

THE ENDOWMENT EFFECT IN YOUTH WITH HOARDING SYMPTOMS

A HIGHER ENDOWMENT EFFECT IN CHILDREN AND ADOLESCENTS WITH
OCD AND HOARDING SYMPTOMS

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A Thesis Submitted to the School of Graduate Studies in Partial Fulfillment of the
Requirements for the Degree of Master of Science

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McMaster University MASTER OF SCIENCE (2016) Hamilton, Ontario (Neuroscience)

TITLE: A Higher Endowment Effect in Children and Adolescents with OCD and
Hoarding Symptoms AUTHOR: Rebecca Wetzel, B.Sc. (McMaster University)

SUPERVISOR: Dr. N. Soreni NUMBER OF PAGES: xiii, 56

Abstract

Hoarding is characterized by (a) the persistent difficulty discarding personal items; (b) clutter that interferes with living areas; and (c) significant distress or functional impairment. Hoarding symptoms often emerge in childhood and adolescence, yet very few studies on hoarding in this age group exist. Current models of hoarding emphasize impairments in decision-making, yet the literature on decision-making processes in hoarding presents inconsistent findings. Preliminary cognitive studies in adults suggest that hoarding may be associated with deficits in value attribution (the tendency to assign value to personal items). Thus, we propose that the Endowment Effect (EE), in which ownership of an item increases its perceived value, may be informative for the study of hoarding symptoms. This study investigated the EE in youth (children and adolescents) with Obsessive-Compulsive Disorder (OCD) and hoarding symptoms. Given that hoarding involves significant difficulty discarding personal items, we hypothesized that hoarding in youth is associated with a higher EE.

Thirty youth participants with a confirmed DSM-5 diagnosis of OCD completed the Endowment Task, a game script of the EE; the Wisconsin Card Sorting Test (WCST), a test of cognitive flexibility; and the Balloon-Analogue Risk Task (BART), a test of risky decision-making. The Children's Saving Inventory-Parent Version (CSI) was used to measure severity of hoarding symptoms. We divided our sample into thirds based on CSI scores to create a 'High Hoarding' group (HH; $n=12$; mean CSI (S.D.)=30.83 (5.47446)) and a 'Low Hoarding' group (LH; $n=10$; mean CSI (S.D.)=5.00 (3.16228)).

The HH group demonstrated a higher average EE than the LH group (average EE, 3.22 and 1.59, respectively). In contrast, no significant between-group differences were found on the WCST and the BART ($t=0.901$, $p=0.378$ and $t=0.338$, $p=0.739$, respectively). The results of this thesis suggest that psychological ownership plays an important role in the manifestation of hoarding symptoms. Thus, we propose that hoarding might be associated with a specific decision-making deficit related to personal possessions.

Acknowledgements

I would like to thank my mentor and supervisor, Dr. Noam Soreni, for providing me the incredible opportunity to be his student and for his patience, support, and guidance throughout my masters. His dedication to research and his clinical expertise and compassion in working with youth has greatly influenced my future career aspirations.

I would like to offer my sincere thanks and appreciation to my supervisory committee members, Dr. Geoffrey Hall and Dr. Randi McCabe. Their knowledge and commitment to research is very inspiring and their feedback and guidance were instrumental in shaping this study. Dr. Hall and I also worked together to create a neuroimaging paradigm of the Endowment Task. Despite his many academic and professional commitments, Dr. Hall always made time to work on this project. This paradigm will be critical in studying the underlying neural mechanisms associated with hoarding symptoms in youth.

I would like to express my heartfelt gratitude to the staff and volunteers at the Anxiety Treatment & Research Centre (ATRC), St. Joseph's Healthcare Hamilton, for their encouragement and support. I would like to thank Dora Fuciarelli for her administrative assistance, Anna Maria Catanzaro for her help with recruitment, and Olivia Merritt for her help with the OCD database.

I am appreciative to the faculty, staff, and students in the MiNDS Neuroscience Graduate Program at McMaster University. I really enjoyed the MiNDS program's collaborative and interdisciplinary research environment. This program provided me with

the opportunity to enhance my knowledge base and skills in conducting and utilizing collaborative research.

Finally, I am profoundly grateful to my parents, Doreen and William, and my sister, Olivia, for their understanding, encouragement, patience, enthusiasm and unwavering support. I truly have the greatest support system in the world and their belief in me has pushed me farther than I thought I could go.

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List of Abbreviations

ADHD	Attention-Deficit/Hyperactivity Disorder
BART	Balloon Analogue Risk Task
CBT	Cognitive-Behavioural Therapy
CGT	Cambridge Gambling Task
CDI	Children's Depression Inventory
CSI	Children's Saving Inventory
CY-BOCS	Children's Yale-Brown Obsessive-Compulsive Scale
DSM-4-TR	Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision
DSM-5	Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition
EB	Endowment Boost
EE	Endowment Effect
FIS	Frost Indecisiveness Scale
GAD	Generalized Anxiety Disorder
HD	Hoarding Disorder
HH	High Hoarding Group
IGT	Iowa Gambling Task
KSADS-P	Kiddie Schedule for Affective Disorders and Schizophrenia for School-Age Children-Present State Interview
LH	Low Hoarding Group
MDD	Major Depressive Disorder
OCD	Obsessive-Compulsive Disorder
OCPD	Obsessive-Compulsive Personality Disorder
SRI	Serotonin Reuptake Inhibitor
WCST	Wisconsin Card Sorting Test
WTA	Willingness to Accept (consumers' selling prices)
WTP	Willingness to Pay (consumers' buying prices)

Declaration of Academic Achievement and Contributors

This thesis consists of four sections. Section 1 provides pertinent background information and provides an overview of the current study. Section 2 presents an overview of the study design, the procedures and measures used, and describes the statistical analyses conducted for the study. Section 3 describes our findings and Section 4 discusses the results, their implications, the strengths and limitations of the study, and also provides recommendations for future research.

This work was conducted at the Anxiety Treatment & Research Centre (ATRC), St. Joseph's Healthcare Hamilton under the primary supervision of Dr. Noam Soreni and was approved by the Hamilton Integrated Research Ethics Board (HiREB). Dr. Geoffrey Hall and Dr. Randi McCabe offered secondary supervision of the study's progress. Participants were recruited from the pediatric Obsessive-Compulsive Disorders outpatient clinic at the ATRC.

Dr. Noam Soreni and myself conceived the research questions for this study. I would like to acknowledge Anna Maria Catanzaro for helping with participant recruitment, Dr. Geoffrey Hall for helping to create a neuroimaging version of the Endowment Task, Olivia Merritt for her help with the clinic's OCD database, and Dr. Noam Soreni for his vigilant support and supervision. Experimental design and protocol, participant recruitment, study visits, neuropsychological testing, data collection, creation of a database, data analysis and interpretation of the results were all conducted by my self (under the supervision of Dr. Soreni) in fulfillment of my thesis requirements. I have also

been involved in the creation and testing of a neuroimaging paradigm of the Endowment Task.

I have presented the study at the following academic conferences: Current Research in Engineering, Science and Technology (CREST) 2015 McMaster University; Faculty of Health Sciences (FHS) Research Plenary 2015 McMaster University; Department of Psychiatry and Behavioural Neurosciences Research Day 2015 & 2016 McMaster University; and the Anxiety and Depression Association of America (ADAA) Annual Conference 2016. An article based on this thesis is under review.

1. INTRODUCTION

1.1 Hoarding Symptoms

1.1.1 Overview and Impact of Hoarding Symptoms

The latest (5th) edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5; American Psychiatric Association, 2013) is the first to recognize Hoarding Disorder (HD) as a distinct form of psychopathology (see Appendix A for DSM-5 criteria of HD). Hoarding is characterized by extreme difficulty discarding or parting with possessions, resulting in clutter, as well as distress or functional impairment (American Psychiatric Association, 2013b; Frost, Steketee, & Tolin, 2011). Hoarding is a multifaceted problem that involves a discrete constellation of symptoms (Frost & Hartl, 1996; Timpano, Shaw, Coughle, & Fitch, 2014). Even before the introduction of the DSM-5, research suggested that hoarding symptoms (difficulty discarding and clutter) were common, with an estimated prevalence in adult samples of 2 to 6% (Frost et al., 2011; Iervolino et al., 2009; Samuels et al., 2008; Steketee & Frost, 2014). Hoarding symptoms are a serious clinical challenge and further research is needed to better understand the etiological and maintaining processes that could, in turn, inform intervention efforts (Muroff, Bratiliotis, & Steketee, 2011; Saxena & Maidment, 2004; Timpano et al., 2014).

