

FACE VALIDITY OF THE MULTIPLE ERRANDS TEST WITH YOUTH IN A
COMMUNITY SETTING

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DEDICATION

I'd like to dedicate this work to my father, whose accident made real to me and our family the profound changes to a person that can occur after brain injury. This event set me on a path to try and understand more about brain injury and this thesis is a culmination of years of thought, questioning and seeking to know more. My dad has always been both a big encourager to me and a tough critic. He believed I could always achieve what I set my mind to and that has helped me to persevere and reach many goals. I also dedicate this work to my mother. My experience with occupational therapy was because of you, and your pragmatic, intelligent, constructive and compassionate world view eventually became my own.

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ABSTRACT

The Multiple Errands Test (MET) is a performance-based assessment of the impact of executive dysfunction in the real-world. For youth (age 16-24) who sustain acquired brain injury, distinguishing gaps in typical development of executive function from acquired impairment(s) can be challenging. A scoping review found no studies examining youth performance on the MET. A revised youth MET (yMET) was developed from a focus group and field tested. The yMET was relevant and cognitively challenging for youth, with older youth performing better than younger. Preliminary results indicate that future studies with the yMET are feasible and warranted.

LIST OF ABBREVIATIONS USED

ABI	Acquired Brain Injury
CMOP-E	Canadian Model of Occupational Performance and Engagement
ICF	International Classification of Function, Disability and Health
MET	Multiple Errands Test
EF	Executive Function
LR	Lead Researcher
PEO	Person Environment Occupation Model
WHO	World Health Organization
yMET	Youth Multiple Errands Test

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To my husband, who has always supported my personal goals, including this one to complete further education, I am thankful for your loyalty and care of me throughout this process. To my three beautiful children, I hope that you grow to love learning and discovery, and always keep asking questions and seeking answers. I am looking forward to more free time to enjoy fun activities together. To my parents, this process has taken many years and hard work and I hope now to be able to spend more time with you. Thank you for the amazing foundation of education you provided me with that has made it possible for me to complete this next level of a Masters degree. And, to my parents in law, your assistance with managing our very busy family life has been invaluable to me throughout this process.

CHAPTER 1 INTRODUCTION

1.1 The Multiple Errands Test (MET) and Real-World Executive Function (EF)

The Multiple Errands Test (MET) is a naturalistic assessment of real-world executive function originally developed by neuropsychologists (Alderman et al., 2003; Knight, Alderman & Burgess, 2002; Shallice & Burgess, 1991.) Shallice and Burgess, the two neuropsychologists who initially designed the MET, observed that patients with frontal lobe brain injuries often scored within the normal range on traditional pencil and paper tests of EF completed in a quiet testing environment but in real life their EF was impaired. They hypothesized that real life is inherently more complex and dynamic with more distractions, interruptions and less structure than the requirements of traditional neuropsychological testing and so they developed the MET to challenge EF in a way that is more representative of the real-world. The MET is a complex shopping activity conducted in a real-world context, with the examiner observing and rating performance of the test taker. More recently, significant contributions to the MET literature have been made by several occupational therapy researchers (Dawson et al., 2009; Morrison et al., 2013; Clark et al., 2015).

1.2 MET and Occupational Therapy

For occupational therapists there is a good fit between the MET and occupational therapy frameworks including theoretical models like the Person-Environment-Occupation (PEO) (Law et al., 1996) model and the Canadian Model of Occupational Performance and Engagement (CMOP-E) (CAOT, 1997; Townsend & Polatajko, 2007). The PEO model illustrates the dynamic interaction between the person, the environment

and occupation (i.e., groups of activities/tasks), with occupational performance as the outcome of the transaction of the person, environment and occupation. The CMOP-E provides a three-dimensional depiction of the relationship of the person (cognitive, physical, affective, spiritual), areas of occupation (self-care, productivity, leisure) and the environment (physical, institutional, social, cultural), bringing greater detail to each domain. Occupational performance and engagement are defined in the CMOP-E as the dynamic interaction of person, occupation and environment.

The MET includes these similar three components, a test taker, in a real-world environment, completing a series of errands designed to challenge EF. The focus of the MET is real-world EF and is understood from the perspective of the CMOP-E model as a cognitive performance component of the person. Unlike most other traditional assessments of EF taking place in a testing environment, the MET enables occupational therapists to directly observe the dynamic interaction of the person, engaged in occupation in a real-world environment and thereby to ascertain not only the impact of EF on everyday life (Knight, Alderman & Burgess, 2002), but also factors influencing occupational performance such as complex, real-world environmental features. The MET also identifies limitations in EF negatively influencing occupational performance and affecting the transactions between and among the person, environment and occupation, in the real-world interactions.

Another important theoretical framework used by occupational therapists and many health professions for understanding health is the International Classification of Functioning, Disability and Health (ICF) published by the World Health Organization (WHO, 2002). According to the ICF there are different dimensions to consider for a

health condition (e.g., executive dysfunction), the body functions/structure, activity and participation dimensions. Additionally, there is an interactive relationship among these dimensions and the environment. The MET assesses at the participation level of the ICF framework, considering the persons' involvement in a life situation in relation to activities and contextual factors. Occupational therapy focuses on meaningful participation in occupations, it is one of the professions' core values. Seen through the lens of the WHO theoretical framework, the MET assesses at the level of participation, the primary targeted level for occupational therapy, making it a relevant tool for occupational therapy.

In clinical practice, the MET is used to assess real-world executive functioning in individuals who have acquired brain injuries (ABI) from stroke, trauma, tumors and other acquired reasons. Executive function refers to complex cognitive processes that coordinate and integrate basic cognitive skills to allow for goal-oriented behaviour. Individuals with an ABI often have impairments in EF. Chan et al. (2008) define the term 'executive functions' as "an umbrella term comprising a wide range of cognitive processes and behavioural competencies which include verbal reasoning, problem solving, planning, sequencing, the ability to sustain attention, resistance to interference, utilization of feedback, multitasking, cognitive flexibility, and the ability to deal with novelty." (p. 201) Deficits in EF can have a profound impact on daily life including ability to work, attend school, and live independently.

New and complex task performance required for adult life roles are reliant on EF. As such, for adolescents and young adults with ABI in the process of transitioning to more adult life roles, impairments in these functions can have significant and lasting

effects on their future. Clinically, working as an occupational therapist, I observed late adolescent and young adults with ABI, unable to manage the complex planning and organization required for completing major assignments in their university studies after ABI. Also, when faced with the significant challenges transitioning to independent living, including managing a schedule and financial budget, planning grocery shopping and meals and doing the housekeeping, young people with ABI were more disadvantaged and tended to fall behind their peers in these areas. I sought a more formal way to measure or describe the problems they were having and impact on their day to day function. I was aware that for this age group that their executive functions were still developing and I was unsure of how to discern acquired impairment related to brain injury from ongoing brain development.

1.3 Development of Executive Functions in Adolescence and Young Adults

Late adolescence and young adulthood are a critical period of brain development for cognitive functions including EF (Taylor et al., 2013). While research suggests that during this stage several components of EF ability improve on traditional tests of EF there is also evidence that development of EF is variable with some aspects maturing at younger ages and others later on (Taylor et al., 2013; Taylor et al., 2015). So, when a brain injury occurs during this stage it can result in deficits that are hard to distinguish from brain functions that are still developing. This was the clinical challenge I faced in my practice as a community based occupational therapist when working with adolescents and young adults who sustained brain injuries. I was aware of the clinical utility and applicability of the MET to occupational therapy practice but I was unsure if I could use the MET with adolescents and young adults knowing their EF were still developing. I

was also unsure what to expect of adolescent and young adult performance on the MET compared to adults. This clinical problem became the starting point for my thesis.

1.4 Thesis Overview

This thesis is organized in the following way. Chapter 2 will provide a scoping review of the existing literature on the MET and identify persisting gaps in research and areas for future study. Then, Chapter 3 will include the detailed methodology for the mixed method study (focus group and field testing of a new MET for youth) that was undertaken to address gaps in research identified by the scoping review. Chapter 4 will present the background, methods and results of the focus group and field testing and discussion of the results. Chapter 5 will discuss how these findings might inform occupational therapy practice, education and research associated with using the MET with youth in a community setting.

CHAPTER 2 LITERATURE REVIEW

The following chapter is a pre-publication version of the final manuscript currently in press. This chapter was primarily written by Vanessa Hanberg with contribution from Dr. Diane MacKenzie and Dr. Brenda Merritt.

2.1 Introduction

Worldwide, brain injury is a leading cause of death and disability, with incidence of pediatric traumatic brain injury (TBI; age \leq 18 yrs.), ranging from 47-280 per 100,000 (Dewan et al., 2016). TBI is one type of Acquired Brain Injury (ABI), and the overall statistics are not known (Toronto ABI Network). ABI can result in a range of physical, cognitive, emotional and behavioural impairments, and is associated with permanent disability, learning disabilities, chronic mental illness, homelessness and incarceration (Colantonio et al., 2014; Dams-O'Connor et al., 2014; Ewing Cobbs et al., 2004). High rates of TBI occur in adolescence and incidence is greater in males (Dewan et al., 2016).

Late adolescence through early adulthood is known to be a critical developmental stage for youth¹ and of the frontal lobe regions of the brain supporting executive function (EF) development (Sowell, Thompson & Toga, 2004). EF includes higher order cognitive processes that co-ordinate and integrate lower order cognitive processes to enable goal directed behaviour (Cicerone et al., 2006; Stuss & Alexander, 2007). Lower order cognitive functions include planning, organizing, problem solving, decision making, impulse control, cognitive flexibility, and goal selection (Hunt et al., 2013). New and

¹ In this paper, the term youth is used for late adolescence into young adulthood, defined as, under 24 years of age.

complex task performance (e.g., academic, work, driving) required for adult life roles, independent living and employment are reliant on EF. Unlike adults, youth have yet to fully develop their cognitive functions including EF (Taylor et al., 2013) and have limited pre-injury experience using intact EF to draw upon after brain injury.

The confluence of developmental phase and EF dysfunction from brain injury creates a disadvantage for youth and has implications for the remainder of their adult life. An additional challenge with this population is that when a brain injury occurs in a youth, it can result in deficits that are difficult to discern from brain functions that are still developing. As such, the consequences of youth brain injury are often under-recognised, misunderstood by professionals and family members, and misinterpreted in the context of continued growth and development (Savage et al., 2005). It is crucial that rehabilitation professionals, working with this subset of brain injury survivors, be able to accurately evaluate and treat these deficits. Of primary concern is generating and using high quality evidence to inform professional judgements concerning functional outcomes.

When evaluating EF in youth, a clear understanding of typical development is needed, so that the problems that arise from brain injury can be identified and distinguished from normal development. Researchers studying the development of EF during typical adolescence and young adulthood have found overall improvement in EF ability on traditional test of EF, but the evidence also indicates that development of EF is variable with some aspects maturing at younger ages and others later on. A few studies have examined EF in neurologically intact youth. Taylor et al. (2013, 2015) used traditional neuropsychological tests of EF with 17-19-year-olds and found non-linear development with periods of improvement, stability and decline in function within this

age range. Toglia and Berg (2013) established a baseline of performance for typical youth (age 16-21) using the Weekly Planning and Calendar Activity (WPCA), a performance-based assessment of EF. These results, while informative, have yet to be correlated with real-world EF functioning.

Evaluation of residual cognitive deficits and impact on function for real-world performance is an essential part of brain injury rehabilitation and within the scope of occupational therapy practice. Evaluation of EF has typically used traditional neuropsychological tests done in an environment free of distraction or interruption. Explicit tasks are completed in short duration which do not tax the executive processes in a similar manner to real life which is inherently more complex (Chan et al., 2008; Shallice & Burgess, 1991; Dawson et al., 2009). In contrast, The Multiple Errands Test (MET) is a naturalistic measure of the impact of EF on everyday life through the observation of an individual's performance of an activity in a real-world setting. The ability to capture contextual influences contributing to task performance makes the MET a useful tool for occupational therapists.

The MET takes place in real-world settings (i.e. shopping mall, hospital lobby) and therefore several site-specific versions of the MET have developed over time. Alderman et al. (2003), in the early stages of MET research identified that "others should be able to adapt it (the MET) for their own environment" (p. 32). Sites specific versions of the MET differ in the testing environment, specific task components, and scoring.

To date there has been no published review of the site-specific versions of the MET to summarize the extent, range and nature of research activity, or to guide therapists

wanting to use or add to the development of a version of the MET in practice.

Additionally, use of the MET with the community dwelling, youth population and gaps in the MET were of interest. The objective of this literature review is to determine if the MET is relevant to use with the youth population in a community setting through evaluation of its clinical utility, measurement properties, and study population characteristics.

2.2 Method

A scoping review was selected as a suitable methodology as defined by Colquhoun et al. (2014), given it “is a form of knowledge synthesis that addresses an exploratory research question aimed at mapping key concepts, types of evidence, and gaps in research related to a defined area or field by systematically searching, selecting, and synthesizing existing knowledge” (p.1292-1294).

The scoping literature review was completed following the Arksey and O’Malley framework (2005) and the recommendations of Levac, Colquhoun, and O’Brien (2010). The six stages of the scoping review were followed; identify the research question, identify relevant studies, study selection, charting the data, collating, summarizing and reporting the results and consultation (Levac et al., 2010).

Stage 1: Identifying the research question

The research question: What does the research tell us about the non-virtual reality, versions of the MET and their clinical utility and measurement properties for measuring EF in the youth population in a community setting?

Stage 2: Identifying relevant studies/Literature search

The following scientific literature databases were searched: PubMed, CINAHL and PsychINFO. Additionally, the following grey literature databases were searched: BASE, CogPrints, and Open Grey. The search terms: *Multiple Errands Test* or, *brain injuries** AND *executive function** AND *clinical assessment tools* or *outcome assessment health care** were used. The asterisk indicates that the term is a MESH term. For this review, the Toronto ABI Network's definition of Acquired Brain Injury (ABI) was used and is defined as is an injury to the brain occurring after birth, which is not hereditary, congenital, or degenerative; it can be caused by a traumatic blow or injury to the head (i.e. Traumatic Brain Injury, TBI), anoxia, or a tumor. Hand searching of the reference lists of included articles retrieved were reviewed to identify additional relevant articles. The search yielded 476 articles across the six databases, which was reduced to 423 when duplicates were removed.

Stage 3: Study Selection

The literature search strategy is outlined in Figure 1 using the preferred reporting items for PRISMA flow diagrams. The original study of the MET by Tim Shallice and Paul Burgess was published in 1991 therefore all articles published after 1991 were included. Additional inclusion criteria: peer reviewed, journal articles published in English, specific to a sample with ABI that focused on MET tool development, and validation. Two thesis dissertations within the grey literature search were excluded as no related studies published in a peer reviewed journal were found. One published poster was excluded as insufficient details were provided to answer the research question. Studies were excluded if the MET was used for qualitative research; to study treatment

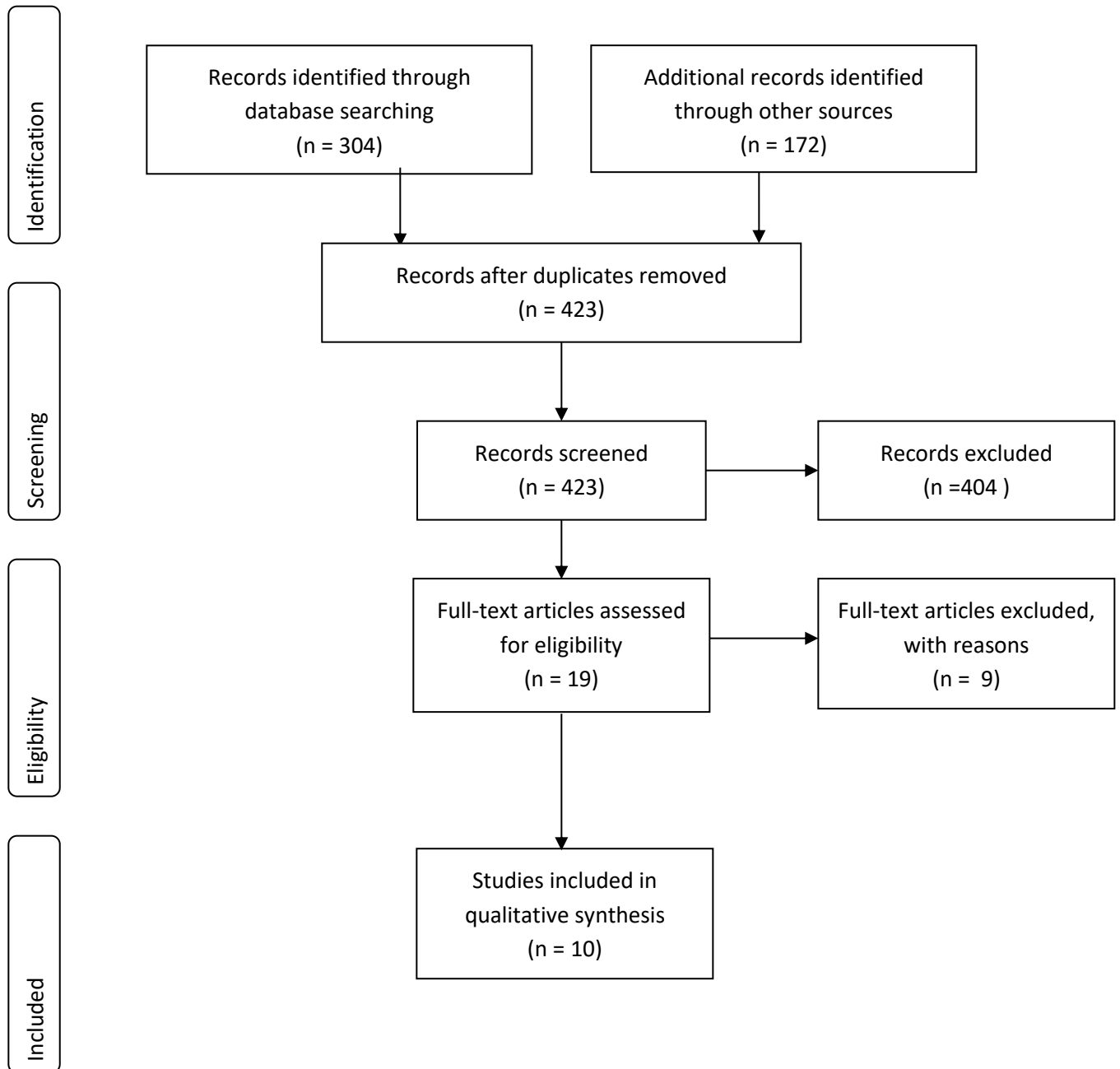


Figure 2.1 Literature search strategy

effectiveness; the sample population was not ABI; the virtual reality MET version was used; and focus was on alternate uses of the MET other than to assess EF.

