time may be needed to complete the task.

Children with Cognitive Impairments:
If cognitive impairments limit a child's ability to read the questions and complete the response selections on the PMOT scale, the questions on the scale will also be provided as single items on laminated cardstock, so that each question can be asked individually. There are two options for response sections that will also be provided on a separate laminated card stock. One option allows the child to select from all six smiley faces. The second option reduces the number of response categories the child has to select from at one time by using a two-step approach. First, the child is asked to respond by selecting either true or not true at all on the index card. Next, depending on which option the child selects, he/she will be asked to then choose the degree to which they feel the statement is true or not true by selecting between three smiley faces. In either of these instances, more time may be needed to complete the task.

Children who are Non-Verbal:
Completing the PMOT scale does not require verbal responses. The PMOT scale can be administered in an interview format and the child can indicate his or her answer by pointing to the appropriate response on the laminated card stock response page.

Participant #: _____

Pediatric Motivation Scale (PMOT)

Example item(s)

a) I like playing basketball


Not true at all


Not true


Not really true


Sort of True


True


Definitely True

b) I don't like playing basketball


Not true at all


Not true


Not really true


Sort of True


True


Definitely True

In today's session…

1. I tried my hardest


Not true at all


Not true


Not really true


Sort of True


True


Definitely True

2. I am happy with how I did


Not true at all


Not true


Not really true


Sort of True


True


Definitely True

3. I had no choice during the activities


Not true at all


Not true


Not really true


Sort of True


True


Definitely True

In today's session…

4. I was bored.


Not true at all


Not true


Not really true


Sort of True


True


Definitely True

5. I felt safe with my therapist


Not true at all


Not true


Not really true


Sort of True


True


Definitely True

6. I didn't do a good job


Not true at all


Not true


Not really true


Sort of True


True


Definitely True

In today's session…

7. I had fun

Not true at all | Not true | Not really true | Sort of True | True | Definitely True

8. I didn't try at all

Not true at all | Not true | Not really true | Sort of True | True | Definitely True

9. I was offered choices

Not true at all | Not true | Not really true | Sort of True | True | Definitely True

In today's session…

10. I felt like my therapist cared about me

Not true at all | Not true | Not really true | Sort of True | True | Definitely True

11. the activities were interesting

Not true at all | Not true | Not really true | Sort of True | True | Definitely True

12. I was able to choose activities

Not true at all | Not true | Not really true | Sort of True | True | Definitely True

In today's session…

13. I felt my therapist helped me


Not true at all


Not true


Not really true


Sort of True


True


Definitely True

14. I did well


Not true at all


Not true


Not really true


Sort of True


True


Definitely True

The activities we did in therapy today…

15. are useful for me

Not true at all | Not true | Not really true | Sort of True | True | Definitely True

16. are activities that I would like to do again

Not true at all | Not true | Not really true | Sort of True | True | Definitely True

17. are important to me

Not true at all | Not true | Not really true | Sort of True | True | Definitely True

The activities we did in therapy today…

18. won't help me


Not true at all


Not true


Not really true


Sort of True


True


Definitely True

19. could help me improve


Not true at all


Not true


Not really true


Sort of True


True


Definitely True

Part II. Open Ended Questions:

1) **In what way could this therapy session have been better?**

2) **Do you have any other thoughts about what we did today?**

The Visual Response Page (1 step)

Not true at all

Not true

Not really true

Sort of true

True

Definitely true

True

Not True

Not true
at all

Not true

Not really
true

OR

Sort of
true

True

Definitely
true

1. In today's session I tried my hardest

---

2. In today's session I am happy with how I did

3. In today's session I had no choice during the activities

---

4. In today's session I was bored

---

5. In today's session I felt safe with my therapist

---

6. In today's session I didn't do a good job

7. In today's session I had fun

---

8. In today's session I didn't try at all

9. In today's session I was offered choices

---

10. In today's session I felt like my therapist cared about me

11. In today's session the activities were interesting

---

12. In today's session I was able to choose activities

13. In today's session I felt my therapist helped me

---

14. In today's session I did well

15. The activities we did in therapy today are useful for me

---

16. The activities we did in therapy today are activities I would like to do again

17. The activities we did in therapy today are important to me

---

18. The activities we did in therapy today won't help me

19. The activities we did in therapy today could be help me improve

---

1) In what way could this therapy session have been better?