Hoarding is associated with significant health and safety concerns for the individual, household residents, and the community at large (Pertusa et al., 2010). The resulting cluttered home environment increases risk of fire, injury from falling, violation of local health, housing, and sanitation laws, eviction, and substantial cost to the individual and community (Frost et al., 2011; Frost, Steketee, & Williams, 2000; Tolin,

Frost, Steketee, Gray, & Fitch, 2008). For afflicted individuals, hoarding is associated with significant disability and functional impairment (Saxena et al., 2011). Individuals with hoarding symptoms report lower quality of life and lower levels of satisfaction with their safety (Saxena et al., 2011). Furthermore, hoarding symptoms are associated with experiencing negative emotions more intensely (Timpano et al., 2014), high rates of psychiatric comorbidity (Frost et al., 2011), and impairments in activities of daily living (Frost, Hristova, Steketee, & Tolin, 2013). In one study, hoarding was associated with an average of 7 work impairment days during a given one-month period, which is the same as that reported by individuals with psychotic disorders and significantly greater than that reported by women with anxiety, mood, and substance abuse disorders (Tolin, Frost, Steketee, Gray, et al., 2008). In addition, individuals with hoarding symptoms were significantly more likely to report a wide range of chronic and severe medical conditions and utilized mental health services at five times the rate among women with anxiety, mood, and substance abuse disorders (Tolin, Frost, Steketee, Gray, et al., 2008). In the same study, nearly 8% of the participants with hoarding symptoms, and 12% of family members reported having been evicted or threatened with eviction because of hoarding (Tolin, Frost, Steketee, Gray, et al., 2008).

The consequences of hoarding extend beyond the afflicted individual to their families and friends. The study by Tolin et al. (2008) also found that 0.1% - 3.0% of individuals with hoarding symptoms had a child or elder removed from the home. Another study reported that, during childhood, living with a family member who hoards was associated with elevated reports of childhood distress and familial strain (Tolin,

Frost, Steketee, & Fitch, 2008). Furthermore, family member ‘rejecting attitudes’ toward the individual with hoarding symptoms was predicted by severity of hoarding symptoms, the individual’s lack of insight into their behaviour, and having lived in a cluttered home during childhood (Tolin, Frost, Steketee, & Fitch, 2008). In addition, an Internet survey completed by healthcare or service professionals indicated that when working with hoarding clients, professionals reported high levels of frustration and irritation, poorer working alliances, and greater patient rejection attitudes than when working with non-hoarding clients (Tolin, Frost, & Steketee, 2012).

Hoarding is also associated with significant costs to the community and society as a whole. In San Francisco, hoarding-related expenses cost landlords and service providers over \$6.4 million in 2009 (Yosef & Lyons, 2009). A survey of Massachusetts Board of Health officers found that 64% of the officers reported at least one hoarding complaint during the five-year study period (Frost, Steketee, & Williams, 2000). Unsanitary conditions and the accumulation of junk were cited as the reason for complaints in 88% of cases, while fire hazards were cited in 67% of complaints (Frost, Steketee, & Williams, 2000). Furthermore, in three cases during the study period, hoarding directly contributed to the death of an individual in a house fire (Frost, Steketee, & Williams, 2000).

Evidently, hoarding is a relatively prevalent and costly problem with negative consequences to the afflicted individual, that individual’s family and friends, and society at large.

1.1.2 Comorbidity of Hoarding Symptoms

Hoarding symptoms are associated with high rates of psychiatric comorbidity; the most common comorbid conditions being depressive disorders, attention deficit/hyperactivity disorder (ADHD), and anxiety disorders (Frost et al., 2011; Wheaton, Timpano, LaSalle-Ricci, & Murphy, 2008).

Major Depressive Disorder (MDD) appears to be a highly comorbid condition. One study found that 50.7% of individuals with HD also met criteria for MDD (Frost et al., 2011). Comorbidity with depressive disorders in general is also very high (Coles, Frost, Heimberg, & Steketee, 2003; Wheaton et al., 2008). For example, Wheaton et al. (2008) found that women with hoarding symptoms were significantly more likely to suffer from bipolar I disorder than women without hoarding symptoms.

ADHD also appears to be highly comorbid with hoarding symptoms. Frost et al. (2011) reported that 27.8% of HD participants met criteria for the inattentive subtype of ADHD. One study that investigated ADHD prevalence rates in a sample of individuals with childhood-onset OCD found that, of participants with ADHD, 42% met criteria for hoarding symptoms (Sheppard et al., 2010). Another study found that 29% of children with ADHD experienced hoarding symptoms, which is similar to the frequency of hoarding symptoms in pediatric OCD samples (Hacker et al., 2012).

Anxiety disorders are also common among individuals with hoarding symptoms. In a sample of individuals with anxiety disorders (panic disorder, specific phobia, social phobia, obsessive-compulsive disorder, and generalized anxiety disorder), 12 – 25% reported significant hoarding symptoms (Tolin, Meunier, Frost, & Steketee, 2011).

Participants diagnosed with Generalized Anxiety Disorder (GAD) and Obsessive-Compulsive Disorder (OCD) were the most likely to report significant hoarding symptoms (Tolin, Meunier, et al., 2011). In fact, comorbidity rates of GAD range from 23.8% (Tolin, Meunier, et al., 2011) to 42% (Samuels et al., 2007).

Hoarding symptoms are highly associated with Obsessive-Compulsive Personality Disorder (OCPD; Wheaton & Van Meter, 2014). For example, Samuels et al. (2002) found that 45% of participants with hoarding symptoms were diagnosed with OCPD. Furthermore, hoarding symptoms frequently occur in OCD (Frost et al., 2011; Frost, Steketee, Williams, & Warren, 2000; Samuels et al., 2002). Among samples recruited from patient populations, 37.5% to 56.7% of individuals with hoarding symptoms also have a comorbid diagnosis of OCD (Pertusa et al., 2008; Tolin, Meunier, et al., 2011). Moreover, there is evidence that the presence of hoarding symptoms in patients with OCD is a marker of poor prognosis (Frost, Steketee, Williams, et al., 2000; Samuels et al., 2002). Samuels et al. (2002) reported that, compared to non-hoarding OCD individuals, those with OCD and hoarding symptoms had an earlier age at onset of, and more severe, obsessive-compulsive symptoms and also had a greater prevalence of social phobia, personality disorders, and pathological grooming behaviours (i.e., skin picking, nail biting, and trichotillomania) (Samuels et al., 2002). A different study reported that compared to non-hoarding OCD individuals, those with OCD and hoarding symptoms not only had more severe illness, but also were more likely to have poorer insight, difficulty initiating or completing tasks, and indecision (Samuels et al., 2007). Furthermore, in a study of pediatric OCD, authors reported that 25% of the sample had hoarding symptoms,

and as a group, the hoarding participants had an earlier age of onset, more severe symptoms of OCD, a greater prevalence of comorbid disorders (i.e., Tourette disorder, social phobia, specific phobia, panic disorder), poorer insight, more difficulty making decisions and completing tasks, and more overall impairment (Samuels et al., 2014). Storch et al. (2007) reported that, relative to non-hoarding OCD youth, youth with OCD and hoarding symptoms had more magical thinking obsessions, more ordering/arranging compulsions, higher levels of anxiety, aggression, and somatic complaints, and overall externalizing and internalizing symptoms. Clearly, hoarding in both adults and youth is a phenomenon that demands both research and clinical attention.

1.1.3 Treatment of Hoarding Symptoms

Psychotropic medication therapy and Cognitive-Behavioural Therapy (CBT) are the two primary forms of treatment for hoarding symptoms. Psychotropic medications for individuals diagnosed with OCD and hoarding symptoms have most often included serotonin reuptake inhibitor (SRI) medications (Saxena & Maidment, 2004). Several studies investigating the influence of OCD symptom factors on treatment response have found that hoarding symptoms were associated with poorer response to treatment with SRIs (Black et al., 1998; Mataix-Cols, Rauch, Manzo, Jenike, & Baer, 1999; Stein et al., 2008; Winsberg, Cassic, & Koran, 1999). Winsberg et al. (1999) investigated the treatment response of 20 adult OCD patients exhibiting hoarding symptoms and found that only one of the 20 patients treated with a variety of SRIs had a satisfactory response, and 9 patients had no response at all. In an analysis of large-scale, controlled trials of SRI treatment for patients with OCD, higher scores on the hoarding dimension predicted

poorer outcome (Mataix-Cols et al., 1999). Stein et al. (2008) reported that Escitalopram, an antidepressant of the SRI class, showed good efficacy across the range of OCD symptoms dimensions, however, hoarding was associated with a poorer treatment response. The authors suggested that hoarding symptoms might be particularly characteristic of an early onset group of OCD patients (Stein et al., 2008). A study of treatment with an SRI, placebo, or CBT for 38 OCD patients found that individuals who did not respond to either CBT or SRI treatment were significantly more likely to have hoarding symptoms (Black et al., 1998).