Records were screened for inclusion/exclusion criteria using titles and abstracts, duplicate articles were removed and a total of 19 full text articles were remaining. After hand searching the reference lists of the 19 full-text articles, three additional, related articles were located. When inclusion/exclusion criteria were applied none of these articles was retained. Full text articles were then screened for inclusion/exclusion criteria yielding 10 articles eligible for the review. The second author was involved in determining study inclusion and exclusion and verified the final study selection.

Stage 4: Charting the data/Data extraction

The 10 eligible articles, all quantitative studies, were reviewed and relevant study information was extracted into Table 2.1. Table 2.2 provides a summary of the psychometric properties and methodological quality per study reviewed. The Data Extraction Form and Guide for Studies Evaluating the Clinical Measurement Properties of Outcome Measures (Law & MacDermid, 2014) was used to identify measurement properties and relevant statistics. Standards for reliability and validity were taken from criteria provided in Law and MacDermid (2014) and Portney and Watkins (2009). The Consensus-based standards for the selection of Health measurement instruments (COSMIN) checklist (Terwee et al., 2011) was used to review the methodological quality of each psychometric property in the scoping review. The 4-point rating scale: ‘excellent, good, fair, poor’ quality was applied to each measurement property in each study. The following COSMIN measurement properties are not in Table 2.2 since no evidence of the

measurement properties was found in the included studies: measurement error, criterion validity, cross cultural validity and responsiveness. Also, a single study reported on ceiling effect which COSMIN classifies an interpretability issue, not a psychometric property. COSMIN guidelines for overall measurement property score is obtained by taking the lowest score for any of the criteria (i.e. worst score counts method). Table 2.3 provides a summary of MET main findings, clinical utility, study strengths, and implications from the scoping review synthesis.

Table 2.1. Descriptive summary of articles reviewed.

Authors	Design	Purpose	MET Version	Test Location	MET Requirements and Scoring	Sample/Generalizability				
						Participants	Participant Residence	Diagnosis Severity	Mean Age (range)	Males /total sample
Shallice T and Burgess P (1991)	Case Study	Develop a performance-based assessment of executive function with open-ended, multiple sub-goal requirements for patients with TBI	MET	Shopping mall	11 subtasks: - 6 simple tasks (e.g., buy items) - Meet at designated time/location after 15 minutes - 4 pieces of information 6 rules Scoring: 4 error subcategories defined; tally of frequency of errors in each error category	D _x =3 CG=9	C	TBI	D _x = 4 (27-55) CG=40 (24-63)	D _x =2/3 CG+
Knight C, Alderman N and Burgess P (2002)	Cross sectional	Develop and explore the validity of a hospital version of the MET.	MET-HV (Hospital Version)	Hospital	12 subtasks: - buy 3 items - collect an item - use telephone - mail item	D _x =20 CG=20 (hospital staff)	H	TBI =12 CVA=5 CVA & TBI =3	D _x =36 (20-53)	D _x = 17/20 CG=gender matche

Authors	Design	Purpose	MET Version	Test Location	MET Requirements and Scoring	Sample/Generalizability				
						Participants	Participant Residence	Diagnosis Severity	Mean Age (range)	Males /total sample
					<p>- 4 pieces of information - meet at designated time/location & tell assessor the time 9 rules</p> <p>Scoring: 4 error subcategories defined; tally of frequency of errors in each error category</p>			Severe - very severe		d with Dx
Alderman N, Burgess P, Knight C and Henman C (2003)	Cross sectional	Develop and explore the validity of a simplified version of the MET. Examine relationship between different types of errors on	MET-SV (Simplified Version)	Shopping mall	<p>12 subtasks: - buy 6 items - 4 pieces of information - meet at designated time/location & tell assessor the time 9 rules</p>	Dx=50 CG=46 (hospital staff and associates)	B	TBI=39 CVA=9 Cerebral tumor resection n=2 -severe	Dx=35 (18-59) CG=29 (21-58)	Dx=41/50 CG=23/46

Authors	Design	Purpose	MET Version	Test Location	MET Requirements and Scoring	Sample/Generalizability				
						Participants	Participant Residence	Diagnosis Severity	Mean Age (range)	Males /total sample
		MET-SV to determine the sub-components underlying multi-tasking performance.			Scoring: 4 error subcategories defined; tally of frequency of errors in each error category					
Tranel D, Hathaway-Neppele J and Anderson S (2007)	Cross sectional	Replicate and extend the finding of Shallice and Burgess (1991) using a closely adapted version of the MET with a group with focal, stable damage to the Ventromedial prefrontal cortex (VMPC).	MET (adapted by authors)	Shopping Mall	Same 11 subtasks as MET but site-specific items and information substituted Scoring: 4 error subcategories defined; tally of frequency of errors in each error category	Dx VMPC= 9 Dx PFC=8 Dx Non-PFC=17 CG=20	†	CVA =6 Resection of arterio-venous malformation =1 Benign tumor = 1 Severity not reported	Dx VMPC =51 † Dx PFC =51 † Dx Non-PFC =51 † CG=54 †	Dx VMPC= 5/9 Dx PFC= 5/8 Dx Non-PFC= 9/17 CG = 8/20

Authors	Design	Purpose	MET Version	Test Location	MET Requirements and Scoring	Sample/Generalizability				
						Participants	Participant Residence	Diagnosis Severity	Mean Age (range)	Males /total sample
		Prefrontal comparison group (PFC)								
Manes F, Villamil A, Ameriso S, Roca M and Torralva T (2009)	Cross sectional	Investigate everyday EF abilities in patients with focal cerebellar lesions using assessments sensitive to damage to the prefrontal cortex including real life tasks (MET).	MET-HV (adapted by authors)	Hospital	<p>12 subtasks</p> <ul style="list-style-type: none"> -buy 3 items -collect an item -use telephone -mail item -3 pieces of information -phone test proctor at designated time & tell assessor the time -Inform proctor when tasks completed 9 rules <p>Scoring: 4 error subcategories defined; tally of frequency of errors in each error</p>	Dx=11 CG=11	†	Cerebellar lesion =11 Severity not reported =11	Dx=51 (28-69) CG Age matched to Dx	Dx=9/11 CG Gender matched to Dx

Authors	Design	Purpose	MET Version	Test Location	MET Requirements and Scoring	Sample/Generalizability				
						Participants	Participant Residence	Diagnosis Severity	Mean Age (range)	Males /total sample
					category & total of all 4 subcategories					
Dawson D, Anderson N, Burgess P, Cooper E, Krpan K and Stuss D (2009)	Cross sectional	Further establish the psychometric properties of the MET, clinical utility, interrater reliability and develop a Baycrest site-specific version -standardize scoring of the instrument for increased ease of use; determine a summary score to discriminates between community	BMET (Baycrest site)	Hospital	12 subtasks -buy 3 items -collect an item -use telephone -mail item -4 pieces of information -meet at designated time/location & tell assessor the time 8 rules Scoring: errors identified and defined ahead of time in the scoring 11 summary scores calculated	Stroke Dx=14 CG=13 TBI Dx=13 CG=12	C	Stroke mild-moderate TBI moderate - severe severity for 2 TBI and 5 stroke unknown	Stroke Dx=59 (33-80) CG=57 (27-81) TBI Dx=43 (26-58) CG=46 (22-57)	Stroke Dx=8/14 CG=7/13 TBI Dx=11/13 CG=10/12

Authors	Design	Purpose	MET Version	Test Location	MET Requirements and Scoring	Sample/Generalizability				
						Participants	Participant Residence	Diagnosis Severity	Mean Age (range)	Males /total sample
		dwelling ABI group and matched controls.								
Maeir A, Krauss S, and Katz N (2011)	Prospective/Cohort	Examine the relationship of the MET at discharge from a rehabilitation hospital to participation in the community 3 months later in a group of individuals with ABI.	MET-HV	Hospital	<p>12 subtasks -buy 3 items -collect an item -use telephone -mail item -4 pieces of information -meet at designated time/location & tell assessor when finished the tasks 9 rules</p> <p>Scoring: 4 error sub-categories defined; total errors ranging from 0-30 possible errors; strategy score – tally of</p>	Dx=30	H	Stroke =19 TBI=8 Tumor=3 Severity not reported	Dx=54 (24-75)	Dx=20/30

Authors	Design	Purpose	MET Version	Test Location	MET Requirements and Scoring	Sample/Generalizability				
						Participants	Participant Residence	Diagnosis Severity	Mean Age (range)	Males /total sample
					number of strategies used					
Morrison T, Muir Giles G, Ryan J, Baum C, Dromerick A, Polatajko H, and Edwards D (2013)	Prospective/Cohort	Examine discriminant validity of the MET-R among a group with mild stroke/CVA; provide an objective scoring system	MET-R (Revised)	Hospital	Not specified; based on MET and MET-HV Scoring: Total time, number of locations visited, number of tasks completed, and total rule breaks)	Dx=25 CG=21	H	stroke mild	Dx=60 † CG=60 †	Dx=10/25 CG=6/21
Cuberos-Urbano G, Caracuel A, Vilar-Lopez R, Valls-Serrano C, Bateman A and Verdejo-Garcia A (2013)	Cross sectional	To examine the ability of the MET scores to predict symptoms of apathy, disinhibition and disorganized behaviour in everyday life	Spanish MET	Hospital	12 subtasks (more similar to MET-HV than BMET) 9 rules Scoring: 4 error subcategories defined; tally of frequency of errors in each error category & total of all 4 subcategories	Dx=30	C	TBI=19 CVA =8 Tumor =2 Anoxia =1 Severity not reported	Dx=35 (19-60)	Dx=25/30

Authors	Design	Purpose	MET Version	Test Location	MET Requirements and Scoring	Sample/Generalizability				
						Participants	Participant Residence	Diagnosis Severity	Mean Age (range)	Males /total sample
		as reported by relatives on the Frontal Systems Behavioural Scale (FSBS) and the DEX and test the reliability of the Spanish HRT-Granada MET-HV. (Spanish MET)								
Clark A, Anderson N, Nalder E, Arshad S and Dawson D (2015)	Cross Sectional	Create a revised version of the BMET to improve its ability to distinguish performance patterns and errors in individuals with ABI	BMET-R (Revised)	Hospital	<u>BMET-R Version A</u> -similar to BMET <u>BMET-R Version B</u> -minor variations to Version A in items to purchase and information to find out Revisions: 1) stopped by examiner after 12	Dx=15 CG=16	C	TBI =8 moderate-severe CVA =8	Dx=63 † CG=61 †	Dx=10/15 CG=10/16

Authors	Design	Purpose	MET Version	Test Location	MET Requirements and Scoring	Sample/Generalizability				
						Participants	Participant Residence	Diagnosis Severity	Mean Age (range)	Males /total sample
		versus healthy individuals; to create an alternate version for use as an outcome measure for determining efficacy of rehab approaches for impairments of EF.			<p>minutes, asked to find a specified flyer and keep it with them</p> <p>2) Find a specific room and its name</p> <p>3) specify time as 2:15 pm rather than amount of time elapsed (ie. After 15 min)</p> <p>Scoring: Task completion classified as completed, partially completed or omitted</p> <p>Total Errors (frequency of task omissions, frequency of partially completed</p>					

Authors	Design	Purpose	MET Version	Test Location	MET Requirements and Scoring	Sample/Generalizability				
						Participants	Participant Residence	Diagnosis Severity	Mean Age (range)	Males /total sample
					tasks, and frequency of inefficient behaviour) Frequency of rule breaks, frequency of task unrelated behaviour, frequency of strategy use					

†missing information.

CG =control group (normal)

Dx= diagnosis group

H = Hospital

C = Community

B = Both

EF: Executive Function

DEX: Dysexecutive Questionnaire; DEX-S: self-rated;

DEX-O: Significant Other

BADS: Behavioural Assessment Dysexecutive Syndrome Battery

FrSBs: Frontal System Behavioural Scale

EFPT: Executive Function Performance Test

SIP: Sickness Impact Profile

AMPS: Assessment of Motor and Process Skills

MPAI-4: Mayo-Portland Adaptability Index

M2PI: Participation index of the MPAI-4

WCST: Wisconsin Card Sorting Test

MCST: Modified WCST

Table 2.2. Psychometric properties and methodological quality per study.

Authors	Overall COSMIN rating*	Internal Consistency	Reliability	Content Validity	Structural Validity	Hypothesis Testing (<i>Construct Validity</i>)
Shallice T and Burgess P (1991)	Poor*	NE	Inter-rater Poor* (non-statistical evidence) 2 observers/ raters Test-retest NE	Experts contribution to item development Fair*	NE	NE
Knight C et al. (2002)	Poor*	Adequate \bar{x} Cronbach's alpha .77 Fair*	Inter-rater Adequate \bar{x} intra-class correlation (ICC) range from .81 (interpretation failures) to 1.00 (rule breaks) Fair* Test-retest Poor* (unpublished data) .83 (N=10)	Expert contribution Poor*	NE	<i>Known Groups:</i> Fair* Significant difference between ABI and control groups (rule breaks, task failures and total errors) ($p < .001-.002$) <i>Convergent:</i> Fair* Moderate ^a correlations between BADS profile score and MET-HV (rule breaks, $-.51, p = .022$; task failures, $-.58, p = .007$; interpretation failures, $.64, p = .003$; and total errors, $-.57, p = .009$) - one association between a factor on the DEX-O, intentionality, and task failures on the MET-HV ($r = .70, p = .001$) <i>Divergent:</i> Fair* Correlations between perseverative error on the MCST with rule breaks ($.66, p = .002$) and MET total errors ($.67, p = .001$) but no other significant correlations to other traditional test of frontal lobe function.
Alderman N et al. (2003)	Poor*	NE	Inter-rater Poor* (non- statistical evidence) 2 rater consensus	Expert Contribution Poor*	MET-SV (two-factor structure, Varimax	<i>Known groups:</i> Excellent* t-tests; significant differences between ABI group and controls for rule breaks ($t = 4.03, p < .001$), task failures ($t = 10.10, p < .001$) and total errors ($t = 7.18, p < .001$)

Authors	Overall COSMIN rating*	Internal Consistency	Reliability	Content Validity	Structural Validity	Hypothesis Testing (<i>Construct Validity</i>)
			Test-retest Poor* (unpublished data) .81 (N=20)		rotated), Rule Breakers and Task Failers exploratory factor analysis Fair*	<i>Divergent: Fair*</i> Evidence provided but not statistical, most ABI group passed traditional tests of executive functioning based on cut-off scores; compared to MET-SV scores, only 5/50 from the ABI group achieved normal scores <i>Convergent: Poor*</i> Rule Breakers showed significantly more executive memory problems (confabulation, deficits in temporal sequencing and perseveration) on the DEX (t=2.13, p=.04); Task Failers showed more symptoms of negative affect (shallow affect, apathy) on the DEX (t=2.30, p=.027) <i>Convergent: Poor*</i> Task failures showed fair ^a correlations with BADS profile score (-.46, p<.01); particularly two sub-tests of BADS, Zoo-Map (-.46, p<.01) and Six Element Test (-.41, p<.01); rule breaks showed fair ^a correlations to performance on Action Program subtest of BADS (-.43, p<.01)
Tranel D et al. (2007)	Poor*	NE	NE	NE	NE	<i>Known groups: Poor*</i> VMPC - significantly more task failures than the NC (p=.000); VMPC had a higher number of overall errors (7.6) than the PFC (5.9) and nonPFC (4.5) ABI comparisons and the NC (3.4). <i>Divergent: Fair*</i> Performances on the MET were not correlated with IQ or memory measures <i>Convergent: Fair*</i> Fair to moderate ^a correlations between some MET variables and scores on WCST and Trail Making Test.