---

2) Do you have any other thoughts about what we did today?

Example 1:

I like playing basketball

Example 2:

I don’t like playing basketball

PMOT Summary Score Sheet

Reverse score items # 3, 4, 6, 8, and 18, which have an (R) after them. You can do this by subtracting the item response from 7, and use the result as the item score for that item. A higher score will indicate more of the concept described in the subscale name. For example, a higher score on perceived competence indicates that the child felt more competent. Then calculate the subscale scores by averaging the items on each subscale.


Not true at all
1


Not true
2


Not really true
3


Sort of True
4


True
5


Definitely True
6

Items	**Subscale Scores**						**Total Scores**
In today's session…	Effort/ Importance	Interest/ Enjoyment	Competence	Relatedness	Autonomy	Value/ Usefulness	
1. I tried my hardest							
2. I am happy with how I did							
3. I had no choice during the activities (R)							
4. I was bored (R)							
5. I felt safe with my therapist							
6. I didn't do a good job (R)							
7. I had fun							
8. I didn't try at all (R)							
9. I was offered choices							
10. I felt like my therapist cared about me							
11. The activities were interesting							
12. I was able to choose activities							
13. I felt my therapist helped me							
14. I did well							
The activities I did in therapy today…							
15. are useful for me							
16. are activities that I would like to do again							
17. are important to me							
18. won't help me (R)							
19. could help me improve							**TOTAL PMOT**
Total Score Per Subscale							=
Number of items Per Subscale	3	4	3	3	3	3	19
Average Score (Total Score/# items)							

Part II. Open Ended Questions:

3) **In what way could this therapy session have been better? Or How could this therapy session have been better?**

4) **Do you have any other thoughts about what we did today?**

Therapist Comments:

APPENDIX D

Parts II and III: Caregiver Assistance and Modification

Circle the appropriate score for Caregiver Assistance and Modification for each item.

	Caregiver Assistance Scale						Modification Scale			
	Independent	Supervision	Minimal	Moderate	Maximal	Total	None	Child	Rehab	Extensive
SELF-CARE DOMAIN	5	4	3	2	1	0	N	C	R	E
A. **Eating**: eating and drinking regular meal; do not include cutting steak, opening containers or serving food from serving dishes	5	4	3	2	1	0	N	C	R	E
B. **Grooming**: brushing teeth, brushing or combing hair and caring for nose	5	4	3	2	1	0	N	C	R	E
C. **Bathing**: washing and drying face and hands, taking a bath or shower; do not include getting in and out of a tub or shower, water preparation, or washing back or hair	5	4	3	2	1	0	N	C	R	E
D. **Dressing Upper Body**: all indoor clothes, not including back fasteners; include help putting on or taking off splint or artificial limb; do not include getting clothes from closet or drawers	5	4	3	2	1	0	N	C	R	E
E. **Dressing Lower Body**: all indoor clothes; include putting on or taking off brace or artificial limb; do not include getting clothes from closet or drawers	5	4	3	2	1	0	N	C	R	E
F. **Toileting**: clothes, toilet management or external device use, and hygiene; do not include toilet transfers, monitoring schedule, or cleaning up after accidents	5	4	3	2	1	0	N	C	R	E
G. **Bladder Management**: control of bladder day and night, clean-up after accidents, monitoring schedule	5	4	3	2	1	0	N	C	R	E
H. **Bowel Management**: control of bowel day and night, clean-up after accidents, monitoring schedule	5	4	3	2	1	0	N	C	R	E
Self-Care Totals	**SELF-CARE SUM** ☐									