CBT for hoarding was developed to treat the following four general types of deficits: information processing, emotional attachment, beliefs about possessions, and behavioural avoidance (Steketee, Frost, Wincze, Greene, & Douglass, 2000). Across several studies, this treatment has produced positive results (Muroff et al., 2009; Steketee, Frost, Tolin, Rasmussen, & Brown, 2010; Steketee et al., 2000; Tolin, Frost, & Steketee, 2007). Frost, Ruby, & Shuer (2013) conducted a wait-list control trial and reported modest declines in difficulty discarding (25%) and clutter (19%), with somewhat larger declines in excessive acquisition (31%). In a study by Tolin et al. (2007), patients with hoarding symptoms received 26 individual sessions of CBT and the authors reported significant decreases in hoarding symptoms from pre- to post-treatment. However, the drop out rate was high—29% of the sample discontinued prematurely (Tolin et al., 2007). Furthermore, the authors noted that hoarding symptoms did not decrease significantly until post-treatment, suggesting that a longer course of treatment might be helpful (Tolin et al., 2007). Thus, this treatment is time and cost intensive, and success appears to be

modest, with most patients remaining fairly symptomatic following the treatment (see Muroff, Bratnott, & Steketee, 2011 for review).

Therefore, supplementary forms of treatment may be beneficial to improve responses for a larger percentage of individuals with hoarding symptoms. Furthermore, negative outcomes are not only present in adults with hoarding symptoms, but in children and adolescents as well (Samuels et al., 2014). Hoarding appears to be a chronic condition: 94% of individuals with hoarding symptoms report a chronic or deteriorating course of symptoms (Tolin, Meunier, Frost, & Steketee, 2010). Thus, if hoarding symptoms are present during childhood and adolescence, they are likely to persist into adulthood. There is a crucial need to develop effective treatments that specifically target hoarding symptoms in youth; however, the literature on hoarding symptoms in youth is very limited.

1.2 Hoarding Symptoms During Childhood and Adolescence

Despite clear evidence that hoarding symptoms often begin in childhood and adolescence (Ayers, Saxena, Golshan, & Wetherell, 2010; Fontenelle, Mendlowicz, Soares, & Versiani, 2004; Grisham, Frost, Steketee, Kim, & Hood, 2006; Tolin, Meunier, et al., 2010), there is a significant gap in research devoted to hoarding symptoms in this age group (Grisham et al., 2006; Morris, Jaffee, Goodwin, & Franklin, 2015). The estimated prevalence of hoarding symptoms in adolescence is 2%, which is similar to that observed in adult samples (Ivanov et al., 2013). In a retrospective study of hoarding symptoms, the majority of adult participants reported that hoarding symptoms began before the age of twenty, with an estimated median age ranging from 11-15 years (Tolin,

Meunier, et al., 2010). A study by Grisham et al. (2006) utilized a retrospective assessment of 51 adults with hoarding symptoms to determine onset of various hoarding symptoms. Participants were first asked to recall two significant life events from each decade and were then asked to rate the severity of collecting/acquiring symptoms, degree of clutter, and difficulty discarding as well as the degree of recognition of a problem at the time of the recalled event. Onset was defined as the time when two mild symptoms or one moderate symptom was present. The authors reported that the mean age of onset of clinical hoarding symptoms was 13.39 years (Grisham et al., 2006). Furthermore, recognition of the hoarding symptoms developed significantly later than any of the symptoms themselves and few participants reported full remission of hoarding symptoms at any point in their lives (Grisham et al., 2006).

Even the presence of mild hoarding symptoms during childhood and adolescence is associated with marked distress and these symptoms often persist into adulthood (Palermo et al., 2011; Tolin, Meunier, et al., 2010). Hoarding symptoms may be mild during childhood and adolescence because parents can restrict the accumulation of clutter (Palermo et al., 2011). Furthermore, hoarding symptoms can become moderate or severe during adulthood, as individuals acquire greater financial and physical independence (Grisham et al., 2006).

Finally, hoarding symptoms are associated with many personal negative outcomes (i.e., increased risk for medical issues, poor sanitation, fire hazard, reduced social functioning etc.; Grisham, Norberg, Williams, Certoma, & Kadib, 2010; Mataix-Cols & Pertusa, 2012). Furthermore, studies have shown that children and adolescents with OCD

and hoarding symptoms had, on average, longer illness duration (Mataix-Cols, Nakatani, Micali, & Heyman, 2008), reduced social functioning (Samuels et al., 2014), poorer insight (Storch et al., 2007), higher levels of anxiety and depression (Storch et al., 2007), and higher rates of comorbid ADHD (Hacker et al., 2012).

Research devoted to hoarding symptoms in pediatric populations is crucial in order to 1) increase understanding about the onset and etiology of symptoms; 2) provide earlier identification of symptoms, which could prevent severe cases of HD in adulthood; 3) improve the functioning of youth who hoard; and 4) develop effective treatments that specifically target hoarding symptoms in youth (Burton, Arnold, & Soreni, 2015; Morris et al., 2015). Furthermore, there is a lack of research investigating information-processing deficits in youth with hoarding symptoms (Morris et al., 2015). Current models of hoarding emphasize information-processing deficits (Frost & Hartl, 1996); however, an absence of information processing impairment in youth could suggest that these deficits are not present before or with onset of symptoms, and therefore may not contribute to hoarding symptoms (Morris et al., 2015).

1.3 The Role of Cognitive Factors in Hoarding

1.3.1 The Cognitive-Behavioural Model of Hoarding

The etiology of hoarding symptoms (i.e. difficulty discarding and clutter) is still unknown. Frost & Hartl (1996) proposed a cognitive-behavioural model of hoarding, which conceptualizes hoarding as a multi-faceted problem arising from: 1) cognitive information processing deficits; 2) flawed beliefs about possessions; 3) difficulties in forming emotional attachments; and 4) behavioural avoidance. This model was originally

based primarily on anecdotal and observational evidence, with limited empirical evidence (Frost & Hartl, 1996). Since Frost and Hartl first introduced the cognitive-behavioural model of hoarding in 1996, newer models view ‘emotional attachment to possessions’ as linked with ‘beliefs about the nature of possessions’ and ‘behavioural avoidance’ is viewed as a mechanism in the relationship between ‘maladaptive beliefs about possessions’ and hoarding symptoms (Gilliam & Tolin, 2010; Steketee & Frost, 2007; Steketee & Frost, 2003). That is, recent models focus on mechanisms of maintenance, including information-processing deficits and maladaptive beliefs about possessions, which in turn result in emotional distress and avoidance behaviours (Gilliam & Tolin, 2010).

Figure 1 shows the cognitive-behavioural model of hoarding adapted from Steketee & Frost (2007). According to the model, a combination of core vulnerabilities (i.e., early life experiences, core beliefs, genetic predisposition, current mood state, personality traits, comorbidity) and cognitive information processing deficits (in the areas of categorization/organization, attention, memory, and decision-making) result in maladaptive beliefs about possessions and highly emotional responses to possessions (Frost & Hartl, 1996; Steketee & Frost, 2007). Resulting negative emotions (i.e., grief, guilt, anxiety/fear) lead to avoidance behaviours (i.e., unwillingness to discard unneeded items) and resulting positive emotions (i.e., pleasure) evoked by possessions lead to saving, excessive acquiring, and clutter (Frost & Hartl, 1996; Steketee & Frost, 2007).