Authors	Overall COSMIN rating*	Internal Consistency	Reliability	Content Validity	Structural Validity	Hypothesis Testing (<i>Construct Validity</i>)
Manes F et al. (2009)	Poor*	NE	NE	NE	NE	<p><i>Known groups: Poor*</i></p> <p>Significant differences between ABI and control group on subscales of the MET-HV: total amount of failures (U=10.0, p=.001); interpretation failure (U=14.0, p=.003); fulfillment of tasks scores (U=14.0, p=.001); and inefficiencies (U=7.0, p<.001)</p> <p><i>Divergent: Poor*</i></p> <p>No significant difference between ABI and controls on most test of neuropsychological battery</p> <p><i>Convergent: Poor*</i></p> <p>WCST had a fair^a correlation with tasks completed on the MET-HV (r=-.47, p=.04)</p>
Dawson D et al. (2009)	Poor*	NE	<p>Inter-rater</p> <p>Adequate †</p> <p>ICC from .71 to .88 (95% confidence interval)</p> <p>Good*</p>	<p>Expert contribution</p> <p>Poor*</p>	NE	<p><i>Known groups: Good*</i></p> <p>Significant differences between frequency of errors for stroke on the BMET than healthy controls; only one type of error (weighted errors score) for TBI participants was significantly higher than controls</p> <p><i>Convergent: Fair*</i></p> <p>Moderate to good^a correlations for TBI group were found between the DEX-O and total errors (0.69, p<.05) as well as weighted errors (0.59, p<.05) of the BMET</p> <p><i>Ecological validity: Fair*</i></p> <p>Moderate to good^a correlations for TBI group between rule adherence and AMP process scores (-0.69, p<.05). Good to excellent^a correlations for stroke group between rule adherence and both scales of the SIP (.78, p<.01/.64, p<.05), the AMPS motor score (-.75, p<.01); moderate to good^a correlation for time to complete with SIP Phys scale (.54, p<.05)</p>

Authors	Overall COSMIN rating*	Internal Consistency	Reliability	Content Validity	Structural Validity	Hypothesis Testing (<i>Construct Validity</i>)
Maeir A et al. (2011)	Fair*	NE	NE	NE	NE	<i>Predictive: Fair*</i> (Pearson correlation analysis) fair ^a correlation for MET total error score with total M2PI $r=.403$ ($p<.05$) and moderate ^a correlation with self-report and significant other report $r=.510$ ($p<.05$) Statistical comparison between two correlation coefficients was not significant ($p>.05$)
Morrison T et al. (2013)	Fair*	NE	<u>Inter-rater</u> Adequate \mp ICC of 1 was found for all test sections Fair*	NE	NE	<i>Known groups: Fair*</i> (Student's t test) Differences between mean scores for control and mCVA group were significant for the majority of MET-R component scores (total tasks completed, rule breaks, performance efficiency) ($p<.001-.002$) <i>Convergent: Fair*</i> Moderate to good ^a correlation between MET-R task completion score and the EFPT total score ($r=-0.55$)
Cuberos-Urbano G et al. (2013)	Fair*	NE	<u>Inter-rater</u> – Adequate \mp ICC from .85 to .98 (95% confidence interval) Fair*	NE	NE	<i>Convergent: Fair*</i> Multiple linear regression models –correlations between HRT-Granada MET-HV and FrSBe scores - strongest association between the MET and the DEX measure of intentionality (% of explained variance = 24%, $p=.009$) - the best predictor of FrSBe scores is the index of “task failures,” although the index of “rule breaks” is also a significant predictor of disinhibition problems.
Clark A et al. (2015)	Fair*	NE	<u>Inter-rater reliability</u> Adequate \mp version A -	Initial step - Inter-professional team of	NE	<i>Known groups: Fair*</i> People with ABI completed fewer tasks successfully, demonstrated more task-unrelated inefficiencies ($p=.04$) in comparison to healthy group (effects of mood/general

Authors	Overall COSMIN rating*	Internal Consistency	Reliability	Content Validity	Structural Validity	Hypothesis Testing (<i>Construct Validity</i>)
			ICC from .64 to .98 (95% confidence interval) Fair* Adequate $\bar{\kappa}$ version B – ICC from .92 to 1.00 (95% confidence interval) Fair*	experts convened to develop alternate version Fair*		cognitive functioning accounted for with mixed model ANOVAs) <i>Ecological validity: Fair*</i> Fair ^a ; and moderate to good ^a correlations for 7 out of a possible 36 correlations ($p=.10$) between the BMET-R indices and the self-report measures of executive ability were found (DEX, MPAI, BRIEF-A)

* Methodological Rating based upon COSMIN Checklist (Terwee et al., 2011)

NE = No evidence

$\bar{\kappa}$ Statistical Standards based on Law and MacDermid (2014)

^a Statistical Standards for strength of association between variables/correlation, based on Portney and Watkins (2009)

EF: Executive Function

DEX: Dysexecutive Questionnaire; DEX-S: self-rated;

DEX-O: Significant Other

BADS: Behavioural Assessment Dysexecutive Syndrome Battery

FrSB: Frontal System Behavioural Scale

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Table 2.3. Summary MET findings, clinical utility, strengths & implications.

Authors	Main Findings	Clinical Utility	Strengths
Shallice T and Burgess P (1991)	<p>Subjects' behaviour and types of errors not seen in controls</p> <p>Subjects had more rule breaks, fewer tasks completed, more inefficiencies</p>	<p>Provides background information, theoretical context of the MET</p>	<p>The open-ended task requirements of the MET were more sensitive to EF difficulties from brain injury than other tests of frontal lobe function.</p>
Knight C et al. (2002)	<p>ABI participants made significantly more rule breaks, total errors and achieved fewer tasks than controls.</p> <p>The cut-off score set at 7 total errors.</p> <p>For ABI group, age correlated significantly with total errors, rule breaks, and task failures. Memory impairment was associated with more errors.</p> <p>Qualitatively the ABI group were more impulsive, broke rules more often, used environmental cues less often, were more reliant on others (asked for help).</p>	<p>MET methodology is adept at measuring extent EF impairment at the level of everyday functioning.</p> <p>Performance may provide clearer link with rehabilitation interventions.</p>	<p>Useful for patients with significant mobility problems, severe behavioural problems, or unable to leave hospital grounds.</p> <p>Allows for free interactions; opportunity to observe social behaviour.</p>
Alderman N et al. (2003)	<p>The MET-SV can discriminate between ABI and controls.</p> <p>Both ABI and controls make errors during performance on MET; ABI make more errors and different ones.</p> <p>Two patterns of errors in ABI 1) Rule Breaking or 2) Failure to achieve tasks.</p>	<p>Time to administer ~ 45 minutes.</p> <p>MET-SV performance appears to be independent of familiarity with environment, gender.</p>	<p>Developed for a range of people more often encountered in clinical practice.</p> <p>Development of site specific versions was encouraged.</p>

Authors	Main Findings	Clinical Utility	Strengths
	<p>A cut off score of 12 or more errors.</p> <p>Concluded the MET-SV is more sensitive to EF difficulties than traditional neuropsychological tests of EF and strongly associated with dysexecutive symptoms in everyday life (ecological validity).</p> <p>Positive correlation between age and rule breaks and total number of errors made.</p>		
Tranel D et al. (2007)	<p>Adds neuroanatomical specificity to previous work.</p> <p>Despite the VMPC group performing worse on the MET, the between-group differences were not dramatic; test would not be diagnostically useful on a case-by-case basis.</p>	<p>Further identified the time and effort to complete the MET as possible barrier; suggested virtual reality version instead.</p>	
Manes F et al. (2009)	<p>A clear pattern of failure in the MET-HV was detected, with performance in cerebellar patients characterized by a greater number of errors (interpretation failures, inefficiencies).</p>	<p>Focal cerebellar lesions may impair real-life problem-solving performance. The MET can detect these EF problems and facilitate the design of rehabilitation strategies aimed at lessening the impact of these deficits in patients' daily living.</p>	
Dawson D et al. (2009)	<p>The BMET discriminates reasonably well between ABI and controls.</p> <p>More difference was found between stroke and their controls than TBI and their controls.</p> <p>Performance on the BMET showed a number of strong and significant correlations with other tests measuring significant other reported EF problems.</p>	<p>MET is useful for community dwelling ABI individuals no longer involved in rehabilitation as well as those used in previous studies who were still involved in rehabilitation.</p> <p>A manual is available from author.</p>	<p>Improvement to scoring described.</p> <p>Focus on ecological validity.</p>

Authors	Main Findings	Clinical Utility	Strengths
	<p>Performance on the MET relates to various aspects of real-world performance.</p> <p>Some suggestion of two types of performance patterns; also found by (Alderman et al., 2003); executive processes can be sub-divided into separate processes that may relate to localization of brain lesion/behavioural patterns in everyday life.</p>		
Maier A et al. (2011)	<p>Higher error scores on the MET correlated with more restrictions in participation on the M2PI (3 months after discharge from hospital).</p>	<p>The MET is able to predict difficulties in participation in the post-acute rehab phase, on community re-entry.</p> <p>Some participants withdrew after being introduced to the MET; test can be overwhelming.</p>	<p>Adds prospective dimension to the ecological evidence regarding the MET.</p>
Morrison T et al. (2013)	<p>The MET-R was able to distinguish between those with mild stroke and controls.</p> <p>Performance on the MET-R showed a moderate correlation with another measure of EF (EFPT)</p> <p>Can help identify clients experiencing EF problems that aren't identified by other/typical clinical assessment methods.</p>	<p>Revised scoring method reduces subjective inferences for the rater; improves the ease of use.</p> <p>Complex test to administer.</p> <p>Recommended this version of the MET be used in acute settings with those not showing deficits in typically used assessments.</p>	<p>Improvements in scoring described.</p> <p>Results can be useful to build awareness of the types of difficulties that may arise with community reintegration.</p>
Cuberos-Urbano G et al. (2013)	<p>Most frequent errors were 'rule breaks' followed by 'task failures';</p> <p>Using proposed cut off of 7 or more total errors, 87% of the sample was correctly classified with EF problems, sensitive test.</p> <p>Participants performance on the MET can predict the behavioural problems they</p>	<p>The MET can be used with culturally different groups (Spanish).</p>	

Authors	Main Findings	Clinical Utility	Strengths
	<p>experience in everyday life (rated by relatives) on two scales (FrSBe and DEX). Apathy and executive dysfunction were predicted by 'task failures' whereas disinhibition symptoms were predicted by 'rule breaks'. MET is able to predict an aspect of EF related to planning/goal directed behaviour (DEX-Intentionality) not easily detected on traditional tests of EF but clinically important.</p>		
Clark A et al. (2015)	<p>Both versions of the BMET-R are able to distinguish the performance of individuals with ABI from those who are healthy. People with ABI omit more tasks, break more rules, make more errors and achieve task less efficiently. <u>Version concordance</u> Pearson r correlations for each version were strongly inter-related <u>Version differences</u> Two significant differences found between versions (fewer tasks completed, fewer inefficiencies on version B)</p>	<p>1 hour to administer</p> <p>The two versions of the BMET-R were developed to enable clinicians to determine treatment efficacy, but evidence of responsiveness has not yet been reported.</p>	
Implications from Synthesis of Scoping Review			
<p>There is a need for further development of:</p> <ul style="list-style-type: none"> • MET versions that take place in a community setting or other real-world settings (i.e. home); versions that can be used in a range of sites, eliminating the constraints of site-specific versions and suitable for community-based OT's. • MET population studies with more diverse sample characteristics (e.g., age groups – adolescents/young adults, gender, socio-cultural considerations). 			

Authors	Main Findings	Clinical Utility	Strengths
<ul style="list-style-type: none">• MET study rigor to address psychometric properties not yet adequately studied or included: face validity, responsiveness, structural/cross cultural validity; internal consistency.• MET revised scoring systems together with specific MET version manual publication to strengthen clinical utility.			

Stage 5: Collating, summarizing and reporting the results

A descriptive, numerical summary was developed for each area of extracted data followed by a thematic analysis to identify and report patterns of strength and gaps in the evidence. The results were interpreted in regard to the original research question and implications of the findings to research and practice discussed.

Stage 6: Consultation

The findings from stage 5 were reviewed by two other research team members, both of whom provided additional perspectives, expertise and levels of meaning. The findings were also submitted for blinded peer review and two independent reviewers contributed perspectives for further revisions.

2.3 Results of the Scoping Review

Study Purpose and Design

The 10 articles reviewed were published between 1991 and 2015. The purpose of all studies related to developing and establishing the properties of various site-specific versions of the MET, two studies also examined the effect of brain lesion location on EF. The purpose for two studies was to develop an objective scoring method to improve clinical utility (Dawson et al., 2009; Morrison et al., 2013). The original study by Shallice and Burgess (1991) used a case study design and two studies used a prospective cohort design (Maeir, Krauss & Katz, 2011; Morrison et al., 2013). The other eight studies used a cross sectional design focussed on the clinical measurement properties of several versions of the MET.

MET Requirements

The original MET was completed in a shopping mall and included 11 subtasks: 6 simple tasks including buying items, meeting at a designated location and time, obtaining 4 pieces of information and following 6 rules. The MET-HV (Hospital Version) included 12 subtasks and 9 rules with some subtasks like the original MET (i.e. items to buy and information to find). The MET-HV specified a broader range of subtasks that were not specified in the original MET including mailing an item and telephone use. The other site-specific versions that use a hospital testing environment have been closely modeled on the MET-HV subtasks with site-specific adaptations but with consistency in the requirements. These four versions include the MET-HV used by Manes et al. (2009), BMET, MET-HV used by Maeir et al. (2011), and Spanish MET. For the MET-R, the requirements are not provided but identified to be based on both the MET and MET-HV. The BMET-R introduced three revisions to the task requirements made following expert consensus. The MET-SV that takes place in a shopping mall, expanded the original MET subtasks from 11 to 12 and rules from 6 to 9.

Sample Characteristics / Age

The testing environment varies across versions of the MET with the assessment taking place in either a hospital or shopping mall. The majority of MET studies (n=7) identified testing in the hospital environment: lobby, main floor or designated boundaries within a hospital complex. Three studies used a shopping mall as the test environment.

There was an array of participant living arrangements reported. Four studies identified different community settings (alone, family homes, group homes), three studies

identified living in the hospital or inpatient setting, one study included both inpatient and outpatients and two studies did not provide this information.

ABI severity was not consistently reported or absent. The first MET study (Shallice & Burgess, 1991) described a severe TBI classification although no formalized measure of severity was referenced. Three studies consisted of mixed etiology ABI of moderate to severe severity (Knight et al., 2002; Alderman et al., 2003; Clark et al., 2015). The BMET study included a greater range of participant severity including stroke and TBI, but some participants could not be classified (Dawson et al., 2009). The MET-R is the only study that focused on those with mild stroke (Morrison et al., 2013).

Across the 10 studies the age range was 18 to 81, with the mean age for both brain injured participants and controls, over 29 years of age. In the majority of articles reviewed (n=9) more than 50% of the study sample were male. The Morrison et al. (2013) study was the only study with a primarily female sample with mild stroke.

Psychometric Properties

Available psychometric properties will be summarized collectively across the articles and then reported for individual MET versions.

Reliability

Reliability refers to the ability of a measure to consistently measure the underlying concept (i.e. real word EF) (Portney & Watkins, 2009). Inter-rater reliability was the most commonly reported. Adequate to excellent inter-rater reliability has been reported for the MET-HV (Knight et al, 2002), MET-R (Morrison et al., 2013), Spanish MET (Cuberos-Urbano et al., 2013) and the BMET- R version B (Clark et al., 2015).

Conversely, the inter-rater reliability of the MET-SV has not been determined statistically. Adequate inter-rater reliability was reported for the BMET (Dawson et al., 2009) and mixed results were found for BMET-R Version A (Clark et al., 2015). Test-retest reliability was mentioned in two studies (Knight et al., 2002 and Alderman et al., 2003) but the data was reported as unpublished. Knight et al. (2002) reported adequate internal consistency for MET-HV.

Validity

Validity refers to the accuracy of the measure in measuring the underlying construct (Portney & Watkins, 2009). Content validity is the extent to which the construct (i.e. real-world EF) measured is adequately reflected by the items/structure of the measure (Law & MacDermid, 2014). It can vary across populations, so it should be established for the population with which the assessment will be used (Haynes, Richard & Kubany, 1995). Face validity is an aspect of content validity and considers if the measure is acceptable and relevant to those who are tested by it (Portney & Watkins, 2009). The developers of COSMIN consider content validity to be the most important measurement property (Terwee et al., 2018). Content validity of the MET is evident as two experts in the field, Tim Shallice and Paul Burgess developed the format and procedures of the original MET (Shallice & Burgess, 1991) and these authors helped to develop three additional versions, the MET-HV (Knight et al., 2002); the MET-SV (Alderman et al., 2003) and the BMET (Dawson et al., 2009). Exploratory factor analysis of the MET-SV supported a two-factor structure, rule breakers and task failers (Alderman et al., 2003) indicating that EF is likely a theoretical construct that can be sub-divided.

Construct validity has been considered across several studies, most often known groups, divergent and convergent validity. In all the studies that looked at known groups validity (n=6), the frequency of errors made by brain injured participants was significantly higher than those of controls for several error categories (Knight et al., 2002; Alderman et al., 2003; Tranel et al., 2007; Manes et al., 2009; Morrison et al., 2013; Clark et al., 2015).

To establish convergent validity the MET was compared to other ecologically valid tests of EF (i.e. intended to measure the same construct). Fair to moderate correlations were found between the MET-HV/MET-SV/BMET and the BADS and DEX (Knight et al., 2002; Alderman et al., 2003; Dawson et al., 2009) and between the MET-R and the EFPT (Morrison et al., 2013). The MET (Spanish version) was found to correlate with the FSBS and the DEX. Ecological validity has been examined and strong correlations found between the BMET and tests intended to measure real-world functioning like the AMPS and SIP (Dawson et al., 2009).

In four studies the version of the MET demonstrated a lack of correlation (divergent validity) with traditional test of frontal lobe function and traditional neuropsychological tests of memory, IQ etc. (Knight et al., 2002; Alderman et al., 2003; Tranel et al., 2007; Manes et al., 2009). Some correlations were found particularly with traditional tests of frontal lobe function, MWCST/WCST (Knight et al., 2002; Manes et al., 2009) and Trail Making Test (Tranel et al., 2007). In general, the MET was found to be more sensitive than traditional methods of evaluation to EF deficits in brain injured individuals. Predictive validity was examined in one study with moderate correlations

found between the MET-HV and a participation index at 3 months post-discharge from rehabilitation (Maier, Krauss & Katz, 2011).

Responsiveness

Responsiveness refers to the ability of a measure to detect change over time (Law & MacDermid, 2014). The BMET-R has been developed to have two versions (Clark et al., 2015) for repeat measurement over time but no evidence of responsiveness of the versions has been reported. The MET responsiveness was not reported in the articles reviewed.

Main Findings and Clinical Utility

Across the majority of studies, performance on the test was able to adequately discriminate between people with and without brain injury. Generally, individuals with brain injury make more errors and different types of errors than controls. They omit more tasks, break more rules, and achieve fewer tasks, less efficiently on the MET. Overall, using the MET to evaluate EF in the real-world can strengthen an occupational therapist's ability to identify people with EF deficits who may otherwise go undetected on traditional tests of EF. The MET can qualitatively and quantitatively measure the impact of EF problems at the level of everyday functioning; social behaviour and contextual influences can be observed, and performance can more directly link to rehab interventions.

Administration time for the MET ranges from 45 min (Alderman et al., 2003) to 1 hour (Clark et al., 2015), some limited equipment is required and transportation to the shopping mall is assumed for the MET-SV. In all the articles reviewed the training requirements for the MET are not clearly reported. A manual is available from the

authors for the BMET (Dawson et al., 2009) but for other versions clinicians are required to read the research article.

Scoring for most MET studies is based on error subcategories defined by Shallice and Burgess (1991) as 1) inefficiencies, 2) rule breaks, 3) interpretation failure and 4) task failure and a tally of the frequency of errors in each sub-category determined by the assessor following MET performance. A cut score has been published for the MET-HV and for the MET-SV. The BMET scoring is different in that errors in each subcategory are defined ahead of time to reduce subjectivity; as well, the MET-R scoring removed error subcategories of inefficiency, interpretation failure and task failure. Instead scoring on the MET-R is defined as total time, number of locations visited, number of tasks completed, and total rule breaks; as well as performance efficiency, the ratio of tasks completed to total number of locations visited.