Self-Care Modification Frequencies

MOBILITY DOMAIN										
A. **Chair/Toilet Transfers**: child's wheelchair, adult-sized chair, adult-sized toilet	5	4	3	2	1	0	N	C	R	E
B. **Car Transfers**: mobility within car/van, seat belt use, transfers, and opening and closing doors	5	4	3	2	1	0	N	C	R	E
C. **Bed Mobility/Transfers**: getting in and out and changing positions in child's own bed	5	4	3	2	1	0	N	C	R	E
D. **Tub Transfers**: getting in and out of adult-sized tub	5	4	3	2	1	0	N	C	R	E
E. **Indoor Locomotion**: 50 feet (3-4 rooms); do not include opening doors or carrying objects	5	4	3	2	1	0	N	C	R	E
F. **Outdoor Locomotion**: 150 feet (15 car lengths) on level surfaces; focus on physical ability to move outdoors (do not consider compliance or safety issues such as crossing streets)	5	4	3	2	1	0	N	C	R	E
G. **Stairs**: climb and descend a full flight of stairs (12-15 steps)	5	4	3	2	1	0	N	C	R	E
Mobility Totals	**MOBILITY SUM** ☐									

Mobility Modification Frequencies

SOCIAL FUNCTION DOMAIN										
A. **Functional Comprehension**: understanding of requests and instructions	5	4	3	2	1	0	N	C	R	E
B. **Functional Expression**: ability to provide information about own activities and make own needs known; include clarity of articulation	5	4	3	2	1	0	N	C	R	E
C. **Joint Problem Solving**: include communication of problem and working with caregiver or other adult to find a solution; include only ordinary problems occurring during daily activities; (for example, lost toy; conflict over clothing choices.)	5	4	3	2	1	0	N	C	R	E
D. **Peer Play**: ability to plan and carry out joint activities with a familiar peer	5	4	3	2	1	0	N	C	R	E
E. **Safety**: caution in routine daily safety situations, including stairs, sharp or hot objects and traffic	5	4	3	2	1	0	N	C	R	E
Social Function Totals	**SOCIAL FUNCTION SUM** ☐									

Social Function Modification Frequencies

Pediatric Motivation Scale Study
Service Provider Survey

You have been invited to participate in this study because you have expertise in the field of brain injury rehabilitation. As a professional in this area, you have knowledge about the physical and cognitive challenges of children with brain injury and children's engagement during rehabilitation. ***Your expertise is valuable to us.***

Based on your opinion, please answer the following questions to the best of your ability. For each statement given below, please indicate whether you strongly agree, agree, somewhat agree, are neutral, somewhat disagree, disagree, or strongly disagree.

1. The items included on this scale appear to represent motivation.

○ *Strongly Agree*
○ *Agree*
○ *Somewhat Agree*
○ *Neutral*
○ *Somewhat Disagree*
○ *Disagree*
○ *Strongly Disagree*

2. The instructions to complete the Pediatric Motivation Scale are easy to follow.

○ *Strongly Agree*
○ *Agree*
○ *Somewhat Agree*
○ *Neutral*
○ *Somewhat Disagree*
○ *Disagree*
○ *Strongly Disagree*

3. The questions on the Pediatric Motivation Scale are clear and easy to follow.

○ *Strongly Agree*

- ○ *Agree*
- ○ *Somewhat Agree*
- ○ *Neutral*
- ○ *Somewhat Disagree*
- ○ *Disagree*
- ○ *Strongly Disagree*

4. Children with brain injury would be able to understand and select an appropriate response (with minimal to moderate assistance) using the smiley face scale.

- ○ *Strongly Agree*
- ○ *Agree*
- ○ *Somewhat Agree*
- ○ *Neutral*
- ○ *Somewhat Disagree*
- ○ *Disagree*
- ○ *Strongly Disagree*

5. The layout of the questions on the Pediatric Motivation Scale was attractive.

- ○ *Strongly Agree*
- ○ *Agree*
- ○ *Somewhat Agree*
- ○ *Neutral*
- ○ *Somewhat Disagree*
- ○ *Disagree*
- ○ *Strongly Disagree*

6. The Pediatric Motivation Scale is at a reading level appropriate for an 8-year old child.

- ○ *Strongly Agree*
- ○ *Agree*
- ○ *Somewhat Agree*

○ *Neutral*
○ *Somewhat Disagree*
○ *Disagree*
○ *Strongly Disagree*

7. A child with a brain injury would not object to answering the questions on the Pediatric Motivation Scale.

○ *Strongly Agree*
○ *Agree*
○ *Somewhat Agree*
○ *Neutral*
○ *Somewhat Disagree*
○ *Disagree*
○ *Strongly Disagree*