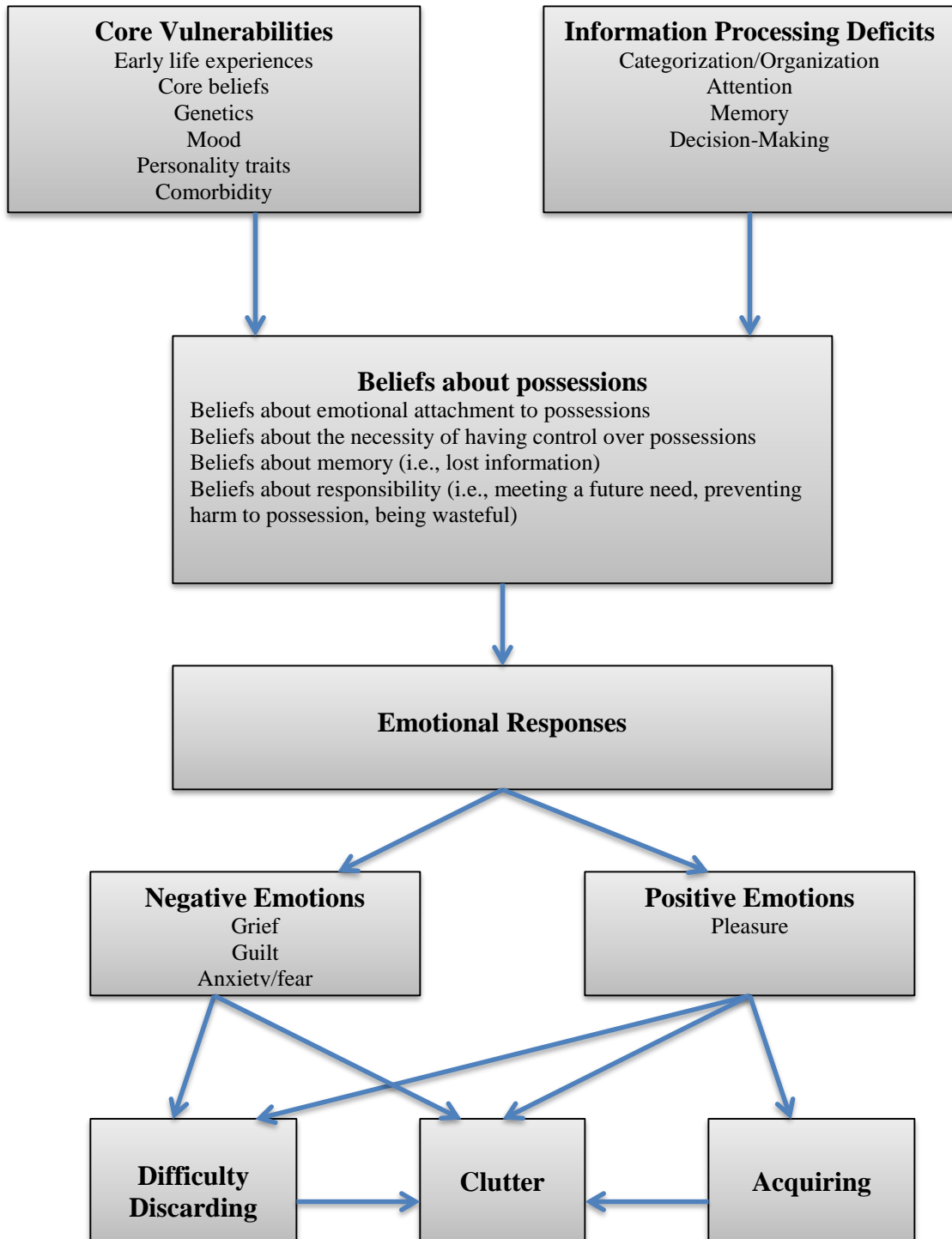


Figure 1. *The Cognitive-Behavioural Model of Hoarding (adapted from Steketee & Frost, 2007)*

Beliefs about possessions fall into four main categories: 1) emotional attachment to possessions (i.e., overestimating the sentimental value of objects, viewing possessions of extensions of oneself, anthropomorphizing possessions); 2) memory concerns (i.e., lack of confidence in memory and overestimation of the importance of remembering information); 3) Responsibility for possessions (i.e., responsibility for being prepared to meet a future need and responsibility to avoid being wasteful); and 4) desire for control over possessions (i.e., exaggerated sensitivity to others touching possessions) (Frost & Hartl, 1996; Gilliam & Tolin, 2010). According to this model, strongly held beliefs about possessions, combined with decision-making deficits, lead individuals to experience significant distress when faced with making decisions about whether to keep or discard possessions, which results in avoidance of discarding (Gilliam & Tolin, 2010).

1.3.2 Decision-Making in Hoarding

Difficulty making decisions has been proposed as a key information-processing deficit of hoarding (Frost & Hartl, 1996). Frost and Hartl (1996) proposed that hoarding is an avoidance behaviour related to indecisiveness; that is, keeping an item may be a way of avoiding decision-making about whether or not to discard it. Indecisiveness is most frequently investigated using the Frost Indecisiveness Scale (FIS; Frost & Shows, 1993), a 15-item self-report questionnaire. Examples of questions include “I try to put off making decisions” and “I always know exactly what I want” (reverse scored). Across four studies, participants with hoarding symptoms reported more indecisiveness than healthy controls (Grisham et al., 2010; Steketee, Frost, & Kyrios, 2003; Tolin & Villavicencio, 2011; Wincze, Steketee, & Frost, 2007). However, across the same four studies,

comparisons between participants with hoarding symptoms and clinical controls (non-hoarding OCD or mood/anxiety disorders) showed notably smaller differences in indecisiveness (Grisham et al., 2010; Steketee et al., 2003; Tolin & Villavicencio, 2011; Wincze et al., 2007; Woody, Kellman-McFarlane, & Welsted, 2014).

In addition to indecisiveness, Frost & Hartl (1996) suggested that perfectionism (i.e., fear of making mistakes), estimates of the instrumental and sentimental values of objects, and beliefs about the consequences of discarding are other aspects of decision-making that contribute to hoarding symptoms. Furthermore, Frost & Hartl (1996) suggested that individuals who hoard might have a higher threshold for deciding what to discard. The decision threshold could involve perceptions of probability of future utility, anticipated consequences of discarding possessions, and self-efficacy for dealing with such consequences (Frost & Hartl, 1996). However, the literature on decision-making processes in hoarding presents inconsistent findings (see Woody, Kellman-McFarlane, & Welsted, 2014 for review).

Typically, decision-making in hoarding is studied using gambling tasks, such as the Iowa Gambling Task (IGT; Bechara, Damasio, Damasio, & Anderson, 1994) or the Cambridge Gambling Task (CBT). The IGT, for example, involves selecting cards from one of four decks in which each card indicates a loss or gain of money. The goal of the game is to win as much money as possible; however, the four decks differ from each other in the number of trials over which the losses are distributed. That is, some decks are ‘disadvantageous decks’, which yield intermittent high rewards but also have higher penalties and thus lead to losses over the long run (Tolin & Villavicencio, 2011). The

participant should gradually learn that two of the decks are ‘disadvantageous’, whereas the other two decks lead to modest but consistent gains. Scoring is based on the difference between the number of cards selected from advantageous and disadvantageous decks (Tolin & Villavicencio, 2011). Gambling tasks involve decision-making while incorporating emotional and cognitive information during risk related situations (Woody et al., 2014). To date, the majority of IGT and CGT studies of hoarding symptoms have found no consistent between-group differences (Blom et al., 2011; Grisham, Brown, Savage, Steketee, & Barlow, 2007; Grisham et al., 2010; Tolin & Villavicencio, 2011) and only one study reported that the presence and severity of hoarding symptoms in OCD is independently negatively associated with IGT performance (Lawrence et al., 2006). Blom et al. (2011) reported that participants with hoarding symptoms and healthy controls showed similar learning progressions on the IGT, whereas OCD participants exhibited slower learning. Grisham et al. (2007) compared participants with OCD and hoarding symptoms to a clinical group (mood or anxiety disorder other than OCD) and a healthy control group. The authors found that all three groups improved their performance over time by selecting more cards from the advantageous decks, with no significant between-group differences (Grisham et al., 2007). Tolin & Villavicencio (2011) compared HD patients, OCD patients, and healthy controls and found that HD patients reported higher indecisiveness on the FIS but the groups did not differ on IGT performance. Similarly, Grisham et al. (2010) found that individuals with hoarding symptoms reported significantly more indecisiveness on the FIS than a healthy control group, but not a clinical control group (current mood or anxiety disorder) but found no

significant between-group differences with respect to performance on the CGT. In the above two studies, participants with hoarding symptoms reported indecisiveness on a self-report questionnaire, but their performance on a decision-making task (IGT and CGT) was unimpaired (Grisham et al., 2010; Tolin & Villavicencio, 2011). This suggests that there may be a discrepancy between perceived and actual decision-making deficits in hoarding (Grisham et al., 2010). It is also possible that individuals with hoarding symptoms have decision-making deficits that are specific to objects of personal relevance, which would not be detected by gambling tasks (Grisham et al., 2010). Given that hoarding is a disorder that revolves around personal possessions (Tolin & Villavicencio, 2011), it is thus possible that decision-making deficits in hoarding are not adequately assessed by risk-related decision-making paradigms.