Methodological Quality

The quality rating for most of the measurement properties in the 10 articles reviewed was either fair or poor. Most studies reported reliability, hypothesis testing/construct validity, and content validity, whereas internal consistency and structural validity were covered by single studies only.

2.4 Discussion

Overall MET Strength

This scoping review supports the MET as a sensitive, ecologically valid and useful tool for occupational therapists to evaluate the impact of EF on real-world performance in adult males (mean age 29 years) with moderate to severe ABI in a naturalistic context (hospital setting). Primarily for this population, the MET has been

found to aid in the identification of EF deficits in real-world situations and to discriminate between people with and without a brain injury.

MET and Youth

There have been no specific studies to examine how the adolescent/young adult population perform on the MET, or its ability to discriminate between healthy individuals and individuals with ABI in this age range. Research is needed to describe and evaluate EF using the MET in neurologically intact teens and young adults (e.g., ages 16-24). As previously mentioned, this developmental stage is unique for EF maturation amidst increasing contextual demands related to life stage. Traditional tests of EF have shed some light on the changes occurring in EF during late adolescence/early adulthood. However, having MET norms for this population could offer a performance-based assessment of EF and provide greater understanding of typical EF development at the performance level within contextual influences. The MET research needs to identify EF problems that arise from youth brain injury which can be distinguished from normal development. Identification of EF issues allows for targeted rehabilitation interventions to address these impairments which is critical information for the youth's support network of the impact of executive dysfunction on real life.

MET and Community Setting

The majority of test development and research has occurred on MET versions intended for use in a hospital testing environment (i.e. the BMET, BMET-R, MET-R and Spanish Hospital version). The benefits of the various hospital versions include their utility for assessing patients with mobility issues and ease of an accessible testing environment for occupational therapists. The MET hospital version(s) task requirements

include a broader range of sub-tasks (i.e. telephone use, mailing an item) compared to the shopping mall versions, allowing the assessor to observe a greater variety of life tasks. Overall, much less research using the MET to test EF in a real-world community setting has been done. Aside from the original case studies, only two studies (Alderman et al., 2003; Tranel et al., 2007) used a shopping mall as a test environment. For occupational therapists working in the community, routine access to a hospital environment is neither feasible nor applicable to the assessment of community dwelling individuals. Using a shopping mall to complete multiple errands is inherently more ecologically valid than simulating a shopping environment in a hospital lobby. As typical in-patient hospital stays become shorter and community reintegration is an expedited goal of rehabilitation, there is a need to develop community versions of the MET. Site-specific versions are also of limited use to occupational therapists without access to the sites so generating versions of the MET that can be used more widely, like in a home, would improve clinical utility for community-based occupational therapists. Finally, there is no evidence the MET can evaluate change in EF over time (treatment effectiveness, maturation or decline in status) or to predict future status (diagnosis or outcome). Research is needed to establish the responsiveness of the various versions of the MET as this will be needed to discriminate change in real-world EF with rehabilitation interventions for youth and adult populations.

MET Clinical Utility

The clarity and standardization of scoring for an assessment tool impacts greatly on clinical utility. The scoring of the MET-SV (Alderman et al., 2003) and MET-HV (Knight et al., 2002) versions lacked clarity and potential for systematic error was evidenced due to the subjectivity of some areas of the scoring. Since several studies

(Tranel et al., 2007, Manes et al., 2009, Maeir et al., 2011; Curberos-Urbano et al., 2013) based their scoring on these early studies, standardization of measurement in these studies was less than optimal. While several revisions to scoring and administration procedures have been developed (Dawson et al., 2009; Morrison et al., 2013) to improve the standardization of the measure for hospital versions (i.e. BMET, MET-R), these revisions have not yet been integrated with the MET-SV that takes place in the community. Therefore, there is need for further MET development for community settings with integration of a revised scoring system.

Most of the studies pertaining to the measurement properties of the MET include a mostly male sample, accurately reflecting the TBI population statistics. Clinicians evaluating EF in females should be aware of this trend in the sample characteristics of the research findings as it impacts generalizability.

MET psychometric properties

This review identified areas of strength and several areas for future development pertaining to the psychometric properties of the MET. There is strong evidence for known groups validity and convergent validity with other ecologically valid tests across multiple versions. Divergent validity is evidenced across several studies with lack of correlation between the MET and traditional tests of EF which is expected given the limitation of most traditional tests of EF at predicting real-world performance. Minimal correlations between the MET and test of frontal lobe function have been reported and is not entirely unexpected as impaired EF has been found in individuals with lesions to the frontal lobes.

Content validity across MET versions has been established by expert consultation but further evidence by other methods such as consultation with the population to be tested is needed. Application of the COSMIN checklist in this review confirmed poor evidence across studies for face validity. The target population of this review is youth therefore it will be important in future research to consult with youth regarding the requirements of the MET to establish the content and face validity of the MET for this population.

The BMET-R has introduced the most significant recent changes to the subtasks requirements as well as contributing a version A and version B for use as an outcome measure. The changes to the BMET-R were made to improve construct validity, however, results indicated that alternate versions did not identically assess real-world EF. The authors of the BMET-R aptly expressed the challenge of future studies is to “*develop, clear, novel, equally challenging, comparable tasks and environments.*” (Clarke et al., 2015: p.14)

The inter-rater reliability of several hospital-based versions of the MET is adequate but evidence is lacking for the community-based MET-SV limiting the confidence that different raters using this version will determine the same results when testing the same person. Further research using a community-based version of the MET should examine inter-rater reliability. The internal consistency of the MET should also be examined further in future studies.

While some articles identify that the time and effort required to administer the MET is a possible barrier to its use (Tranel et al., 2007; Morrison et al., 2013), the MET

provides a measure of EF in the real-world which is often the missing information that occupational therapists need to make accurate judgements concerning the functional outcomes of ABI. Additional gaps in the research identified include that further development and publication of version-specific manuals is still needed for standardization of the MET and to aid therapists wanting to use the MET in clinical practice, as well there is need for additional culturally specific versions to be developed.

Finally, most measurement property ratings in the included articles fell in the fair or poor rating primarily due to the COSMIN checklist requirements for sample size. Further research on the MET with larger samples will improve methodological quality of the measurement properties and enable greater confidence in the MET psychometric properties.

Review Limitations

This review was limited to published journal articles and therefore unpublished information concerning the MET was not included. A published poster MET-Home Version preliminary results (Suzanne Burns of Texas Woman's University in October 2016) was excluded due to insufficient detail. Virtual versions of the MET were also excluded as not all occupational therapists in the community have access to this technology. Although beyond the scope of this review, comparing the similarities and differences between the virtual MET measurement properties and those versions of the MET in this review could add to the understanding of the strengths and limitations of the various versions. Qualitative studies were not included as these would not assist with examining the psychometric properties of the MET; however, clinical utility of the MET

has been examined from a qualitative perspective by Nalder, Clark, Anderson & Dawson (2015).

2.5 Conclusion

This scoping review examined the current evidence regarding the non-virtual reality, versions of the MET, and aimed to help occupational therapists understand the strengths, shortcomings and utility of various versions of the MET in relation to the characteristics of the participants and the clinical setting. This review found no evidence that the MET can measure real-world EF in the youth population in a community setting. Rather, the review found the MET was most effective at distinguishing adult male individuals with moderate to severe ABI from neurologically intact controls in a hospital testing environment. While the MET is a complex assessment, it correlates strongly with real-world function and can strengthen an occupational therapists' ability to identify people with EF deficits who may otherwise go undetected on traditional tests of EF. The MET can inform treatment planning and patient/family education by identifying the problems that could occur in resuming life roles and the need for support. The review also identifies that the methodological quality of included studies was low which provides guidance for methodological considerations in future research.

CHAPTER 3 METHODOLOGY

3.1 Rationale

The scoping review of the various MET versions made it clear that little is known about how typically developing or brain injured youth perform on the MET assessment and if the assessment is applicable to this population.

To better understand the degree to which the MET could measure the impact of real-world EF for the youth population, is a matter of instrument validity. To date, the content validity of the MET for the adult population has been established by expert contribution. Content validity is the extent to which the construct (i.e. real-world EF) that a test is designed to measure is adequately reflected by the items/structure of the measure (Law & MacDermid, 2014) and it can vary across populations, so it should be established for the population with which the assessment will be used (Haynes, Richard & Kubany, 1995). Face validity is an aspect of content validity and considers if the measure is acceptable and relevant to those who are tested by it (Portney & Watkins, 2009). In a review article by Auger, Demers and Swaine (2005) pragmatic criteria of measurement tools including the concept of acceptability are defined. Based on their discussion acceptability is defined in this study as a subjective rating of the level of difficulty of the assessment.

A mixed method pilot study was planned. Several site-specific versions of the MET have been developed and the version used, as a starting point in this study was based on the MET-SV (Simplified Version) (Alderman et al., 2003) as it takes place in a community setting (refer to **Appendix A**). Hereafter, I have referred to this version of the

MET as the original MET. The pilot study aimed in Part I: focus group, to examine the face validity of the original MET from the perspective of typically developing youth in a suburban, community setting. Following the focus group, youth input on the MET was integrated and the revised version named the yMET (youth MET). Then Part II of the study was conducted to provide preliminary data on how this population perform on the yMET.

3.2 Research Questions

The research questions for this mixed method study were as follows:

Part I: Focus group

- 1) What is the face validity of the original MET for a group of typically-developing youth (age 16-24) in a community setting?

Part II: Pilot study

- 2) How do typically-developing youth perform on the yMET administered in a community setting?

Previous work on EF in youth suggests linear progressive improvement in several components of EF ability from adolescence to age 22 on traditional neuropsychological tests of EF (Taylor et al., 2013). Therefore, the hypothesis for this study was that younger participants will make more errors and complete fewer tasks on the MET than older participants (using the age range of 16-24).

Part I and Part II

3) What is the acceptability of the yMET for youth in a community setting?

3.3 Recruitment and Sampling

Recruitment posters for Part 1 and Part II were posted by the lead researcher (LR) at known agencies (recreation centres with programs for youth, high school, college, church with youth group) and provided to parents of youth known to the LR as a means to purposively recruit youth (refer to **Appendix B & C**). The youth were asked to contact the LR by telephone/email if they are interested in finding out more about the study. In addition to purposive sampling, snowball sampling was used by asking interested study participants to identify others who met the study criteria and asking them to contact the LR (Depoy & Gitlin, 2011). Please note, the Part II yMET group study posters were not posted until completion of the focus group. The focus group and yMET group did not have overlapping members as focus group members had the opportunity to review, think about and discuss the MET assessment which was assumed would have affected their performance on the yMET compared to youth who were blind to the assessment requirements until the time of completing the assessment.

3.4 Part I: Focus Group

For the focus group, the lead researcher purposively recruited 5 youth, male and female, within the age range of 16-24. The size of focus group was determined based on a range of published recommendations for between 4-12 participants (Hollis, Openshaw & Goble, 2002; Ivanhoff & Hultberg, 2006).

Those interested in participating in the focus group were emailed an information letter (refer to **Appendix D**) to determine further interest in participating in the focus

group and asked to confirm they met inclusion/exclusion criteria in a response email. Key informants were purposively recruited and selected for maximum variation by the LR based on age, gender, and at least some shopping experience (3 rating or higher on the shopping scale-defined in inclusion criteria below). Ivanhoff and Hultberg (2006) recommend homogeneity as a priority when selecting participants for a focus group but that some differences amongst group members are important to capture the diversity of the group. Therefore, the LR selected a mix of ages within the targeted age range and a mix of genders but recruited those with at least some experience of the topic. It was expected that the differences in the group would increase the transferability of the findings (Hollis, Openshaw & Goble, 2002).

Inclusion criteria: Adolescents and young adults who were between the ages of 16-24 and who lived with their family, roommate(s) or on their own in the community. Youth needed to be able to read, understand and speak English and be comfortable with talking in a group discussion. They needed to have at least some experience with shopping in a mall setting. This was determined by a subjective rating of their level of their experience level with shopping with the following categories: [1 = never, 2= rarely (once/year), 3=occasionally (3-4 times/year), 4=a moderate amount (monthly), 5=often (weekly)].

Exclusion criteria: Adolescents and young adults who were younger or older than age 16-24, with a history positive for traumatic brain injury or other diagnosed neurological disorder including Attention Deficit Hyperactivity Disorder, due to the impact of these conditions on EF which is the focus of the MET assessment. Youth who rated their level of experience with shopping as 1=never or 2= rare

(once/year) on the frequency categories. Exclusion criteria were determined by self-report.

Interested focus group participants were asked to confirm they met study inclusion/exclusion criteria. Once it was determined that the focus group participants met the inclusion/exclusion criteria for the study, they were emailed the consent form, a copy of the MET instructions (**Appendix A**), the focus group questions (**Appendix E**) and the date and location of the focus group. On the day of the focus group they were asked to bring a signed consent form or if they forgot, copies were provided at the focus group and signed consent obtained from each participant before the group started. Youth in the focus group were asked to participate by first reviewing the MET assessment with the group facilitator who was also the LR (refer to **Appendix A**) and then answer the questions on the discussion guide (refer to **Appendix F**). The discussion guide was based on the stages suggested by Ivanoff & Hultberg (2006) for running focus groups. To explore the face validity of the MET with the youth population questions were aimed at finding out perceptions of the language and content of the original MET. The questions were mostly open ended and included probe questions to elicit more information. A few questions also asked for a final preference or consensus on information discussed. The approximate amount of time for participant emails was 15 minutes and 1 hour for the focus group. The focus group information was collected by audiotaping the focus group and recording on a flip chart, responses to focus group questions.

Once the data was collected through the focus group discussion and recorded the data was transcribed by the LR. Focus group participants were assigned a number code to protect the identity of each participant. The data was then organized in a chart format by

responses to each question, and the contribution from each participant was labeled with their corresponding number code (participant identifier). All data was then reviewed for clarity by the LR. The charted focus group data was reviewed by another member of the research committee to ensure clarity and accuracy. The questions from the focus group that addressed the reasons for the proposed changes to the assessment were reviewed for themes and codes for these themes assigned. Final themes were summarized as well as consensus on any proposed changes to the MET.

Development of the yMET

The themes from the focus group and proposed changes were used to develop the yMET. The basic requirements of the original MET remained the same (to buy 6 items, find 4 pieces of information and follow the rules); however, at the end of the focus group, youth provided possible changes to the language/content and consensus on the most relevant proposed changes to develop a MET intended to be used by youth in a community setting. This revised version of the MET was termed the yMET and was used in Part II. Other researchers have made substantive changes to the requirements of specific versions of the MET following input from an expert panel. For example, Clark et al., (2015) revised the Baycrest Multiple Errands Test (BMET) by convening a panel and made three changes to the requirements of the BMET via consensus.

3.5 Part II: yMET Group

For the yMET group, the lead researcher recruited 9, male and female, community dwelling youths (age 16-24). The number of participants for the yMET group was planned to be within the range suggested by Hertzog, (2008) for pilot studies and to allow

for stratification of the sample into two, non-overlapping age groups (i.e., age 16-18, age 19-24). Stratification of the sample was planned so that younger and older age groups could be compared in terms of their performance on the MET and to ensure that the sample was equally representative of all the ages in the age range. Where possible, near equal numbers of male and female youths were recruited to each age group.

Those interested in participating in the yMET group were emailed an information letter (refer to **Appendix G**) to determine further interest in participating in the yMET group and to confirm they met the inclusion/exclusion criteria in a response email. The LR assigned eligible participants to two non-overlapping age groups, with equal numbers in each age group (i.e. age 16-18, age 19-24) and a near equal mix of males and females.

Inclusion criteria: Adolescents and young adults who were between the ages of 16-24 and who lived with their family, roommate(s) or on their own in the community. Youth needed to be able to read, write, understand and speak English and able to walk or independently use a wheelchair/other ambulatory aid for about half an hour in a shopping mall setting. They needed to have at least some experience with shopping in a mall setting. This was determined by a subjective rating of their experience level with shopping with the following categories [1 = never, 2= rarely (once/year), 3=occasionally (3-4 times/year), 4=a moderate amount (monthly), 5=often (weekly)].

Exclusion criteria: Adolescents and young adults who were younger or older than age 16-24, with a history positive for traumatic brain injury or other diagnosed neurological disorder including Attention Deficit Hyperactivity Disorder, due to the

impact of these conditions on EF which is the focus of the MET assessment. Youth who rated their level of experience with shopping as 1=never or 2= rare (once/year) on the frequency categories. Exclusion criteria were determined by self-report.

Interested yMET study participants were asked to confirm they met study inclusion/exclusion criteria. Once it was determined that the yMET study participants met the inclusion/exclusion criteria for the study, they were emailed the consent form and schedule of dates they could choose from to participate in the study. They were asked to email their choice of time to complete the assessment to the LR. Then they were asked to meet the LR at a large, sub-urban mall in Western Canada at their scheduled assessment time and to bring the signed consent form. If they forgot to bring a signed consent form, copies were provided at the time of assessment and signed consent obtained from each participant before the assessments started. The approximate amount of time for participant emails was 15 minutes and 40-60 minutes for the assessment at the mall. The yMET assessment takes 20-30 minutes to complete and participants were asked to give their opinion of the complexity of the assessment which took another 10 minutes. A few additional minutes were added for introductions and to complete the consent form if they did not bring the completed form with them to the assessment.

The assessment took place when the participant was available. The LR followed the participant while they completed the assessment to observe and record their performance on a scoring sheet.

For the assessment the participant was given a small amount of money (\$20) by the LR to purchase 6 items and they were asked to find out 4 pieces of information while

following the rules set out for the yMET assessment. The money was intended for the assessment and any money not spent was returned to the researcher. If participants ran out of money they were not provided with more money as sticking to the budget is one of the cognitive requirements of the shopping task. Participants were not required to spend their own money and were asked to return items purchased and any change to the researcher at the end of the assessment

After completing the yMET, participants were asked to 1) document their impressions of the assessment (open ended) and 2) rate the complexity of the assessment on the following Likert-type scale: 1 = Extremely Easy; 2= Easy; 3= Neither easy or difficult; 4= Difficult; 5= Extremely Difficult.

The questions were completed in a semi-private location (i.e. a bench away from other people). As the mall was a public area the LR made every effort to locate a private area for the participant to complete the questions.