8. In your opinion, has any major topic related to motivation been omitted?

_____

_____

_____

_____

_____

_____

9. How long do you think it would take a child to complete the Pediatric Motivation Scale?

_____

_____

_____

10. During therapy, what is a reasonable length of time that you could spend completing this scale with a child?

○ < 5 minutes

○ 5-10 minutes
○ 11-15 minutes
○ 16-20 minutes
○ 21-25 minutes
○ 26-30 minutes
○ > 30 minutes

11. Based on your knowledge of the brain injury population, what is a reasonable number of questions to include on the Pediatric Motivation Scale? Please select as many responses as you think would apply.

○ < 5 questions
○ 5-10 questions
○ 11-15 questions
○ 16-20 questions
○ 21-25 questions
○ 26-30 questions
○ > 30 questions

12. In your opinion, would this scale be helpful to you as a therapist/teacher?

○ Yes
○ No
○ Maybe

13. If you answered yes to the above question, please explain how this scale could be helpful to you.

_____

_____

_____

_____

_____

_____

14. If you answered yes to question 12, please move on to the next question. If you answered no to question 12, please explain why this scale would not be helpful to you.

_____

_____

_____

_____

_____

_____

15. Are there any items on this scale that appear redundant or unnecessarily repeated?

_____

_____

_____

_____

_____

16. Were any of the questions unclear or ambiguous? If so, will you say which and why?

_____

_____

_____

_____

_____

17. Are there any other obstacles or challenges you see in patients reporting their motivation on PMOT?

_____

_____

_____

_____

_____

_____

18. Would you add any other open-ended questions?

_____

_____

_____

_____

19. a) Which response format do you think would most meet the needs of children with brain injuries (please circle)

Stars or Smiley Faces

b) Can you please explain why?

_____

_____

_____

_____

_____

20. Do you think that results can inform intervention planning?

_____

_____

_____

_____

_____

_____

21. Do you have any other comments you wish to share?

_____

_____

_____

_____

_____

_____

Thank you very much for your valuable input!

Participant Number: _____

Pediatric Motivation Scale Study
Administration Questionnaire

1. Was the child able to understand the questions on the Pediatric Motivation Scale?

(Please circle)

YES NO

Comments:

_____

_____

_____

_____

_____

_____

2. Was the child able to understand the concept of the smiley face scales?

(Please circle)

YES NO

Comments:

_____

_____

_____

_____

_____

_____

3. Was the child able to select an appropriate response (with minimal to moderate assistance) using the smiley face scale?

(Please circle)

YES NO

Comments:

4. How much assistance did the child require?

(Please circle)

minimum assistance moderate assistance maximum assistance

5. Did the child object to answering any of the questions?
(Please circle)

YES NO

Comments:

6. How long did it take to complete the Pediatric Motivation Scale?

7. Were any of the questions unclear or ambiguous? If so, will you say which and why?

8. Would you add any other open-ended questions?

_____

_____

_____

9. Any other comments?

_____

_____

_____

_____

_____

Participant Number: _____

Clinician Demographic Questionnaire

Date: _____

1. Please select your discipline:

___ Speech & Language Therapist

___ Occupational Therapist

___ Physiotherapist

___ Other

___ Recreation Therapist

2. Please indicate the number of years you have been working in the field of rehabilitation with children.

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3. Please indicate the number of years you have been working specifically with children with brain injury?

Participant Number: _____

Child in Rehabilitation Demographic Questionnaire

Date: _____

Sex (Please circle): Male Female

Age: _____

Grade: _____

Date of Injury: _____

Days Post Injury: _____

Type of Injury:

_____

_____

Level of Consciousness (if applicable): _____

Participant Number: _____

Healthy Child Demographic Questionnaire

Date: _____

1. Sex (Please circle) Male Female

2. Age: _____

3. Birthdate: _____

4. Grade: _____

5. Does your child have a history of any serious medical conditions or learning/behavior problem?

(Please circle) YES NO

If so, please record the type of medical condition or learning/behavioral problem:

_____

_____

_____

_____