1.3.3 Making Decisions About Personal Items

Two recent studies (Tolin, Kiehl, Worhunsky, Book, & Maltby, 2009; Tolin et al., 2012) suggested that decision-making deficits in hoarding are specifically associated with discarding or replacing personally owned items. In the Tolin et al. studies (2009 & 2012), adult participants brought their own paper items to the lab (i.e. junk mail) and were scanned while making decisions about whether or not to shred or keep personal paper items as well as control paper items that did not belong to them. Participants with hoarding symptoms, but not healthy controls, took significantly longer to make the decision to shred vs. to keep their own paper items and reported higher anxiety when deciding about their own papers than when deciding about control paper items. The authors reported that the hoarding group showed an abnormal pattern of activity in the

anterior cingulate cortex and insula, which are regions thought to be associated with emotionally significant decision-making. These regions were hypoactive when deciding about control paper items and hyperactive when deciding about their own items. The authors suggested that individuals with hoarding symptoms may have difficulty identifying the emotional significance of a possession and regulating emotional state during decision-making about whether to discard that possession (Tolin et al., 2012).

Another study by Wincze et al. (2007) explored categorization processes in individuals with clinically significant hoarding symptoms, individuals with OCD without hoarding, and healthy controls. The authors found that on tasks sorting common household items, the groups did not differ on the number of piles created nor on the amount of time taken to categorize (not discard) (Wincze et al., 2007). However, on a task sorting personally-relevant items, the hoarding group took more time to categorize, created more piles, and reported more anxiety than the healthy controls and also took more time and created more piles than the OCD group (Wincze et al., 2007). Grisham et al. (2010) also found similar results on a task of categorization. Participants with hoarding symptoms took longer to categorize, created more piles and remained more anxious after categorizing personal items, but not non-personal items, than clinical (Axis I mood or anxiety disorder) and non-clinical controls (Grisham et al., 2010).

In summary, there are preliminary findings of a possible specific decision-making deficit that concerns personally relevant possessions in hoarding. However, the underlying factors for this observed phenomenon remain unknown and there is a lack of

research on decision-making processes in children and adolescents with hoarding symptoms.

1.4 The Behavioural Economics Perspective

Research suggests that cognitive decision-making processes are affected by representation of value (Blakemore & Robbins, 2012). Thus, it is plausible that impaired decision making related to personal items in hoarding is associated with disruptions in the way individuals assign value to, predict future utility levels of, and evaluate experienced outcomes related to items as they make decisions on obtaining, keeping, or discarding items (Sonuga-Barke & Fairchild, 2012). In line with this hypothesis, it may be useful to study hoarding using an approach grounded in Behavioural Economics- a perspective that views the individual as an active agent who assigns value to items based on tastes and preferences, then implements and adjusts plans based on the assignment of value and judgments regarding expected utility of the items (Sonuga-Barke & Fairchild, 2012). The behavioural economics perspective is in stark contrast to the biomedical model, which views the individual as a passive vector of biological factors (i.e. risk genes, pathophysiology; Sonuga-Barke & Fairchild, 2012). Rather, the behavioural economics perspective focuses on personal agency in explanations of abnormal behaviour (Sonuga-Barke & Fairchild, 2012); thus, this perspective allows for consideration of value-attribution during decision-making, a process that seems notably abnormal among individuals with hoarding symptoms (Frost & Hartl, 1996). Indeed, tasks based on behavioural economics may be beneficial to understanding differences in decision-making processes specific to personal items in hoarding.

1.5 The Endowment Effect

The Endowment Effect (EE) was first described by the behavioural economist Richard Thaler (Thaler, 1980) as a possible formulation of the observed differences between consumers' selling prices (willingness to accept, WTA) and buying prices (willingness to pay, WTP). The EE is a specific case of value-based appraisal that refers to the bias of individuals to increase the perceived value of an item if they take ownership of the item (Thaler, 1980). The EE is typically demonstrated in two ways: 1) in the valuation paradigm, the minimum compensation that sellers are willing to accept (WTA) to give up an item they possess is higher than the maximum amount that buyers are willing to pay (WTP) to acquire the same item (Kahneman, Knetsch, & Thaler, 1990; Knetsch & Sinden, 1984); and 2) in the exchange paradigm, participants who are randomly endowed with one of two items are more resistant to trade the item they were endowed with for another item of similar value (Harbaugh, Krause, & Vesterlund, 2001; Knetsch, 1989; Morewedge & Giblin, 2015). In the exchange paradigm, the endowment boost (EB) is defined as the average across the two objects of the increase in the likelihood that an individual selects an object when they are endowed with it, relative to being endowed with the other object (Harbaugh et al., 2001).

The validity of the EE is strongly supported by a series of studies employing diverse methodologies, such as experiments when people are asked hypothetical questions about values of non-market goods (Franciosi, Kujal, Michelitsch, Smith, & Deng, 1996), as well as laboratory experiments (i.e., participants tend to keep the item that they own when they are offered an opportunity to trade it for an item of similar

monetary value; Harbaugh et al., 2001; Kahneman et al., 1990). Furthermore, these studies have shown that the EE occurs instantaneously upon being endowed with an object (Kahneman et al., 1990) and valuation increases with duration of ownership (Strahilevitz & Loewenstein, 1998). Moreover, the EE has been demonstrated to be a result of loss aversion (Van Dijk & Van Knippenberg, 1996), is sensitive to feelings of involvement and attachment to an item (Saqib, Frohlich, & Bruning, 2010), and is associated with distorted evaluations of the utility of items (Nayakankuppam & Mishra, 2005; Tolin & Villavicencio, 2011).

There is evidence that the EE appears to be stable across age groups. A study by Harbaugh et al. (2001) compared the EE in children (kindergarten, third-grade, and fifth-grade) and adults (undergraduates) and reported that the EE did not differ significantly between age groups. That is, although the undergraduates have accumulated substantially more market experience than the kindergartners, and are far more familiar with trading, receiving, and giving up items, the EE for the two groups was nearly the same. Another three-part study found that children (aged 3-4 years) consistently evaluated their own possessions, relative to other identical toys, more positively following a self-focus manipulation (Hood, Weltzien, Marsh, & Kanngiesser, 2016). Although true longitudinal data on EE are lacking, these results suggest that the EE appears to be an important aspect of preferences, rather than a transitory abnormality that diminishes with increased market experience (i.e., shopping, trading, buying, and giving up items; Harbaugh et al., 2001). Thus, these results support the validity of studying the EE as it appears in youth (children and adolescents).

Given that hoarding is characterized by extreme difficulty deciding about whether to keep or discard personal items (Tolin & Villavicencio, 2011), it is plausible that individuals with hoarding symptoms may manifest a higher EB (i.e. will be more likely to keep the item they already possess than exchange it for an item of similar value) than those who do not have hoarding symptoms. To date, however, there is no published research on the EE in either adults or youth with hoarding symptoms.

1.6 Aims of the Current Study

The purpose of the current study is to investigate the EE in youth (children and adolescents) with OCD and hoarding symptoms. Specifically, the primary aims of the study were to determine:

- A. whether youth with OCD and hoarding symptoms will differ from youth with OCD without hoarding symptoms on magnitude of the EB
- B. whether youth with OCD and hoarding symptoms will differ from youth with OCD without hoarding symptoms on a measure of cognitive flexibility
- C. whether youth with OCD and hoarding symptoms will differ from youth with OCD without hoarding symptoms on a measure of risky decision-making

We hypothesized that hoarding in youth is associated with a higher EB but not with reduced cognitive flexibility or general decision making impairment.

2. METHODS

2.1 Participants

Thirty child and adolescent participants meeting DSM-5 criteria for OCD participated in the study. Participants were eligible for the study if they were (1) 7 to 18 years of age; (2) fluent in English; and (3) had a confirmed DSM-5 diagnosis of OCD. Exclusion criteria were (1) DSM-5 diagnoses of schizophrenia spectrum disorders, bipolar spectrum disorders, or autism spectrum disorders; and (2) a history of a known neurological disorder that could potentially impact neuropsychological test scores.