Once the yMET group data was collected, each participant's performance on the yMET was assigned a unique identification number and reviewed and scored by the LR. SPSS was used to analyze the data and descriptive statistics calculated for all areas scored (i.e. task completion, task omissions, total errors, total rule breaks, total inefficiencies, strategy use and time to completion.) The descriptive statistics for the stratified age groups were used to determine if there were trends in the data across the stratified age groups.

yMET group participants' impressions of the yMET were considered along with the focus group data to triangulate the changes to the original MET. A tally of the complexity ratings was determined.

3.6 Community Consent

Prior to the pilot study, the LR contacted the mall administration of a sub-urban mall in Western Canada and negotiated with them to use the space as a research site and indicated the LR would be video recording research participants. The mall administration provided permission to the LR to use the mall as a research site (refer to **Appendix H**). Initially the LR planned to video record each participants' performance on the yMET similar to previous published research about the MET; however, the mall administration requested that the LR contact the individual stores likely to be entered as part of the study and request permission to video record in the store. After telephoning the stores at the mall to obtain corporate email contacts, the LR emailed a letter to the stores' corporate contact (refer to **Appendix I**) to request their permission and to explain the safe guards the LR planned to put in place to protect the privacy of those in the store who may be unintentionally included on the video recording. The LR received several responses indicating that the LR was not permitted to video record for research purposes within their stores and therefore it was determined the LR would measure and score participants completing the MET as is done in clinical practice (i.e. observation, note taking and scoring based on the observed performance). A copy of the email providing permission to use a meeting room at the community centre to conduct the focus group is provided in **Appendix J**.

3.7 Participant Informed Consent

In British Columbia, where the LR resides and where this study took place, there is no law that governs how old participants must be to consent to participate in research. According to the British Columbia Children's Hospital website REB requirements, they recommend using an adolescent assent form for "children between the ages of 14 to 18 years who, in the context of a particular study, are deemed not competent to consent on their own behalf but who have the capacity to assent."

For this study, the LR considered that in both the focus group and yMET group there was minimal risk to participation, that was no more risk than those typically encountered by youth in aspects of their everyday life (for example group discussions at school and shopping activities in the community). The risk associated with participation in either group could have included feeling uncomfortable with either the group discussion or requirements of the assessment and participants were given the option to leave the group or stop the assessment at any time. The time commitment with study participation and need to meet the researcher at the focus group location or shopping mall were both outlined in the information letters. Youth were prompted in the information letter to discuss the need to be transported to the meeting locations with their parent/guardian. The LR assumed that the youth interested in this study appreciated the possible impact of foreseeable risks and benefits to them and they understood how the conditions of the research may affect them. For the purpose of this study the LR assumed the youth age 16-24 were competent and could consent to their participation in the study.

An informed consent letter to the focus group participants (**Appendix K**) or yMET study participants (**Appendix L**) describing the study was provided to participants by email and opportunity for them to ask questions of the LR provided. Participants in both groups were asked to review, print, and sign the consent form and to bring the form to the respective meeting with the LR. Copies of the consent form were provided at the time of the meeting in the event that participants forgot to bring a signed consent form. Consent for audiotaping group discussion was obtained from the focus group participants.

Participants were able to withdraw their participation and data at any time during the focus group or yMET study process up until two weeks after the focus group or one month after completing the yMET. It was deemed not possible to remove data from the study after these time frames due to the analysis process.

3.8 Risk and Benefit Analysis

There were minimal risks anticipated for focus group participants, no different to what focus group participants would have encountered in a classroom discussion with peers. There was low risk of negative group dynamics (i.e. someone cuts you off while speaking) and the review of ground rules in the focus group guide (refer to **Appendix F**) was intended to reduce the chances of this occurring. There was minimal risk anticipated for yMET group participants. There was low risk that they may have felt frustration due to the demands of the assessment. The information gained from this study has contributed to increased knowledge and understanding of real-world executive functioning in adolescents and young adults. It assisted in developing a version of the MET that can be used with this population in the community.

3.9 Compensation

Participants needed to meet the LR at the designated meeting location for the focus group and at the shopping mall for the yMET therefore there were minor expenses incurred by them or their parents for driving a car or taking a bus. For those who participated in the focus group, refreshments were provided and a \$10 gift card for participation. For those who participated in the yMET group they were given a \$20 gift card for participation. Funding for the focus group refreshments and gift cards as well as for the yMET group money came from the LR's own funds.

3.10 Privacy and Confidentiality

Privacy and confidentiality of participants and the information they share was ensured by assigning each individual a code. A list of participants, their demographic information and assigned codes were known only to the LR.

Data collected for the focus group was audio recorded by the LR, who was also the focus group facilitator. Audio data was recorded on the LR personal computer and stored in a drive that was encrypted. At the end of the study audio recordings will be permanently deleted from the computer.

All focus group data transcribed for analysis was associated with the participant code number identifier not the participant's personal/demographic information. Transcription was done by the LR and reviewed by a research team member. The transcription document(s) were saved on the LR computer in an encrypted drive and the file(s) will be deleted at the end of the study. If a direct quote was used in a publication or

for educational purposes the participant had consented to it and was identified indirectly as Group member 1, 2, 3 etc. The consent form for focus group participants specifically addressed direct quotes and that participants who are quoted in reports, presentations or journal articles would not be identified.

All data from the yMET group, including paper copies of materials used by participants during the assessment and scoring or electronic files, were associated and labeled with the participant identifier and not associated with their personal/demographic information. Files were stored electronically on the LR computer in an encrypted drive or in paper form in the locked file cabinet in the LR's office. Scoring sheets and information written down by the participants were reviewed by the LR to finalize scoring of the yMET assessment and only seen or used for educational purposes if the participant had given consent to do so. At the end of the study, saved files containing yMET scoring data were deleted off the computer and paper materials destroyed.

For both Part 1: focus group and Part II: yMET group results were primarily described as aggregate results. For those who indicated on the consent form they wanted to receive a summary of the results, this was provided when the study was finished.

3.11 Roles and Duties of Research Team

The LR proposed the original research concept and was responsible for study design, recruitment of participants, data collection and analysis. Dr. Diane MacKenzie, Supervisor, has expertise in neuroscience and quantitative research methods and she is a faculty member with the School of Occupational therapy. Dr. MacKenzie reviewed and provided feedback to the study design, data collection and analysis. Dr. Brenda Merritt,

committee member has expertise in quantitative research methods and clinical measurement research. Dr. Joan Versnel, committee member has expertise in child and adolescent transitions, qualitative and mixed-method research. Dr. Versnel and Dr. Merritt are faculty members of the School of Occupational Therapy reviewed and provided feedback to the study design, data collection and analysis.

CHAPTER 4 PILOT STUDY

The following chapter has been submitted as a manuscript for publication and is currently under revision. This chapter was primarily written by Vanessa Hanberg with contribution from Dr. Diane MacKenzie and Dr. Joan Versnel.

4.1 Introduction

Late adolescence and young adulthood are a critical period of brain development for cognitive functions including executive function (Taylor et al., 2013). Executive function (EF) is an overarching set of cognitive functions that coordinate and integrate subordinate cognitive functions to enable goal directed behaviour. These subordinate cognitive functions include goal selection, initiation, planning, organizing, problem solving, decision making, impulse control and cognitive flexibility (Hunt et al., 2013). Impairment in EF from Acquired Brain Injury (ABI) profoundly impacts everyday life, particularly in the underlying cognitive abilities necessary for new and complex task performance that are required for adult life roles like employment and independent living. The challenge in the adolescent and young adult population is that executive dysfunction from ABI can be difficult to distinguish from normal development and has possible implications for the remainder of adult life (Beauchamp et al., 2011).

The Multiple Errands Test (MET) is a naturalistic assessment of real-world EF used by occupational therapists and neuropsychologist to identify the impact of impaired EF. The MET is a complex shopping activity conducted in a real-world context, with the therapist observing and rating performance. The test taker is required to buy 6 items, find out 4 pieces of information and follow a set of rules while completing the activity. A

scoping review of the MET previously identified the MET is a sensitive, ecologically valid and useful tool for occupational therapists to evaluate the impact of EF on real-world performance (Hanberg, MacKenzie & Merritt, in press). The scoping review found that across the non-virtual reality versions of the MET, the main evidence of its use is in adult males with ABI mainly in a hospital setting with limited evidence in community settings (Hanberg et al., in press). The review also identified no evidence for the MET in the late adolescent and early adult population, termed youth (age 16-24) hereafter, and poor evidence across studies for content and face validity.

Content and face validity are fundamental psychometric properties for assessment instruments. Content validity is the extent to which the construct (i.e. real-world EF) measured is adequately reflected by the items/structure of the measure (Law & MacDermid, 2014). It can vary across populations, so it should be established for the population with which the assessment will be used (Haynes et al., 1995). The developers of the Consensus-based standards for the selection of health measurement instruments (COSMIN) consider content validity to be the most important measurement property because, *“it should be clear that the items of the [measurement instrument] are relevant, comprehensive, and comprehensible with respect to the construct of interest and target population.”* (Terwee et al., 2018: p. 16) To date, the content validity of the MET for the adult population has been established by expert contribution.

Face validity is an aspect of content validity and considers if the measure is acceptable and relevant to those who are tested by it (Portney & Watkins, 2009). In a review article by Auger et al., (2005) pragmatic criteria of measurement tools including the concept of acceptability are defined. Based on their discussion, acceptability is

defined as a subjective perception of the level of difficulty of the assessment. Relevancy of an assessment, for our purposes, refers to the appropriateness for youth of the items/structure in current time, circumstances and contemporary culture. Thus far, no evidence for the face validity of the MET has been reported for any population.

To address several gaps in the MET literature for youth, the aim of this research was first to examine the face validity of the original MET from the perspective of typically developing youth in a suburban, community setting and then, based on their perceptions and input to integrate potential changes to the MET and pilot test the MET (with possible changes) in a community setting with youth. The research questions were as follows:

- 1) What is the face validity of the original MET for the youth age group (age 16-24) in a community setting?
- 2) How do youth perform on the yMET (youth) administered in a community setting?
- 3) What is the acceptability of the yMET for youth in a community setting?

Previous work on EF in youth suggests several areas of improvement in EF ability from age 17-19 on traditional neuropsychological tests of EF (Taylor et al., 2013) therefore the assumption for this study was that younger participants will make more errors and complete fewer tasks on the MET than older participants (using the age range of 16-24).

4.2 Methods

The study was designed to follow a sequential exploratory design, a form of mixed method design, starting with the collection of qualitative data, followed by tool

modification and then collection and analysis of quantitative data (Creswell, 2014).

Ethics approval for the study was obtained in 2017, as was written informed consent from all participants. Given the MET is a naturalistic assessment taking place in real-world environments, several site-specific versions of the MET have been developed for use in hospital or community settings (i.e. shopping mall). The version used in this study is based on the MET-SV (Simplified Version) (Alderman et al., 2003) since it takes place in a community setting. Hereafter, the MET-SV version of the MET is referred to as the MET.

Focus group design

In order to explore the face validity of the MET with the youth population, a focus group was selected as a suitable way to document their perceptions of the language and content of the MET. A focus group is defined by Ivanhoff and Hultberg (2006) as, “*a group discussion in which persons from the target group discuss different aspect of a topic*” (p.125). These authors define focus group methodology as, “*exploratory in nature*” and explain that focus groups can be used by occupational therapists at various stages of research including for constructing tools/instruments and associated developing material. Focus group methodology has its foundations in holistic philosophical viewpoints which hold that knowledge is based on human experience within social, linguistic and cultural environments (Depoy & Gitlin, 2011, p.29). In a focus group, group interactions are a key element where, “*participants can reveal multiple understandings and meanings and provide the researcher with a number of different perspectives in their own words*” (Ivanoff & Hultberg, 2006, p.127). Given the kind of knowledge that a focus group would generate it was determined to be a fitting way to explore what youth think of the

MET as well as the language and content as a means of establishing the face validity of the MET for use with a youth population.

Focus group participants

The guidelines provided by Hollis et al., (2002) as well as Ivanhoff and Hultberg, (2006) were consulted for planning and delivery of the focus group. There is a range of recommendations for focus group size from four to twelve (DePoy & Gitlin, 2011; Hollis et al., 2002; Ivanhoff & Hultberg, 2006). The focus group sample was based on non-random methods, convenience and snowball sampling. Ivanhoff and Hultberg (2006) recommend homogeneity as a priority when selecting participants for a focus group but that some differences amongst group members are important to capture the diversity of the group. Therefore, the lead researcher selected a mix of ages within the targeted age range (age 16-24), a mix of genders and recruited from those with at least some experience with shopping. It was expected that the differences in the group would increase the transferability of the findings (Hollis et al., 2002).

Focus group procedure

Ahead of the focus group, a focus group guide was developed based on published suggestions for content, number and types of questions (Hollis et al., 2002; Ivanoff & Hultberg, 2006). Key questions and probes were developed with an understanding they were a guide rather than a specific protocol. The lead researcher was the group facilitator of the focus group. Focus group discussion was audio-recorded and recordings transcribed verbatim. The transcript was then analysed using a thematic analysis as defined by Braun and Clarke (2006). The step-by-step guide for thematic analysis as outlined by Braun and Clarke (2006) was followed. There are six phases of thematic

analysis: familiarizing with your data, generating initial codes, searching for themes, reviewing themes, defining and naming themes and producing the report. A second researcher independently reviewed the transcript and initial codes to confirm the findings.

Pilot study methods

Following the focus group data analysis, the MET was revised based on youth input and named the yMET (youth MET). The yMET was then used in a pilot study with community dwelling, typically developing youth age 16-24 in a sub-urban mall setting. The pilot study participants were recruited by non-random sampling methods, convenience and snowball sampling. The plan was to administer the yMET with 12, male and female, community dwelling youths (age 16-24). Guidelines for the number of participants for the pilot study was determined by reviewing Hertzog (2008) who suggest 10 or even fewer if the purpose of the study is acceptability of formatting or clarity of instructions. Pilot study participants completed the yMET at a shopping mall in Western Canada, starting at a designated location with lead researcher observing their performance. Participants were read the instructions, provided with a copy of instructions, map of the mall, with required money and a pen. The lead researcher was not permitted to video record in the mall environment to document each participant's performance on the yMET, therefore the researcher kept detailed field notes for each participant writing down specific details of events, observations and occurrences. The yMET was scored according to the scoring guidelines developed by Dawson, Nalder and Clark (2016) with permission from the authors. These scoring guidelines were chosen to improve the standardization of scoring across MET studies and because errors in performance and total error scores were clearly defined. A total errors score was

calculated by adding tasks omitted, partial task failures and rules broken. Partial task failures were defined ahead of time from a list of identifiable errors that prevent full completion of the task. Participants were asked after completing the yMET to rate the level of perceived difficulty when completing the yMET on a Likert scale (1=extremely easy to 5=extremely difficulty) and to respond to an open-ended question about their experience completing the yMET.

4.3 Results

The results are presented for the focus group followed by the pilot study. The focus group consisted of five youth, 3 females and 2 males, age 16-22 years old and lasted an hour.

Focus Group

Examples of initial codes from the transcript included: difficulty of the task, understanding rules/instructions, questioning item relevancy, cell phone use. Two main themes were generated from the focus group data: 1) Maintain Assessment Purpose which incorporated the two sub-themes of i) difficulty of task and ii) limiting cell phone use and 2) Rethinking Assessment Relevancy which incorporated three sub-themes i) Clarity of rules and instructions, ii) Appropriateness to person (age 16-24), location, circumstances and contemporary interest iii) Item substitutions.

Theme 1: Maintaining Assessment Purpose

Generally, youth in the focus group perceived that the MET assessment is difficult “*there are a lot of rules to follow*” (FG1);” *it’s a little bit difficult to ... understand everything*” (FG2), however, one member stated “*it’s not that difficult*” (FG5). The focus group discussion indicated several factors that contribute to making the MET assessment

challenging. These include the rules and the cognitive demand associated with the rules, *“There is a lot of multi-tasking, and I’m not very good at multi-tasking, it’s a little stressful...”* (FG3); unusual/unfamiliar items and/or where to buy the item(s); understanding the assessment requirements due to language used in the MET and relevancy of the tasks to current time and place.

While the focus group participants recognized that changes would need to be made to the MET assessment, the discussion highlighted the need to balance maintaining the integrity of the assessment purpose with changes to language and content. FG5 stated, *“I can understand it all just fine...some of it is used in Britain, and doesn’t transfer over well...such as words like packet of plasters, I frankly don’t have a clue what that is,”* and, FG2 stated, *“I suppose the question then is about relevancy or difficulty.”* It was important to the group that when considering changing the assessment that the integrity of the assessment purpose was not compromised by reducing the challenge of the assessment. When discussing changing an item, one participant said, *“I feel like you need to choose something equally challenging to find.”* (FG1) Maintaining the level of challenge was discussed as an important factor when substituting items or restricting cell phone use. The group unanimously felt that while using cell phones during the assessment was relevant to their age group, cell phone use to look up information required for the assessment should be restricted as unlimited cell phone use could make finding the information too easy and limit the opportunity for the therapist to observe performance directly, *“... I would have some kind of contingency in a far as cell phone, because I think they could just get all the information ...they won’t move, and it kind of takes away from the spirit of the multiple errands test, when you are basically condensing*

multiple errands into a single...you don't have to use a crutch, but you can use it." (FG2)

Generally, the group felt that item substitutions should stay within the same category and be equally challenging to find.

Theme 2: Re-thinking Assessment Relevancy

When considering making changes to the assessment, it was more important that those completing the assessment understand the instructions and task requirements than taking into consideration personal shopping preferences. FG3 stated, *"yeah...one or two items could be changed, but what's relevant to me might not be relevant to someone else, like someone might not know where to get a candle, where I'd say bath and body works, some else might not say so..."* FG1 stated, *"Uhhh, yeah, I'm more on the side where, I just mean like if I was given this task, I don't think I'd care what the items were or if I'd use them, as long as I knew what they all were, I can identify them..."*

Some discussion focused on possible gender differences i.e. girls know about the store Forever 21 whereas the boys had never been in this store or limited knowledge of the store. A clear understanding of the task requirement was discussed as being related to cultural specific language in the MET, issues of contemporary interest to youth and location specific constraints. FG2 said, *"I think I agree that the language is a bit dated, for someone from our generation, our culture...it's a little bit difficult to ... understand everything..."* and FG5 said, *"... no one really goes to libraries anymore."* Substitutions or changes to reflect Canadian ways of saying things, current habits of youth and to be practical in the specific mall the assessment would occur were suggested.

Changes to the MET

Overall there was more group consensus on substitutions for the information to be gathered by youth on the MET (the second task on the MET), than which items to purchase (the first task on the MET). Substitutions to information to be gathered were more directly related to issues of current youth habits and location specific constraints. While substitutions to items for purchase were suggested, this topic was more debated and generally it was more important that items to purchase were put in Canadian terms but be otherwise unchanged, to maintain the challenge of the assessment. The revised instructions, based on focus group input are found in Appendix M. A chart of the changes made to the MET is found in Table 4.1.

Pilot Study

Nine youth age 16-24 years old participated in the pilot study. Refer to Table 4.2, first column for a summary of the results and descriptive statistics for the pilot study. One participant revealed, after yMET completion, that they had an ABI due to a sport-related concussion (i.e. met the exclusion criteria for prior neurological injury). The participant's scores were compared to the others and given his scores on the yMET were within the range of the other participants, the data was included in this study.

Based on the final sample, 7 of the 9 participants were in the age range 16-19 and 2 of the 9 participants were in the age range 20-24. To examine general trends in the data and address the hypothesis, two categories with close to equal numbers in each category were determined, age 16-18, termed younger group and age 19-24, termed older group. General trends in the data supported that the younger participants (N=5) had a higher mean total error score, $\bar{M}=8.2$ compared to the older participants (N=4) mean total error

score of $\bar{M}=5.5$. Younger participants also completed fewer tasks, $\bar{M}=9.8$ compared to older participants, $\bar{M}=11.25$.

The rules most often broken by youth on the yMET were, the rule ‘*do not speak to the person observing you unless this is part of the exercise*’ and ‘*you must carry out all these tasks but may do so in any order*’ with 7 of 9 participants breaking these rules. The scoring of the rule to carry out all the tasks is scored broken if any of the 12 tasks are omitted. Four of the 9 youth broke the budget rule ‘*you should spend no more than \$17*’.

Table 4.1. Summary of original MET changes in the yMET.

Original MET	Substitution on yMET	Reason from Focus group	Practical Issues
Small brown loaf	Small loaf of brown bread	Canadian word use, understanding	
Packet of plasters	Package of bandaids	Same as above	
Bar of chocolate	Chocolate bar	Same as above	
Single light bulb	Package of matches OR candle OR bar of soap No consensus, no change	3/5 FG members wanted to change this item but no consensus on what the final change should be	
Birthday card	No change		
Key ring	No change		
What is the headline from either today’s ‘Daily Mail’, ‘Daily Mirror’ or ‘The Sun’ newspapers?	Details of the sale at Old Navy (what is on sale and what is the sale amount) OR Special of the day at restaurant	Contemporary interest	
What is the closing time of the library on Saturday?	What is the closing time of specific restaurant/the Mall on Saturday?	Contemporary interest	Location specific constraint; there is no library at this mall
What is the price of 1 pound or kilogram of tomatoes?	No change		
How many shops sell televisions?	How many cell phone providers are in the Mall?	Contemporary interest	
You must meet me under the clock 20 minutes after you	Meet me at the Mall directory, 20 minutes after I have said “...begin	The clarity of this item was discussed, and revisions suggested including	This mall does not have a clock, so another designated

Original MET	Substitution on yMET	Reason from Focus group	Practical Issues
have started this task and tell me the time.	the exercise” and tell me the time. You can then continue the exercise.	explicitly stating they can continue the exercise after the meeting at the directory.	location was determined (the mall directory).
Whilst carrying out this exercise you must obey the following rules:	While carrying out this exercise you must follow these rules:	Cultural specific language, use Canadian words/expressions instead	
You must carry out all these tasks but may do so in any order	No change		
You should spend no more than 5 pounds	You should spend no more than \$17	Cultural specific language	Lead researcher determined all items can be purchased with \$14 but this leaves very little room. The amount was increased to \$17 (they are given \$20 so they still have to budget and stay within the budget)
You should stay within the limits of the upper floor of the shopping centre	You should stay within the limits of the mall and do not exit the mall to the outdoors	Location constraints; discussion in FG that mall is big but if you limit them to upper floor there are items/information they likely can't locate with this limitation.	You have to exit the main doors to the Mall and either walk across an outdoor parking lot or underground parking area to access Walmart. If this rule stays, they can't go to Walmart without violating a rule.
No shop should be entered other than to buy something	No change Additional explanation provided in the instructions read aloud	Needs to be clarified based on Focus group feedback	
You should not go back into a shop you have already been in	No change		
You should not buy any item from the stalls	You should not buy any items from the kiosks OR You should not use your cell phone more than two times to search for information	Contemporary interest, it was more important to limit cell phone use than include the rule about kiosks. Rather than add in another rule about cell phone use, the cell phone limit replaced this rule.	

Original MET	Substitution on yMET	Reason from Focus group	Practical Issues
You should buy no more than 2 items from Tesco	You should buy no more than 2 items from the Dollar Store	Location specific issues	
Take as little time to complete this exercise without rushing excessively	No Change		
Do not speak to the person observing you unless this is part of the exercise	No Change		

Table 4.2. Descriptive statistics of youth performance on the yMET, with reference to other versions.

	yMET	BMET	BMET-R
	Mean (range) N=9	Mean (range) Stroke Controls (SC) N=13 TBI Controls (TC) N=12	Mean (range) Version A (VA) Controls* N=16 Version B (VB) Controls* N=16
Age (years)	18.67 (16-24)	SC = 56.7 ± 15.8 TC = 46.1 ± 9.6	61.4 ± 12.0
Males/Females	4/5	SC = 7/6 TC = 10/2	10/6
Tasks Completed (out of 12)	10.44 (8-12)	SC = 8.3 ± 2.1 TC = 6.8 ± 1.3	VA = 9.3 ± 1.7 VB=8.1 ± 2.0
Tasks Not Completed/Omissions	1.56 (0-4)	SC= 0.7 ± 0.8 TC = 0.8 ± 1.5	VA=0.8 ± 1.3 VB=1.3 ± 1.7
Partial Task Failure	3.44 (1-6)		
Rules Broken (out of 8)	2.11 (1-3)	SC= 1.6 ± 1.2 TC= 2.4 ± 1.3	VA=2.1 ± 1.5 VB=2.8 ± 2.2
Total Error Score†	7.00 (2-9)	SC=9.1 ±5 TC=12.7 ±4.9	VA= 4.8 ±3.4 VB=4.5 ±2.0
Total Time to Complete (min)	28.56 (20-38)		
Perceived Difficulty Rating	2.78 (1-4)		

BMET – Baycrest Multiple Errands Test (Dawson et al., 2009)

BMET-R – Baycrest Multiple Errands Test Revised (Clark et al., 2015)

*Counterbalanced design between design exposure

† yMET defined total errors = tasks omitted, partial task failures and rules broken

Dawson et al., (2009) defined total errors = task failures, task omissions, rules broken and other inefficiencies.

Clark et al., (2015) defined total errors = task omissions, tasks partially completed and inefficient behaviour.

The task most often omitted was task #12, *‘tell the examiner when finished the exercise’*, with 6 of 9 youth not completing this task.

The mean perceived difficulty rating for the 9 participants was 2.78 indicating that youth who complete the yMET found it to be between ‘easy’ and ‘neither easy or difficult’. Two of the nine youth perceived the yMET as ‘difficult’ after they completed it.

Qualitative Comments

The youth participants provided comments of their subjective experience following completing the yMET. Several comments directly address the issue of acceptability which was defined in this study as perceived level of difficulty. The budget and time constraints were reasons provided for perceived level of difficulty.

P4 *“hard, things are more expensive then I thought; hard to find things that fit the price; what is a key ring?”*

P5 *“When I first got here and saw the list I thought it would be an easy task, but when I did it I found difficulty finding things within my budget.”*

P8 *“The part found most difficult was remembering to look at the time and not go over budget.”*

The cognitive challenge associated with decision making and multi-tasking were other reasons provided for level of difficulty. As well, there were comments that showed evidence of metacognition or understanding of one’s own thought processes.

P6 *“I thought it was somewhat difficult but do-able. I had to make decisions on where I would buy certain things based off if I thought I could find them at other stores.”*

P7 *“It was slightly difficult because of all the tasks that I had to complete, and the items took a bit of thought to find, but overall, it was a moderate challenge.”*

P1 *“Showed me some things about myself that I didn’t fully notice before; it was a fun challenge.”*

P2 *“Interesting exercise! ... brings out themes in how I approach tasks; very curious to see results and comparatives.”*

There were comments to indicate that for some youth the yMET was easy.

P3 *“It was simple, with clear instructions and it was quick.”*

P9 *“Straight forward task and what was expected.”*

Field Notes

The majority of youth (7/9) consulted the Mall directory and one youth looked at the map provided. Other environmental cues that were used to complete the tasks were the Mall hours posted on the doors to the mall, asking store clerks and asking at the service desk in the Mall. All the youth participants relied on their personal cell phone to keep track of the time with no instances where participants used their cell phones other than to momentarily check the time.

4.4 Discussion

Multiple strategies were used to understand the acceptability of the MET for the youth population. Several focus group members indicated they thought the MET would be difficult to complete and based on their input aspects of the MET were modified or substituted to address location specific issues, Canadian/contemporary language and terminology as well as other issues relevant to youth. Then, the pilot study group rated

their perceptions of the level of difficulty after completing the yMET on the Likert scale and results showed the level of acceptability for the youth age group mostly fell in the “easy” to “neither easy or difficult” rating. The open-ended question the participants completed after the yMET concerning their experiences while completing the yMET included words like fun, interesting, simple, clear, quick, straight forward and do-able. The written feedback that indicated increased level of challenge/difficulty included terms like moderate challenge, somewhat difficult and time/budget constraints. These multiple strategies; focus group discussion, Likert scale rating and the open-ended question were used together to determine the acceptability or perceived level of difficulty of the yMET for youth. Triangulation of the findings of acceptability by these multiple strategies helps to strengthen the accuracy of the findings.

Another study aim was to examine how youth perform on the yMET given the cognitive development and maturation of EF in this age group. Previous published versions of the MET provide an understanding of how adults, both adults with brain injury and non-brain injured controls perform on the MET, but it is not possible to make a direct comparison across MET versions due to the version differences (i.e. different testing environments, shopping mall and hospital and item and scoring differences). While direct comparisons can not be made, how youth did on the yMET in this pilot study relative to adult non-brain injured controls in previously published studies of the MET was considered. We based the scoring methods of this study on those developed by the researchers of the Baycrest Multiple Errands Test (BMET), as such, consideration is given to two of the BMET studies (Clark et al., 2015; Dawson et al., 2009) and presented in Table 2 in the grey columns to distinguish from yMET results. There are differences in

the definitions of total errors between studies. There is greater conformity in how other areas of scoring were defined including tasks completed, tasks not completed (task omissions) and rules broken. Generally, youth in the pilot study appear to perform on the yMET in a similar way to adults in previous studies with greatest variability in total error scores attributable to differences in scoring definitions across studies. Future studies using the yMET with larger sample size, consistent scoring methods and either comparison of youth performance to adult performance or a longitudinal study with youth into adulthood would further elucidate the development of real-world EF in this age group.

Examining the trends in the errors made by youth on the yMET provides some indication of the cognitive challenge for this age group. The rule most often broken by youth on the yMET was the rule to not speak to the examiner unless part of the exercise. This rule requires youth to use impulse control, as they carry out the yMET, an area of cognitive control still developing in this age group (Blakemore & Robbins, 2012; Peach & Gaultney, 2013). Typically, youth completing the yMET asked the examiner questions (although given time before starting to ask questions) or reported difficulties to the examiner (i.e. 'I've run out of money'). The task most often omitted by youth was the task to explicitly tell the examiner when finished the exercise. While this information is clearly printed in bold letters on the instruction sheet and read aloud to all participants before they begin the yMET, it is the last task presented. It could be that youth are already thinking about how they will approach the various yMET tasks therefore they have 'tuned out' and are not paying attention at this stage of the instructions. This information is then not stored in working memory for them to recall later at the end of the

yMET when they are required to do this task. Youth performance in this pilot study of the yMET support that the yMET is sensitive to identifying areas impacting EF such as impulse control and attention and can assist occupational therapists working with youth to develop strategies to improve these skills.

The focus group identified that an issue relevant to youth and part of contemporary youth habits is routine cell phone use and an over-reliance on cell phones. Despite their relevancy, cell phones were identified by the focus group participants as something that could interfere with MET performance. The cell phone could be used to look up required information without the participant having to move to a location or search for information in the physical environment. As such, cell phone use was restricted in the yMET rules to *'no more than two times to search for information'* and in the instructions provided in Appendix A, youth were also told they could use their cell phone to look at the time. From field note analysis, no youth broke the cell phone use rule, more specifically, no youth used their cell phone to search for information instead they mostly used the directory or other sources of information in the physical environment. When youth used their cell phone it was to keep track of the time, an important task requirement. Overall, the yMET is cognitively demanding enough for youth that they did not use their cell phones for non-yMET related purposes (i.e. distraction) and remained engaged in the yMET tasks throughout.

For occupational therapists working with youth, this study has demonstrated that the yMET can be used with typically developing youth in a community setting to identify areas impacting real-world EF. The pilot study provides preliminary evidence that younger participants in the youth age group make more errors and complete fewer tasks

but the small sample size limits the strength of this evidence. Future yMET studies with larger sample size and a comparison group or longitudinal design would provide a clearer understanding of the development of real-world executive functioning occurring in this age group.

Study Limitations

For the focus group part of this study, only one focus group with a minimum number of people in the group was conducted. When several focus groups are conducted it allows for a broader range of perspectives and a greater likelihood of saturation or the point at which information gathered does not provide new understandings. With only one focus group conducted in this study it was not possible to reach a point of saturation and a narrow range of view points are considered. Another method to enhance the rigor of data collection and analysis for the focus group would be member checking but it was not undertaken for this study due to timing as following the focus group, the youth were starting a new school year and unavailable to provide further feedback.

While small sample size limits the strength of the evidence of the pilot study and the conclusions that can be made, this pilot study serves a purpose in determining the feasibility of future larger studies. A further study limitation was that in this study it was challenging to recruit the full range of ages (age 16-24), with fewer participants in 20-24 ages therefore the data is likely to be more representative of how the younger end of this age range perform on the yMET.

4.5 Conclusion

The results of this mixed method study provide evidence for the face validity of the yMET with a typically developing youth population in a community setting and that the yMET is acceptable to this population. Youth also appear to perform in a similar way to healthy adults on the yMET although this was not demonstrated by statistical methods rather from general trends in relation to previously published studies with adults.

Preliminary results with the youth population support that the yMET tasks are sufficiently demanding that with clear cell phone use rules, youth do not rely on cell phones for yMET task completion; the yMET is sensitive to identifying underlying cognitive skills that impact real-world EF in youth; and that older participants in the age range perform better than younger participants. These preliminary results indicate that a larger future study with the yMET is feasible and warranted.

CHAPTER 5 CONCLUSION

The outcome of this thesis concerning the face validity of the Multiple Errands Test with youth in a community setting has implications for occupational therapy education, practice and research.

5.1 Implications for Occupational Therapy Education

Occupational therapy education and training typically includes a broad understanding of normal development of motor, cognitive, behavioural and emotional functions from birth through adulthood and related to the aging process. Some education touches on the maturation of cognitive functions in the late adolescent and young adult age group but in the LR's experience, there was more emphasis on infant and early childhood development. This thesis highlights issues for occupational therapy educators concerning cognitive development in the transition from adolescence to adulthood. Firstly, cognitive development is complex and protracted from birth to young adulthood and underlying brain structures associated with cognitive functions are developing at different rates throughout. Over the last decade, emerging research in the brain imaging field has shown the development of the frontal lobes extends into the mid-twenties so we can now assume areas of cognitive function (i.e. EF) which are associated with the frontal lobes are still developing into early adulthood. This recently disseminated research in related fields must be integrated into occupational therapy education as it refines occupational therapy's understanding of normal cognitive development and impacts occupational therapy cognitive assessment as well as rehabilitation strategies and expectations. The WHO (2011) and Stats Canada (Turcotte, 2015) have expanded the age

range for what they consider to be youth to age 24 which is a further justification to adopt a similar understanding in occupational therapy education. Additionally, occupational therapists are often in a position to educate and advocate for youths with ABI to teachers, family members, peers, employers and funding sources for supports and rehabilitation services and can be key players in transferring this research into practice and policy (i.e. knowledge translation).

The implications for completing cognitive assessment with this age group is that occupational therapy students and practitioners need to think critically when assessing youth compared to the adult population. Occupational therapy students, clinicians and funders reading reports must consider the appropriateness of a cognitive assessment for the youth population vs adult population by considering if the research to validate the assessment has considered the underlying development of cognitive functions in this unique group. The bottom line is that cognitive assessments intended to be used with adults may not be suitable to use with youth.

5.2 Implications for Occupational Therapy Practice

The impetus for this thesis came from a clinical questions or challenge related to occupational therapy practice with youth with ABI. The LR wanted to understand if the MET could be used with this age group in a community setting and how typically developing youths' performance on the MET compared to healthy adults, given that EF is still developing in youth. The focus group provided the LR with a variety of insights into what youth think of the MET and helped create the yMET. The small sample size for the yMET portion of the pilot study did not enable a direct comparison of youth performance

to adult performance on the yMET but future studies can build on this work to determine if the yMET can discriminate between youth and adult performance and if the yMET is sensitive to the development of EF. This study has provided evidence of the face and content validity of the yMET for the youth population as well as updating the MET to be more reflective of contemporary culture. Occupational therapy students, clinicians, and researchers should be aware that if they are using the MET as developed more than two decades ago the items and specific content may not be relevant for either youth or younger adults. This study has added a version of the MET, the yMET that can be used specifically with typically developing youth in the community as no previous versions had face validity for youth and few versions were intended for community use. Although the yMET is a challenging assessment to administer and takes more time and resources than some other assessments of cognitive function, it provides information of real-world executive function that is often not provide by other assessments. The investment of time upfront in administering the yMET can save time later when additional assessments are administered and continue to lack the needed information about real-world contexts.