Participants were recruited from the pediatric Obsessive Compulsive Disorders outpatient clinic at the Anxiety Treatment and Research Clinic, St. Joseph's Healthcare Hamilton. All participants recruited to the study had been previously assessed by a registered Child and Adolescent Psychiatrist (Dr. N. Soreni).

2.1.1 Choice of an OCD Sample

All participants recruited to the study had a primary DSM-5 diagnosis of OCD. The choice of a sample with a primary diagnosis of OCD was made because the frequency of hoarding symptoms in samples with OCD is higher than in the general population (Samuels et al., 2002; Wheaton et al., 2008).

Hoarding was only recognized as a separate disorder in the DSM-5 (American Psychiatric Association, 2013a). In the previous (4th) edition of the DSM (DSM-4-TR), hoarding was one of the diagnostic criteria for OCPD and the DSM-4-TR also stated that a diagnosis of OCD should be considered when severe hoarding obsessions and compulsions are present (American Psychiatric Association, 2004).

Furthermore, recruitment of youth samples based primarily on hoarding symptoms is difficult because recognition of hoarding symptoms typically begins a decade or more after onset of the symptoms and thus may often go undiagnosed in youth (Grisham et al., 2006; Storch et al., 2011; Tolin et al., 2010). Moreover, even when present, hoarding symptoms are usually not the main reason for referral in youth; children with hoarding symptoms are likely to present to a clinic with comorbid OCD, anxiety, or ADHD (Hacker et al., 2012; Samuels et al., 2014).

A significant consequence of how youth with hoarding symptoms enter the clinic, as well as the fact that hoarding was only recognized as a distinct entity in the DSM-5, is that the majority of research on hoarding in youth relies on samples ascertained based on another disorder (primarily OCD; e.g. Samuels et al., 2014).

2.2 Materials

2.2.1 Kiddie Schedule for Affective Disorders and Schizophrenia for School-Age

Children-Present State Interview (KSADS-P; Kaufman et al., 1997) is a semi-structured diagnostic interview used to assess clinical diagnoses based on the DSM-4, with updates to reflect changes based on the DSM-5. A registered Child and Adolescent Psychiatrist (NS) administered the interview, employing both the child and the parent as informants. This KSADS-P is a widely used method of assessment with good reliability and validity (Ambrosini, 2000). Based on the KSADS-P interview, only those children and adolescents with a confirmed diagnosis of OCD were eligible to participate in the study. For our analyses, we included KSADS-P categorical diagnoses of anxiety and ADHD.

2.2.2 Children's Saving Inventory-Parent Version (CSI; Frost, Steketee, & Grisham,

2004) was used to measure presence and severity of hoarding symptoms. The CSI is based on the Saving Inventory-Revised (SI-R; Frost et al., 2004), a widely used self-report questionnaire designed for adults. Scale format and response choices of the CSI are consistent with the SI-R. The CSI is a 20-item parent-rated scale designed to assess child hoarding symptoms including difficulty discarding, clutter, excessive acquisition, and distress/impairment. Each item is measured on a 5-point Likert scale (None, A little, A moderate amount, Most/Much, Almost All/Completely). Parents were asked to indicate the extent to which each statement described their child in the past week. CSI total score is calculated by summing the scores on each of these items. Thus, the minimum score on this survey is 0 and the maximum is 80. Higher scores on the CSI suggest more hoarding symptoms (Storch, Muroff, et al., 2011). According to Storch et al. (2011), the CSI is a reliable and valid assessment of hoarding behaviours among youth with OCD, with excellent psychometric properties including good internal consistency for the CSI Total ($\alpha=0.96$) and factor scores (Discarding $\alpha=0.95$; Clutter $\alpha=0.90$; Acquisition $\alpha=0.94$; Distress/Impairment $\alpha=0.84$) and excellent one-week test-retest reliability (CSI Total Score $r=0.92$; Discarding $r=0.85$; Clutter $r=0.89$; Acquisition $r=0.86$; Distress/Impairment $r=0.90$; all $p < 0.001$). Convergent and discriminant validity was evidenced by strong relationships with the OCI-CV Hoarding factor and with hoarding obsession/compulsions on the CY-BOCS (the CSI Total Score related strongly with the OCI-CV Hoarding factor $r = .69$, $p < 0.001$; and with hoarding obsession/compulsions on the CY-BOCS $r = 0.53$, $p < 0.001$; Storch et al., 2011). Known groups validity was evidenced by higher CSI scores for those endorsing hoarding on the CY-BOCS Symptom Checklist (e.g. the mean CSI

Total Score for those endorsing hoarding compulsions was 44.7 versus 17.9 for those not endorsing hoarding compulsions on the CY-BOCS; Storch et al., 2011).

2.2.3 Children's Yale-Brown Obsessive-Compulsive Scale (CY-BOCS; Goodman, Price, Rasmussen, Riddle, & Rapoport, 1991) is a 10-item measure of obsession and compulsion severity rated over the previous week on a five-point Likert scale. Summing the applicable 5 items derives Obsession and Compulsion severity scores; a Total Score is derived by summing all 10 scale items. The CY-BOCS was administered to the parents and child by the clinician. Storch et al. (2004), found that the CY-BOCS is a reliable and valid clinician-rated measure for assessing OCD symptomatology in youth. Internal consistency was good for the CY-BOCS Obsession and Compulsion Severity Scores ($\alpha = 0.80$ and 0.82 , respectively), and the Total Score ($\alpha = 0.90$; Storch et al., 2004). Scahill et al. (1997) reported that the CY-BOCS yields reliable and valid subscale and total scores for obsessive-compulsive severity in children and adolescents with OCD. Scahill et al. (1997) found that intraclass correlations for the CY-BOCS Total, Obsession, and Compulsion scores were .84, .91, and .66, suggesting good to excellent inter-rater agreement for subscale and total scores and the CY-BOCS Total score showed a high correlation with a self-report of obsessive-compulsive symptoms ($r = .62$).

2.2.4 Children's Depression Inventory (CDI; Kovacs, 1985) is a 27-item self-report questionnaire used to assess presence and severity of depressive symptoms in youth during the previous 2 weeks. Widely used, the CDI has demonstrated strong psychometric properties (Craighead, Smucker, Craighead, & Ilardi, 1998; Kovacs, 1985). The total score of the self-report CDI has excellent internal consistency ($\alpha=0.90$; Soreni et al.,

2014). We included the CDI total score in our analysis because evidence suggests that cognitive performance is associated with mood symptoms (see McClintock, Husain, Greer, & Cullum, 2010 for review).

2.2.5 Endowment Task (Harbaugh et al., 2001; Knetsch, 1989). The EE was studied using the previously tested and published game script of trading items by Harbaugh et al. (2001). Participants are given one item and told, “this is yours; it belongs to you now”. Participants are then given a minute to examine the item. Next, participants are offered an opportunity to trade their item for an item of roughly equivalent monetary value. The participants choose to either keep the item they were endowed with (by placing a blue sticker on the item) or to trade it for the other item (by placing a yellow sticker on the item). The second and third rounds are played exactly as the first, but with different pairs of items. This procedure is repeated for 3 of the 4 pairs of items described in Table 1 of Appendix 2. Children (age 7 to 11) choose from the first three pairs of items (pairs A&B, C&D, E&F), and adolescents (age 12 to 18) choose from the last three pairs of items (pairs C&D, E&F, G&H). The items were chosen because they are familiar and appeal to both boys and girls and the items in a pair were roughly of equivalent monetary value. The items chosen are similar to the items that Harbaugh et al. (2001) used. The items that participants were endowed with were randomized.

The EB equals $\frac{1}{2} p_{A|A}/p_{A|B} + \frac{1}{2} p_{B|B}/p_{B|A}$, where $p_{A|B}$ denotes the probability of selecting object A when endowed with object B (Harbaugh et al., 2001). Generally speaking, the EE is observed if EB is measured as greater than 1; that is, the probability

that a subject chooses “item A” is higher if they were initially endowed with item A than if they were endowed with “item B”.

2.2.6 Wisconsin Card Sorting Test (WCST; Grant & Berg, 1948; Heaton, Chelune, Talley, Kay, & Curtiss, 1993). Given that a higher EB score could potentially be the outcome of reduced cognitive flexibility (i.e. participants may choose to keep “own” items simply because they tend to adhere to known patterns), we tested cognitive flexibility using the WCST. The test consists of four stimulus cards, which are placed in front of the participant (one red triangle, two green stars, three yellow crosses, and four blue circles) and a response deck containing 64 cards. The participant must place each consecutive response card in front of one of the stimulus cards, wherever it appears to match best. The participant is not informed of the correct matching principle, but receives immediate feedback of ‘right’ or ‘wrong’ each time. Once the participant has made ten consecutive correct sorts, the sorting principle is changed without warning and the participant must adapt to the new rules. Cognitive flexibility is demonstrated by the ease with which the participant is able to shift strategies when the implicit rules change without warning.