The scoping review has also provided occupational therapy clinicians who have used the MET, are currently using the MET or who have an interest in using it, a comprehensive overview of the non-virtual reality versions of the MET, strengths and gaps in the evidence as well as clinical utility. Many clinicians do not have the time to complete a thorough and in-depth review of a body of literature therefore the scoping review provides a valuable and needed resource.

5.3 Implications for Occupational Therapy Research

The scoping review portion of this thesis identifies several gaps in the body of non-virtual reality, MET research and recommends directions for future research. The pilot study provides evidence that a larger study with youth and the yMET is feasible and necessary.

This thesis topic also has relevance for the development and validation of measurement instruments in the field of research as it brings into focus that content validity is dynamic and should be periodically examined (Haynes et al., 1995). Widespread societal changes associated with the rapid growth of technology may impact the content and face validity of assessments developed a decade or more ago. The impact of these changes is likely to be even more significant for assessments that take place in real-world environments. For example, when the original MET version was developed around 1991, the items included finding the headline of a newspaper and the closing time of a library. In contemporary North American culture, advancements in technology like cell phones and tablets now mean that newspapers and libraries are less prevalent in the culture rather online news and library websites with book downloads are more common. These societal changes impact the validity of an assessment and mean that assessments may require updating over time to reflect issues of contemporary interest and importance to certain populations (i.e., youth population) particularly if the assessment is intended to be used with this population.

While the focus group members felt that limiting cell phone use was an important consideration to enable the therapist to observe yMET performance, use of cell phone

technology has impacted how contemporary youth find information and shop. It will be important to consider in further revisions of the yMET whether there is a way to allow youth to use their cell phones without explicit limitations and track how and what they do with the cell phone to complete yMET tasks. This may require additional programs to track what websites were visited and the number of swipes/touches on specific webpage content.

This pilot study consisting of both a focus group and then field testing of a new version of the MET based on focus group input and has provided a methodology for revising the MET for other populations. Researchers can use this methodology to establish the face validity of the MET for other populations and obtain their specific insights concerning the items, language and requirements of the MET. In addition to expert panel contribution that is frequently a method for formulating assessment items or requirements and establishing content validity, this methodology adds the perspective of the people who will be tested by the assessment.

Appendix A: Original MET Instructions

Taken from p. 44 of Alderman, Burgess, Knight & Henman, (2003)

INSTRUCTIONS

In this exercise you should complete the following three tasks:

- 1) You should buy the following items

Small brown loaf	bar of chocolate
Packet of plasters	single light bulb
Birthday card	key ring

- 2) You should obtain the following information and write it down in the spaces below
 - 1) What is the headline from either today's 'Daily Mail', 'Daily Mirror' or 'The Sun' newspapers?
 - 2) What is the closing time of the library on Saturday?
 - 3) What is the price of 1 pound or kilogram of tomatoes?
 - 4) How many shops sell televisions?

- 3) You must meet me under the clock 20 minutes after you have started this task and tell me the time.

TELL THE PERSON OBSERVING YOU WHEN YOU HAVE COMPLETED THE EXERCISE

Whilst carrying out this exercise you must obey the following rules:

- You must carry out all these tasks but may do so in any order
- You should spend no more than £5
- You should stay within the limits of the upper floor of the shopping centre
- No shop should be entered other than to buy something
- You should not go back into a shop you have already been in
- You should not buy any item from the stalls
- You should buy no more than 2 items from Tesco
- Take as little time to complete this exercise without rushing excessively
- Do not speak to the person observing you unless this is part of the exercise

These written instructions are provided to the test taker but they also hear the following instructions read out loud to them.

“In this exercise I want you to complete three tasks. The tasks are: to buy the six items listed on this sheet (examiner to indicate and describe items on sheet); to obtain and write down four pieces of information (examiner to indicate and describe items on sheet); and

to meet me under this clock 20 minutes after I have said "...begin the exercise" and tell me the time.

However, whilst completing this exercise you must obey the rules listed on your instruction sheet (examiner to indicate and describe rules on sheet).

You must carry out all of these tasks but you may do so in any order. You should spend no more than £5: although I've given you £10 you should spend no more than five. You should stay within the limits of the upper floor of the shopping centre. This means you must not leave by the doors at either end, use any lifts, stairs or escalators. No shop should be entered other than to buy something, so if you go into a shop it should be with the intention of buying something. You should not go back into a shop you have already been in, so if you've been into a particular shop you should not go back into it again. You should not buy any items from the stalls: these are the stalls (show to subject) you must only buy items from shops. You should buy no more than two items from Tesco. Take as little time as possible to complete this exercise without rushing excessively.

During this exercise I shall be following you from a distance and observing what you are doing. Please do not speak to me unless this is part of the exercise.

Finally, approach me and tell me when you have completed the exercise.

Is that clear, have you any questions?

Now tell me what you must do.

"Begin the exercise."



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Appendix B: (Focus Group) Recruitment Poster

PARTICIPANTS (*AGE 16-24*) NEEDED FOR RESEARCH
IN *THINKING AND REASONING*

We are looking for youth volunteers (age 16-24) to take part in a study of The Multiple Errands Test (MET).

The MET is an assessment of the mental processes that allow us to plan, focus attention, remember, and complete multiple tasks.

You would be asked to: *participate in a focus group to get your impressions of the Multiple Errands Test.*

Your participation would involve *one focus group session*, lasting about an hour.

In appreciation for your time, you will receive *refreshments and a \$10 gift card to a coffee shop.*

For more information about this study, or to volunteer for this study, please contact:

Vanessa Hanberg, Lead Researcher
Dalhousie University - School of Occupational Therapy

778-574-7605

Email: vanessa.hanberg@dal.ca

This study has been reviewed by and has received ethics approval through the office of Human Research Ethics Administration at Dalhousie University.

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Appendix C: (yMET Group) Recruitment Poster

PARTICIPANTS (*AGE 16-24*) NEEDED
FOR RESEARCH IN *THINKING AND REASONING*

We are looking for youth volunteers (age 16-24) to take part in a study of The Multiple Errands Test (MET)

The MET is an assessment of the mental processes that allow us to plan, focus attention, remember, and complete multiple tasks.

You would be asked to: *complete the Multiple Errands Test*

Your participation would involve one session to complete the assessment at a Mall in British Columbia [information redacted], lasting about an hour.

In appreciation for your time, you will receive
a \$20 gift card.

For more information about this study, or to volunteer for this study,
please contact:

Vanessa Hanberg, Lead Researcher
Dalhousie University - School of Occupational Therapy

778-574-7605

Email: vanessa.hanberg@dal.ca

This study has been reviewed by, and has received ethics approval through the office of Human Research Ethics Administration at Dalhousie University.

Call Vanessa Hanberg
778-574-7605

OR

Email: vanessa.hanberg@dal.ca

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OR

Email: vanessa.hanberg@dal.ca

Appendix D: (Focus Group Participant) Information Letter

Dear Focus Group Participant:

I am conducting a study on the Multiple Errands Test (MET), a real life situation assessment used by occupational therapists. The test aims to identify brain functions that are used in everyday life and are needed during activities that are new, complicated and unstructured. Examples of real life complicated activities could include completing a major school project, or starting a new job. These brain functions are still developing in your late teens and early 20's, and are needed more as teenagers become young adults.

So far, the MET has mostly been used in a hospital setting with adults who have experienced a brain injury. There is little research on its use with teens and young adults who live in the community.

The purpose of the focus group is to get your perspective on the assessment. You will not be doing the assessment but instead you will be discussing the assessment. I want to learn about what adolescents and young adults think of the MET assessment and the items that make up the assessment. To finish, if the group proposes changes to the items on the MET assessment, the group will come to an agreement on the most important changes.

It is hoped that the information obtained from this focus group will help the researcher in understanding if the MET assessment is relevant to use with youths in a community setting.

I am seeking input from:

Adolescents and young adults between the ages of 16-24 who live at home with family, alone or with roommate(s). You need to be able to read, understand and speak English and comfortable with talking in a group discussion. You need to have at least some experience with shopping in a mall setting and no history of brain injury or neurological disorder including Attention Deficit Hyperactivity Disorder (ADHD). These are the criteria you need to meet to participate in this study.

Individuals who volunteer for this focus group will participate in a group discussion to take place at the Cloverdale Community Centre. The focus group will take approximately 1 hour and will be audio-recorded.

This study has been reviewed by the office of Human Research Ethics Administration at Dalhousie University.

There will be refreshments offered during the focus group session and you will receive a gift card (\$10 value) to a coffee shop for your participation in the focus group.

If you are interested in participating in this study please contact Vanessa Hanberg by telephone (778-574-7605) or by email (Vanessa.Hanberg@dal.ca). If you are eligible to be in the study, you will then be sent more information about the location and time of the focus group, the participant consent form, and a copy of the assessment and focus group questions to review ahead of time. If you will be relying on your parent/guardian to drive you to the focus group, please share this letter of information with them. If you know of other individuals who may be interested in participating, please feel free to discuss this focus group with them, **share** this letter with them and ask them to contact me directly for further information.

Thank You,

Vanessa Hanberg OT Reg. (BC), Occupational Therapist
MSc OT (Post Professional) Candidate
School of Occupational Therapy
Dalhousie University Tel: 778-574-7605 Email: Vanessa.Hanberg@dal.ca

Appendix E: Focus Group Questions

“Ice Breaker” Question

What is your favorite thing to do/buy at a shopping mall?

- 1) What are your impressions of the assessment?
- 2) What do you think of the language used in this assessment?
- 3) What do you think of the six items the test taker is asked to buy?
- 4) What do you think of the four pieces of information the test taker is asked to find?

Exit Question

- 1) Is there anything else you would like to say about the MET assessment and what was discussed today?

Appendix F: Focus Group Guide and Questions

1. Guide

Introduction/Setting the Stage

Welcome and thank you for agreeing to be a part of the focus group. I appreciate your willingness to participate. My name is Vanessa, I will be facilitating the discussion today and you can ask me questions if needed.

The purpose of the meeting today is to discuss the Multiple Errands Test, an assessment tool used by occupational therapists. The reason I am conducting the focus group is to hear your opinion of the assessment as adolescents/young adults and for you to suggest a few changes. I need your input and will be asking you for your opinions on the assessment language and items.

I am going to go over a few ground rules to start us off

- 1) I want you to do the talking.
 - I want everyone to participate.
 - I may call on you if I haven't heard from you in a while.
- 2) There are not right or wrong answers.
 - Every person's experiences and opinions are important.
 - Speak up whether you think the same or differently.
 - I want to hear a wide range of opinions.
- 3) Please show respect for others comments and listen when they talk.
- 4) I will be audio recording the group.
 - I want to capture what you have to say and not to miss information.
 - I don't identify anyone by name in my report. You will remain anonymous.

Focus Group Questions (see below)

Ask Engagement Question.

Before we get to the questions about the MET assessment I am going to provide you with background to the assessment and review the MET assessment and instructions. I will also provide you with a copy of the instructions that you can take notes on and use as a reference.

When an occupational therapist completes this assessment, he/she meets the person (test taker) at the shopping mall, for example, in the food court. Review the MET instructions and procedure (**Appendix A**).

Ask Exploration Questions.

Helpful probes:

- Can you talk about that more?
- Help me to understand what you mean
- Can you give an example?

Note: The other questions that may arise are listed in italics under each question and are dependent on the focus group discussion.

Conclusion

I think we've come to the end of our questions. Thank you for your honest opinions and participation today – you were very helpful at this early, but very important stage of this study.

Again, thank you very much for your participation today. We really appreciate your help.

2. Questions

Engagement/Ice Breaker Question

- 5) What is your favorite thing to do/buy at a shopping mall?

Exploration Questions

- 6) What are your impressions of the assessment?
- 7) What do you think of the language used in this assessment?
- If there are changes to language, what are the changes?*
 - Then establish group consensus. What are the words/phrases you think should be changed the most (rank top 3 at least)?*
- 8) What do you think of the six items the test taker is asked to buy?
- If there are some items that are unfamiliar/irrelevant, then, are there other items (that fit the \$15 budget) you can suggest to buy?*
 - Why do you feel these items are more relevant?*
 - Then establish group consensus for changes listed in a. What are the items you think should be changed the most (rank top 3 at least)?*
- 9) What do you think of the four pieces of information the test taker is asked to find?
- If there are pieces of information that are unfamiliar/irrelevant to this age group, then, are there other pieces of information you can suggest that a person your age would typically need/want to find out at a shopping mall?*
 - Why do you feel this information is more relevant?*

- c. Then establish group consensus for changes listed in a. *What are the pieces of information you think should be changed the most (rank top 3 at least)?*

Exit Question

- 2) Is there anything else you would like to say about the MET assessments, the questions *or consensus rankings?*

Appendix G: (yMET Group Participant) Information Letter

Dear Pilot Study Participant:

I am conducting a study on the Multiple Errands Test (MET), a real life situation assessment used by occupational Therapists. The test aims to identify brain functions that are used in everyday life and are needed during activities that are new, complicated and unstructured. Examples of real life complicated activities could include completing a major school project, or starting a new job. These brain functions are still developing in your late teens and early 20's, and are needed more as teenagers become young adults.

So far, the MET has mostly been used in a hospital setting with adults who have experienced a brain injury. There is little research on its use with teens and young adults who live in the community.

The purpose of this study is to tryout the MET assessment with youth in a community setting to get preliminary information about how youth, aged 16-24, do on the assessment.

It is hoped that the information obtained from this study will contribute to the knowledge of other occupational therapists and health professionals who work in this area.

I am seeking input from:

Adolescents and young adults between the ages of 16-24 who live at home with family, alone or with roommates. You need to be able to read, understand and speak English, and able to walk or independently use a wheelchair/other walking aid for about half an hour. You need to have at least some experience with shopping in a mall setting and no history of brain injury or neurological disorder including Attention Deficit Hyperactivity Disorder (ADHD). These are the criteria you need to meet to participate in this study.

Individuals who volunteer for this study will have the opportunity to complete the MET assessment, which is a shopping activity, at the Mall [information redacted]. The time commitment will be about 15 minutes for emails before the assessment, and 40-60 minutes for the meeting to complete the assessment at the mall. The MET assessment takes 20-30 minutes to complete and I will follow you to observe your performance. I will also ask you after to give me your opinion of your experience while completing the assessment.

During the assessment you will be given a small amount of money by the researcher to buy six items and asked to find out four pieces of information. The money is intended for the assessment and any money not spent will be returned to the researcher. The items purchased will also be returned to the researcher when the assessment is completed. If you run out of money during the assessment you will not be provided with more and you are not required to spend your own money. In appreciation for your participation you will receive a \$20 gift card after completing the assessment.

This study has been reviewed by Human Research Ethics Administration at Dalhousie University.

If you are interested in participating in this study please contact Vanessa Hanberg by telephone (778-574-7605) or by email (Vanessa.Hanberg@dal.ca). If you are eligible to be in the study, you will then be sent more information about the pilot study as well as the participant consent form. If you will be relying on your parent/guardian to drive you to the assessment, please share this letter of information with them. If you know of other individuals who may be interested in participating, please feel free to discuss this study with them, **share** this letter with them and ask them to contact me directly for further information.

Thank You,
Vanessa Hanberg OT Reg. (BC), Occupational Therapist
MSc OT (Post Professional) Candidate
School of Occupational Therapy, Dalhousie University
Tel: 778-574-7605 Email: Vanessa.Hanberg@dal.ca

Appendix H: Email Permission from Mall

Vanessa Hanberg

From: PB

Sent: February 1, 2017 10:36 AM

To: vhanberg@rehabilitation.ca

Subject: Research Project at Shopping mall.

Hi Vanessa.

We have approval for you to do the project at the centre with the provision that you get permission from any stores that you plan to visit.

Hope that helps. I will be leaving my position at the end of February. After that you can contact the marketing director who is aware of the project. Her email is [information redacted for privacy].

Thanks.

PB

Appendix I: Request for Permission to Video Record in Store for Master's Thesis Research Study

April XX, 2017

Lead researcher:

Vanessa Hanberg, O.T. Reg. (BC)
Masters of Science (Post-Professional Occupational Therapy) Candidate
School of Occupational Therapy Dalhousie University.
Email: Vanessa.Hanberg@dal.ca
Phone: (778)574-7605

Other researchers

Dr. Diane MacKenzie O.T. Reg. (NS)
School of Occupational Therapy Dalhousie University
Email: diane.mackenzie@dal.ca or
Phone: (902)494-2612

Dr. Brenda Merritt O.T. Reg. (NS)
School of Occupational Therapy Dalhousie University
Email: b.merritt@dal.ca or
Phone: (902)494-1213

Dr. Joan Versnel O.T. Reg. (NS)
School of Occupational Therapy Dalhousie University
Email: jversnel@dal.ca or
Phone: (902)494-2601

Introduction

I am a licensed occupational therapist and Masters of Science (post professional occupational therapy) student at Dalhousie University. As part of my graduate program, I will be conducting a research study in a community setting, specifically the Shopping Mall in, British Columbia, Canada. I have explained my request and the steps I will take to protect the privacy and confidentiality of those in the mall at the time I complete the research study to the administration of the Shopping Mall. The mall administration has given me permission to complete the research study if I contact each store separately for their permission. I am seeking approval from your store at the Shopping Mall to record the research participants who may enter as part of my research study. Specific details of the study are provided below.

For the study, research participants will complete a standardized assessment called the Multiple Errands Test. The test requires research participants to choose where they purchase a list of items within a shopping mall environment. Given the list of items, there is a high probability participants will enter your store to purchase items. As part of the research methodology, I plan to record each research participant while they complete the tasks in the mall so that I can complete a detailed analysis of the Multiple Errands Test.

There is the potential that other people including cashiers and other customers may be unintentionally videotaped within your store. In order to respect their privacy and confidentiality, recordings will be edited and measures taken to obscure any identifying features (e.g., faces, nametags). For the privacy and confidentiality of the research participants, or others in the recording, the recordings will not be distributed beyond the research team (noted above) or used beyond research/educational purposes.

I am requesting that you provide written permission to record my research participants in your Shopping Mall location as outlined above. I will remain in contact with your store manager at the Shopping Mall location and provide further details regarding the dates this research study will be completed.