We selected ‘number of perseverative errors’ as the outcome measure.

Perseveration errors occur when the participant persists in using the “old” sorting principle after receiving negative feedback. The WCST has clinical utility as a general measure of cognitive functioning among children and adolescents (G J Chelune & Baer, 1986; Romine et al., 2004). The WCST is age-dependent, but its sensitivity is not restricted by age; that is, it is possible to establish differences in skill level on the WCST

at older and younger ages (Chelune & Thompson, 1987). The WCST has been used to assess cognitive flexibility among adults with hoarding symptoms (Lawrence et al., 2006; Mcmillan, Rees, & Pestell, 2013; Tolin, Villavicencio, Umbach, & Kurtz, 2011). To the authors' knowledge, the WCST has not been conducted in children with hoarding symptoms.

2.2.7 Balloon Analogue Risk Task (BART; Lejuez et al., 2002). Given that a higher EB score could potentially be the outcome of a broader decision-making deficit, we tested broader decision-making performance using the BART. The BART is a youth-friendly computerized gambling task designed to measure risky decision-making. Participants are presented with a computer-simulated balloon and balloon pump and earn 5 cents for every pump that does not result in the balloon exploding. Participants are told that the balloon can explode at any time after the trial begins, which results in a loss of all money earned for the given trial. Participants are given the option to stop inflating a balloon at any time to bank the money they earned on that trial in the 'total earned box' and move on to the next balloon. The task consists of 30 trials and takes approximately 10-20 minutes.

We selected 'adjusted average number of pumps' (defined as average number of pumps excluding the balloons that exploded) as the dependent measure. The BART is a valid behavioural measure of risk-taking as it correlated consistently with self-report measures of risk-taking and has shown moderate validity with real world risk-taking behaviours such as substance use, pathological gambling, and aggression (Hunt, Hopko, Bare, Lejuez, & Robinson, 2005; Lejuez et al., 2002). Lejuez et al. (2007) evidenced the

utility of the BART in assessing risk behaviours in youth. The BART has also been used to assess risky decision-making among adults with clinically significant hoarding (Rasmussen, Brown, Steketee, & Barlow, 2013).

2.3 Procedure

Potential participants who met the inclusion and exclusion criteria, expressed an interest in participating in the study, and provided consent to contact were then contacted by my self or another research assistant. For individuals who were still interested in participating after being contacted, a study session was set up at their convenience. Enrollment required child/adolescent assent as well as parent/guardian consent. Before providing informed assent and consent, as approved by the Hamilton Integrated Research Ethics Board (HiREB), participants and their guardians were informed that “the purpose of the current study is to examine thought processes in children and adolescents with OCD. This study will help us learn more about why some children and adolescents have a lot of difficulty getting rid of possessions. The study will involve the completion of questionnaires and several tasks, some of which will be done on the computer”.

The study session took place in a standard clinical psychology research room at St. Joseph’s Healthcare Hamilton. There were only a few items in the room, including two computers. Doors and blinds were shut to minimize distractions. Testing sessions for participants typically took between 1.5 and 2 hours. Participants had no prior knowledge of the experimental procedures. The parent/guardian completed a questionnaire while the child/adolescent completed the questionnaires and cognitive tasks, which were administered in a separate room using a randomly selected order for each participant.

2.4 Data Analysis

Analyses were performed using IBM SPSS statistics (OS X 23). First, we computed descriptive information for the entire sample. Next, we calculated CSI total score by summing the scores on the Discarding, Clutter, and Distress/Impairment factors. We did not include the CSI ‘Acquisition’ factor because ‘Excessive acquisition’ is not a DSM-5 HD criterion; rather, it is listed as a specifier of HD (See Appendix 1 for DSM-5 criteria of HD). Next, we divided our sample ($N=30$) into thirds based on total CSI scores obtained. Further analysis of our data focused on only two groups: a “Low Hoarding” (LH) group (i.e. CSI scores in the lower 33.3% of our sample, $n=10$) and a “High Hoarding” (HH) group (i.e. CSI scores in the upper 33.3% of our sample, $n=12$).

Fisher’s exact tests and independent-samples t-tests were used to compare demographic characteristics across the two groups. Then, we computed the EB for the LH and HH groups based on the guidelines outlined by Harbaugh et al. (2001). Next, we used Fisher’s exact tests to test the null hypothesis that endowment had no effect in each of the LH and HH groups. We used Fisher’s exact tests instead of Chi-square tests due to our small sample size. To rule out the possibility that endowment scores were the result of increased tendency for cognitive perseveration or broader decision making deficits, we performed independent samples t-tests to compare between-groups differences on the WCST and the BART.

3. RESULTS

3.1 Sample Characteristics

Demographic characteristics of the full sample ($N=30$) are presented in Table 1. The full sample consisted of 30 children and adolescents (age 7 to 18 years) with a confirmed diagnosis of OCD, mean age (S.D.)= 13.17(3.281), 16 male, 14 female. Demographic and clinical characteristics of participants in the LH and HH groups are presented in Table 2. The LH ($n=10$) and HH ($n=12$) groups had no statistically significant between-group difference of age (mean age (S.D.), 13.70 (3.020) and 12.58(3.895), respectively), $t(20)=0.739$, $p=0.468$. Fisher's exact tests demonstrated that the LH and HH groups did not differ significantly in their sex composition (male:female, 7:3 and 6:6, respectively), $p=0.415$, or race, $p=1.000$. In regards to medication use, 3 individuals (30%) in the LH group and 4 individuals (33.3%) in the HH group were on psychotropic medication at the time of the study (LH group: Prozac, Sertraline, Escitalopram, Cipralex; HH Group: Fluvoxamine, Zoloft, Fluoxetine, Cipralex). The two groups did not differ significantly in their use of psychotropic medication, $p=1.00$.

Table 1

Demographic Characteristics of the Full Sample (N=30)

Characteristic	Full Sample
N	30
Age, Mean (S.D.)	13.17 (3.281)
Gender, n (%)	
Male	16 (53.3%)
Female	14 (46.7%)
Race, n (%)	
Caucasian	29 (96.7%)
Other	1 (3.3%)

Table 2

Demographic and Clinical Characteristics

Characteristic	LH	HH	Independent Samples t-test		Fisher's exact test
			<i>t(df)</i>	<i>p</i>	<i>p</i>
N	10	12	–	–	–
Age, Mean (S.D.)	13.70 (3.020)	12.58 (3.895)	0.739(20)	0.468	–
Gender, <i>n</i> (%)					
Male	7 (70.0%)	6 (50.0%)	–	–	0.415
Female	3 (30.0%)	6 (50.0%)	–	–	
Race, <i>n</i> (%)					
Caucasian	10 (100.0%)	11 (91.7%)	–	–	1
Other	0 (0.0%)	1 (8.3%)	–	–	
Psychotropic medication, <i>n</i> (%)	3 (30.0%)	4 (33.3%)	–	–	1

Note: LH = Low Hoarding Group; HH = High Hoarding Group

3.2 Hoarding-Specific Characteristics

The full sample (N=30) had a mean CSI Total Score (Discarding, Clutter, and Distress/Impairment factors) of 18.733 ($SD=12.046$). Mean CSI Total and factor scores for the LH and HH groups are presented in Table 3. The HH group had a significantly higher mean CSI Total Score than the LH group (mean CSI score (S.D.), 30.833 (5.474) and 5.000 (3.162), respectively), $t(18)=13.813$, $p < .001$. Participants also differed on the individual subscales of the CSI (Discarding, Clutter, and Distress/Impairment), with the HH group reporting significantly higher hoarding symptoms on all three subscales: Difficulty Discarding, $t(16.471) = 8.335$, $p < .001$; Clutter $t(13.502) = 5.373$, $p < .001$; and Distress/Impairment, $t(20) = 6.423$, $p < .001$.

Hoarding symptom profiles for the HH and LH groups are depicted in Figure 2. Figure 2 also shows a comparison of the acquisition factor, which was not included in the calculation of the CSI Total Score (see section 2.5). As expected, the HH group endorsed high levels of symptom severity. Figure 2 clearly shows that the HH group obtained the highest mean score on the CSI factor ‘Difficulty Discarding’.