Thank you for taking the time to consider the request. Your response to my request can be sent to my email listed below. Should you have any questions regarding this request, please contact me by phone (778) 574-7605 or by email (Vanessa.Hanberg@dal.ca).

Sincerely,

Vanessa Hanberg OT Reg. (BC), Occupational Therapist
MSc OT (Post Professional) Candidate
School of Occupational Therapy
Dalhousie University
778-574-7605
Vanessa.Hanberg@dal.ca

Appendix J: Email Permission

Vanessa Hanberg

From: LB

Sent: June 1, 2017 5:42 PM

To: vhanberg@gmail.com

Subject: RE: facility booking request form

Hi Vanessa,

It's my pleasure to help you! You would definitely be granted permission – there's nothing in what you described that would prevent you from using our centre for your study.

Regarding the month in advance – that is not a rule, per se. It's more for your information and recommending that you book early, as we do get a lot of requests. If the space is available, you are welcome to book a few days in advance. I would suggest MP 206, as it's our smallest and least expensive room.

Kind regards,

LB

[Information redacted for privacy]

From: vhanberg@gmail.com [mailto:vhanberg@gmail.com]

Sent: June-01-17 10:15 AM

To: LB

Subject: RE: facility booking request form

Hi Lori,

Thanks for this information. I am not quite yet ready to book the meeting room but I see I need to book a month in advance.

I am an occupational therapist and I will be using the meeting room to conduct a 1 hour focus group for my master's thesis. The focus group will consist of approx. 8 teens and young adults. My research study has been reviewed by Dalhousie University Ethics Review Board and they have asked that I obtain permission from the community centre to use the space for research purposes (i.e. conducting the focus group). The focus group will not be open to the public and the focus group is not advertised per se but there will be posters about the focus group at several locations in the area and interested participants will contact me to be a part of the focus group. I will serve some Timbits/light refreshments for those who attend.

Please let me know if you need further information from me and please respond indicating if I have permission to use the community centre for this focus group.

Thanks again,

Vanessa Hanberg

Appendix K: (Focus Group) Informed Consent

INFORMED CONSENT LETTER

Project title: The Face Validity of the Multiple Errands Test (MET) used with youth in a community setting.

Lead researcher:

Vanessa Hanberg, O.T. Reg. (BC)
Masters of Science (Post-Professional Occupational Therapy) Candidate
School of Occupational Therapy Dalhousie University.
Vanessa.Hanberg@dal.ca (778)574-7605

Other researchers

Dr. Diane MacKenzie, O.T. Reg. (NS)
School of Occupational Therapy Dalhousie University
Email: diane.mackenzie@dal.ca or
Phone: (902)494-2612

Dr. Brenda Merritt O.T. Reg. (NS)
School of Occupational Therapy Dalhousie University
Email: b.merritt@dal.ca or
Phone: (902)494-1213

Dr. Joan Versnel O.T. Reg. (NS)
School of Occupational Therapy Dalhousie University
Email: jversnel@dal.ca or
Phone: (902)494-2601

Introduction

You are invited to take part in a focus group as part of a research study being conducted by Vanessa Hanberg, OT, a graduate student at Dalhousie University as part of her Masters of Science (post professional occupational therapy) degree at Dalhousie University.

The purpose of this letter is to provide you with information on the focus group and provide information on any possible risks or benefits. Participation in this focus group is voluntary and if you have any questions about this focus group, please do not hesitate to contact Vanessa Hanberg. Contact details are provided below.

The risks to you for participation in this focus group are minimal. The information below tells you about what is involved in the research, what you will be asked to do and about any benefit, risk, inconvenience or discomfort that you might experience.

Purpose and Outline of the Focus Group

The purpose of the focus group is to get your perspective on an assessment called the Multiple Errands Test (MET). The MET is a real life situation assessment used by occupational therapists. The test aims to identify cognitive abilities which require complex brain function known as executive function. These brain functions are used in everyday life and are needed during activities that are new, complicated and unstructured. Examples of real life complicated activities could include completing a major school project, or starting a new job. These brain functions are still developing in your late teens and early 20's, and are needed more as teenagers become young adults.

For the focus group you will not be doing the assessment, instead I will review the assessment with you as a group and then ask you to answer some questions about the assessment in a group discussion. I want to learn about what adolescents and young adults think of the MET assessment and the items that make up the assessment. If the group proposes any changes to the assessment the group will then come to an agreement on the most important changes.

It is hoped that the information obtained from this focus group will assist in making the MET assessment appropriate to use with youth in a community setting.

Who Can Take Part in the Focus Group

You may participate in this study if you are between the ages of 16-24 years old. You also need to be living in the community with family, alone or in shared accommodations. You need to be able to read, understand and speak English and be comfortable with talking in a group discussion. You need to have at least some experience with shopping in a mall setting and no history of brain injury or neurological disorder including Attention Deficit Hyperactivity Disorder (ADHD). You will be contacted by email prior to the focus group to confirm your eligibility and participation.

What You Will Be Asked to Do

Once your eligibility to participate in the focus group has been determined, you will be invited to attend the 1 hour focus group meeting at the Community Centre in [information redacted for confidentiality] British Columbia. You will be asked to read and sign this consent form and bring it to the assessment. The focus group will be audio recorded.

Possible Benefits, Risks and Discomforts

The risks for this focus group are minimal. You may also not benefit personally from your participation in this focus group. If during the focus group you are feeling uncomfortable, or if participation in the group discussion is bothersome, you can leave the focus group session at any time. The information gained from this focus group may contribute to increased knowledge and understanding of the impact of executive functioning on everyday life for adolescents and young adults who live in the community.

Compensation / Reimbursement

For those who participate in the focus group, refreshments will be provided and you will receive a \$10 gift card for participation.

How your information will be protected:

After completing the consent form participants will be assigned an identification number. A list of participants' names, their demographic information and assigned codes will be known only to the lead researcher. This data will be securely stored electronically on the principal investigators' personal computer that is protected with encryption. Signed consent forms will be securely stored in a locked filing cabinet in the principal investigator, Vanessa Hanberg's office (in BC). Participants will be audio recorded and the recording will be encrypted and securely stored on the principal investigators' personal computer. What is said on the audio recording will be written out word for word in a transcript. Participants' codes will be used on the transcript and this is the only way participants will be identified on the transcript. The transcripts will be stored by the lead researcher on a computer that is protected by encryption. When the transcript is shared with another researcher they will only see the coded transcript.

Your identity will not be revealed when the data from this research is reported. If a direct quote is used in a publication or for educational purposes you will be identified as Group member 1, 2, 3, etc.. The research materials including audio-recordings, transcripts and consent forms will be destroyed at the completion of the study. While the researcher will keep data confidential there is no guarantee that other participants in the focus group will maintain confidentiality.

If You Decide to Stop Participating

Participation in this focus group is completely voluntary and you can choose to not participate in the focus group. You can withdraw from the focus group at any point. If you decide to stop participating at any point in the focus group, you can also decide whether you want any of the information that you have contributed up to that point to be removed or if you will allow us to use that information. You can decide for up to two weeks after your participation if you want us to remove your data. After that time, your data will not be able to be removed from the study due to the analysis process.

How to Obtain Results

We will provide you with a summary of the results when the study is finished if requested.

Questions

Please contact Vanessa Hanberg at (778) 574-7605, Vanessa.Hanberg@dal.ca at any time with questions, comments, or concerns about the focus group and the research study.

If you have any ethical concerns about your participation in this research, you may also contact Research Ethics, Dalhousie University at (902) 494-1462, or email: ethics@dal.ca

Appendix K: (Focus Group) Informed Consent

WRITTEN INFORMED CONSENT

Title of Research Study: The Face Validity of the Multiple Errands Test (MET) used with youth in a community setting.

Lead researcher:

Vanessa Hanberg, O.T. Reg. (BC)
Masters of Science (Post-Professional Occupational Therapy) Candidate
School of Occupational Therapy Dalhousie University.
Vanessa.Hanberg@dal.ca (778)574-7605

I have read the explanation about this study. I have been given the opportunity to discuss it and my questions have been answered to my satisfaction by Vanessa Hanberg. I understand that I have been asked to take part in responding to 2-3 emails, and a focus group that will be audio recorded. I agree to take part in this study. I realize that my participation is voluntary and that I am free to withdraw from the study at any time, until two weeks after the focus group is completed.

I understand that this study has been reviewed by, and has received ethics approval through the office of Human Research Ethics Administration at Dalhousie University. If I have any concerns or comments as a result of my participation in this study I may contact Catherine Connors, Director of Human Research Ethics Administration, at (902)494-1462.

I agree that my contribution to the focus group, including direct quotations, may be used without identifying me.

Yes No

I agree that researchers can contact me about related research projects in the future.

Yes No

Participant Name (please print)

Participant Signature

Date

I would like to receive a summary of the results.

Yes No

Please forward to me by email: _____

Please forward to me by post: _____

Appendix L: (yMET Group) Informed Consent

INFORMED CONSENT LETTER

Project title: The Face Validity of the Multiple Errands Test (MET) used with youth in a community setting.

Lead researcher:

Vanessa Hanberg, O.T. Reg. (BC)
Masters of Science (Post-Professional Occupational Therapy) Candidate
School of Occupational Therapy Dalhousie University.
Vanessa.Hanberg@dal.ca (778)574-7605

Other researchers

Dr. Diane MacKenzie, O.T. Reg. (NS)
School of Occupational Therapy Dalhousie University
Email: diane.mackenzie@dal.ca or
Phone: (902)494-2612

Dr. Brenda Merritt O.T. Reg. (NS)
School of Occupational Therapy Dalhousie University
Email: b.merritt@dal.ca or
Phone: (902)494-1213

Dr. Joan Versnel O.T. Reg. (NS)
School of Occupational Therapy Dalhousie University
Email: jversnel@dal.ca or
Phone: (902)494-2601

Introduction

You are invited to take part in a research study being conducted by Vanessa Hanberg, OT, a graduate student at Dalhousie University as part of her Masters of Science (post professional occupational therapy) degree at Dalhousie University.

The purpose of this letter is to provide you with information on the study and provide information on any possible risks or benefits.

Participation in this study is voluntary and if you have any questions about this study, please do not hesitate to contact Vanessa Hanberg. Contact details are provided below.

The risks to you for participation in this study are minimal. The information below tells you about what is involved in the research, what you will be asked to do and about any benefit, risk, inconvenience or discomfort that you might experience.

Purpose and Outline of the Pilot Study

The purpose of this study is to find out more about how youth do on an assessment called the Multiple Errands Test (MET). The MET is a real life situation assessment used by occupational therapists. The test aims to identify cognitive abilities which require complex brain function known as executive function. These brain functions are used in everyday life and are needed during activities that are new, complicated and unstructured. Examples of real life complicated activities could include completing a major school project, or starting a new job. These brain functions are still developing in your late teens and early 20's, and are needed more as teenagers become young adults.

It is hoped that the information obtained from this pilot study will provide preliminary information about how youth, aged 16-24, do on the assessment and will contribute to the knowledge of other occupational therapists and health professionals who work in this area.

Who Can Take Part in the Research Study

You may participate in this study if you are between the ages of 16-24 years old. You also need to be living in the community with family, alone or in shared accommodations. You need to be able to read, understand and speak English, and able to walk or independently use a wheelchair/other ambulatory aid for about half an hour. You need to have at least some experience with shopping in a mall setting and no history of brain injury or neurological disorder including Attention Deficit Hyperactivity Disorder (ADHD). You will be contacted by email prior to the focus group to confirm your eligibility and participation.

What You Will Be Asked to Do

Once your eligibility to participate in the study has been determined, you will be invited to participate in an assessment for 40-60 minute with the lead researcher at the [information redacted for privacy/confidentiality] Shopping Mall in British Columbia. You will be asked to read and sign this consent form and bring it to the assessment. The assessment will take place based on your availability and you will be given some choice to arrange the specific assessment time. Once you decide on an assessment timeslot, email the date and time to the lead researcher. You will need to arrange your own transportation to and from the Shopping Mall.

For the assessment you will be given a small amount of money by the lead researcher to purchase 6 items and you will be asked to find out 4 pieces of information and follow a set of rules while completing the shopping activity. The researcher will be following you while you complete the assessment to observe and record your performance. The money is intended for the assessment and any money not spent will be returned to the researcher. If you run out of money during the assessment you will not be provided with more and

you are not required to spend your own money. While you will not be reimbursed to participate in this assessment you may choose to keep any of the items you purchase as part of the assessment but you are not required to keep the items and can give them to the researcher at the conclusion of the assessment. After completing the MET you will also be asked about your experience while completing the assessment.

Possible Benefits, Risks and Discomforts

The risks for this study are minimal. You may also not benefit personally from your participation in this study. If during the assessment, you are feeling uncomfortable, or if the requirements of the assessment are particularly bothersome you can stop the assessment at any time. The information gained from this study may contribute to increased knowledge and understanding of real-world executive functioning in adolescents and young adults.

Compensation / Reimbursement

In appreciation for your participation in this study, you will be given a \$20 gift card.

How your information will be protected:

After completing the informed consent signature page participants will be assigned an identification number. A list of participants' names, their demographic information and assigned codes will be known only to the lead researcher. This data will be securely stored electronically on the principal investigators' personal computer that is protected with encryption. Signed consent forms will be securely stored in a locked filing cabinet in the principal investigator, Vanessa Hanberg's office (in BC). The instructions you are provided with for the assessment and any notes you take will be assigned the identification number and stored in the locked cabinet at the lead researcher's office. Your performance on the assessment will be scored and saved securely on the lead researchers' computer and the comments you provide of your experience while completing the assessment will be transcribed and saved securely on the lead researchers' computer.

Your identity will not be revealed when the data from this research is shared with the research team or reported. No one will have direct access to your data except for Vanessa Hanberg. The research materials including what you write down, scoring and consent forms will be destroyed at the completion of the study.

If You Decide to Stop Participating

Participation in this study is completely voluntary and you can choose to not participate in the study. You can withdraw from the study at any point. If you decide to stop participating at any point in the study, you can also decide whether you want any of the information that you have contributed up to that point to be removed or if you will allow us to use that information. You can also decide for up to one month after your

participation if you want us to remove your data. After that time, your data will not be able to be removed from the study due to the analysis process.

How to Obtain Results

We will provide you with a summary of the results when the study is finished if requested.

Questions

Please contact Vanessa Hanberg at (778) 574-7605, Vanessa.Hanberg@dal.ca at any time with questions, comments, or concerns about the research study.

If you have any ethical concerns about your participation in this research, you may also contact Research Ethics, Dalhousie University at (902) 494-1462, or email: ethics@dal.ca

Appendix L: (yMET Group)

WRITTEN INFORMED CONSENT

Title of Research Study: The Face Validity of the Multiple Errands Test (MET) used with youth in a community setting.

Lead researcher:

Vanessa Hanberg, O.T. Reg. (BC)
Masters of Science (Post-Professional Occupational Therapy) Candidate
School of Occupational Therapy Dalhousie University.
Vanessa.Hanberg@dal.ca (778)574-7605

I have read the explanation about this study. I have been given the opportunity to discuss it and my questions have been answered to my satisfaction by Vanessa Hanberg. I understand that I have been asked to take part in responding to 2-3 emails, and an assessment at a shopping mall. I agree to take part in this study. I realize that my participation is voluntary and that I am free to withdraw from the study at any time, until one month after my assessment is completed.

I understand that this study has been reviewed by, and has received ethics approval through the office of Human Research Ethics Administration at Dalhousie University. If I have any concerns or comments as a result of my participation in this study I may contact Catherine Connors, Director of Human Research Ethics Administration, at (902)494-1462.

I agree that my performance on the assessment will be used without identifying me
Yes No

I consent to the use of my performance on the assessment in a presentation for educational or research purposes provided that I am not identified in any way.
Yes No

I agree that researchers can contact me about related research projects in the future.
Yes No

Participant Name (please print) Participant Signature Date _____

I would like to receive a summary of the results.
Yes No

Please forward to me by email: _____
Please forward to me by post: _____

Appendix M: yMET Instructions

In this exercise I want you to complete the following three tasks:

4) You should buy the following items:

Loaf of whole wheat bread	chocolate bar
Package of band aids	single light bulb
Birthday card	key ring

5) You should obtain the following information and write it down in the spaces below:

5) What is the sale at Old Navy (what is on sale and what is the sale amount)?

6) _____
What is the closing time of the Mall on Saturday?

7) _____
What is the price of 1 pound or kilogram of tomatoes?

8) _____
How many cell phone providers are in the Mall?

6) Meet me at the Mall Directory, 20 minutes after you have started the task and tell me the time.

While carrying out this exercise you must follow these rules:

- You must carry out all these tasks but may do so in any order
- You should spend no more than \$17
- You should stay within the limits of the mall and do not exit the mall to the outdoors
- No store should be entered other than to complete the tasks
- You should not go back into a shop you have already been in
- You should not use your cell phone more than two times to search for information
- You should buy no more than 2 items from the Dollar Store
- Take as little time to complete this exercise without rushing excessively
- Do not speak to the person observing you unless this is part of the exercise

TELL THE PERSON OBSERVING YOU WHEN YOU HAVE COMPLETED THE EXERCISE

These written instructions are provided for you and I will also read the following instructions:

“In this exercise I want you to complete three tasks. The tasks are: to buy the six items listed on this sheet (examiner to indicate and describe items on sheet); to obtain and write down four pieces of information (examiner to indicate and describe items on sheet); and to meet me at the Mall directory, 20 minutes after I have said “...begin the exercise” and tell me the time. You can then continue the exercise.

However, while completing this exercise you must follow the rules listed on your instruction sheet (examiner to indicate and describe rules on sheet).

You must carry out all of these tasks but you can do so in any order. You should spend no more than \$17 although I’ve given you \$20. You should stay within the limits of the Mall. This means you must not exit the Mall to go outdoors. No store should be entered other than to complete the tasks. Do not go into a store unless you have the intention to buy a task item or find information needed for the task. You should not use your cell phone more than two times to search for information. You can use your cell phone to look at the time. You should not go back into a store you have already been in. You should buy no more than two items from the Dollar Store. Take as little time as possible to complete this exercise without rushing excessively. During this exercise I will be following you from a distance and observing what you are doing. Please do not speak to me unless this is part of the exercise.

Finally, approach me and tell me when you have completed the exercise.

Is that clear? Do you have any questions?

Now tell me what you must do.

“Begin the exercise.”

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