Table 3

Means and Standard Deviations for CSI Factor and Total Scores

CSI	LH	HH	Independent Samples t-test	
			$t(df)$	p
Difficulty Discarding, Mean (S.D.)	1.400 (2.271)	14.167 (4.687)	-8.335 (16.471)	< .001
Clutter, Mean (S.D.)	0.800 (1.229)	7.250 (3.934)	-5.373 (13.502)	< .001
Distress/Impairment, Mean (S.D.)	1.700 (1.636)	6.333 (1.723)	-6.423 (20)	< .001
Total Score, Mean (S.D.)	5.000 (3.162)	30.833 (5.474)	-13.813 (18.038)	< .001

Note: CSI = Children's Saving Inventory; LH = Low Hoarding Group; HH = High Hoarding Group

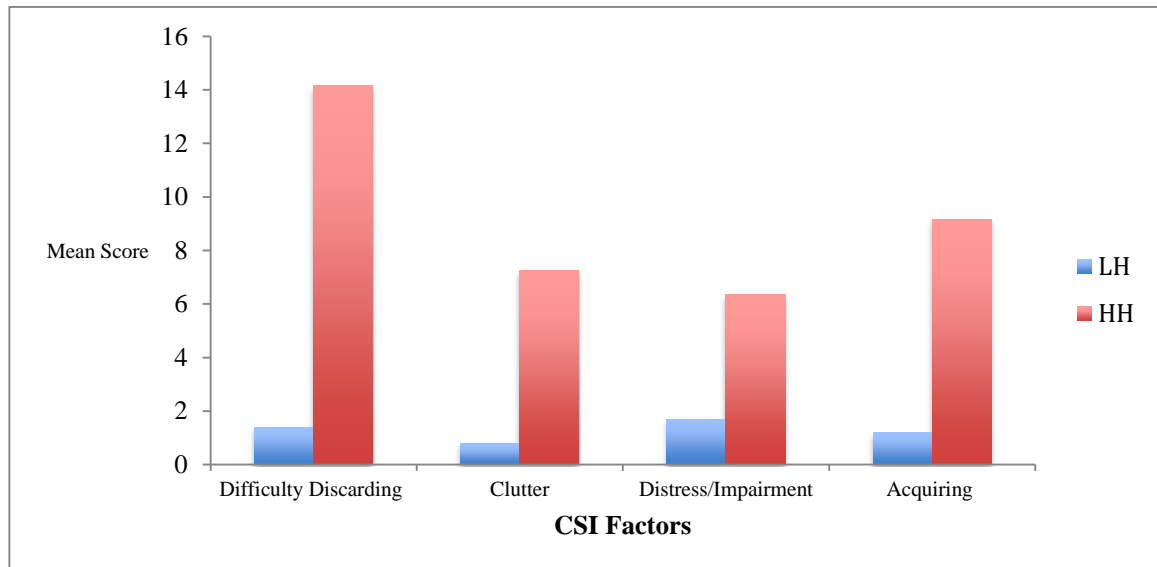


Figure 2. Comparison of Hoarding symptoms on the CSI

3.3 Comorbidity of Sample

We performed independent samples t-tests to compare the LH and HH groups on severity of obsessions and compulsions (CY-BOCS) and depressive symptoms (CDI).

Table 4 shows that there were no statistically significant differences between the LH and HH groups on CY-BOCS obsessions ($t(20)=0.357, p=0.725$), CY-BOCS compulsions ($t(20)=1.397, p=0.178$), CY-BOCS total ($t(20)=0.313, p=0.758$), or CDI total scores ($t(20)=0.139, p=0.891$).

We performed Fisher's exact test comparisons of the two groups on categorical measures of ADHD, GAD, Social Phobia, Specific Phobia, Separation Anxiety and Panic Disorder (KSADS-P). As indicated in Table 5, the HH group had a significantly higher prevalence of ADHD ($p=0.031$) but no significant differences were found for prevalence

of GAD ($p=0.074$), Social Phobia ($p=0.348$), Specific Phobia ($p=0.096$), Separation Anxiety ($p=0.594$) and Panic Disorder ($p=1.000$).

Table 4

Means and Standard Deviations for CY-BOCS and CDI

Measure	LH	HH	Independent Samples t-test	
			<i>t(df)</i>	<i>p</i>
CY-BOCS Obsessions, Mean (S.D.)	11.20 (2.741)	11.67 (3.284)	0.357(20)	0.725
CY-BOCS Compulsions, Mean (S.D.)	11.90 (3.872)	9.58 (3.872)	1.397(20)	0.178
CY-BOCS Total Score, Mean (S.D.)	22.10 (5.934)	21.25 (6.662)	0.313(20)	0.758
CDI Total Score, Mean (S.D.)	11.70 (8.667)	11.25 (6.524)	0.139(20)	0.891

Note: LH = Low Hoarding Group; HH = High Hoarding Group

Table 5

KSADS-P Comorbid Diagnoses

KSADS-P	LH	HH	Fisher's exact test
			<i>p</i>
ADHD, <i>n</i> (%)	1 (10.0%)	7 (58.3%)	0.031
GAD, <i>n</i> (%)	1 (10.0%)	6 (50.0%)	0.074
Social Phobia, <i>n</i> (%)	4 (40.0%)	2 (16.7%)	0.348
Specific Phobia, <i>n</i> (%)	0 (0.0%)	4 (33.3%)	0.096
Separation Anxiety, <i>n</i> (%)	1 (10.0%)	3 (25.0%)	0.594
Panic Disorder (without Agoraphobia), <i>n</i> (%)	1 (10.0%)	1 (8.3%)	1.000

Note: ADHD = Attention-Deficit/Hyperactivity Disorder; GAD = Generalized Anxiety Disorder; LH = Low Hoarding Group; HH = High Hoarding Group

3.4 The Endowment Task

Table 6 presents the EB for each pair of items. The HH group demonstrated a higher average EB (for Pairs 2 & 3) than the LH group (Average EB, 3.22 and 1.59,

respectively). Fisher’s exact test rejected the null hypothesis of no EE for the HH group ($p=0.007$) but did not reject the null hypothesis of no EE for the LH group ($p=0.269$). The HH group’s choices for each of the four pairs of trades are presented in Tables 2.1 through 2.4 of Appendix 2 and the LH group’s choices are presented in Tables 3.1 through 3.4 of Appendix 2. For the HH group, the EE is quite large. For example, table 2.2 of Appendix 2 shows that, in the HH group, 5 of the 7 participants who were endowed with item C kept it, while 2 switched to item D. Of the 5 participants who were endowed with item D, only one switched to C while 4 kept D. Overall, the HH group was on average 3.22 times more likely to choose the object they were endowed with than the object they were not endowed with. In comparison, the LH group was on average 1.59 times more likely to choose the object they were endowed with than the object they were not endowed with.

Table 6

Endowment Boosts by Group

Pair 1 (ages 7-11)		Endowment Boosts			Average EB (Pairs 2 & 3)	Fisher's exact test
		Pair 2	Pair 3	Pair 4 (ages 12-18)		p
LH	Undefined because $n_{A B}=0$, but $p_{B B}/p_{B A}=2.00$	1.67	1.5	2.46	1.59	0.269
HH	Undefined because $n_{A B}=0$, but $p_{B B}/p_{B A}=3.00$	3.18	3.25	1.75	3.22	0.007

Note: LH = Low Hoarding Group; HH = High Hoarding Group; EB = Endowment Boost

3.5 Neuropsychological Tasks

Table 7 presents means and standard deviations for each of the neuropsychological measures.

The HH and LH groups showed no statistically significant between group difference on the WCST's 'number of perseverative errors' variable ($t=0.901$, $p=0.378$). 'Number of perseverative errors' (errors that involve perseveration on the previously acquired set) gives an indication of cognitive flexibility.

The HH and LH groups showed no statistically significant between group differences on the BART's 'adjusted average number of pumps' variable ($t=0.338$, $p=0.739$). 'Adjusted average number of pumps' (average number of pumps excluding the balloons that exploded at random) gives an indication of advantageous decision-making ability.

Table 7

Means and Standard Deviations for Neuropsychological Measures

Measure	LH	HH	Independent Samples t-test	
			$t(df)$	p
WCST Perseverative Errors, Mean (S.D.)	6.9 (3.107)	6 (1.414)	0.901 (20)	0.378
BART Adjusted average number of pumps, Mean (S.D.)	26.69 (11.989)	28.45 (12.227)	0.338 (20)	0.739

Note: WCST = Wisconsin Card Sorting Test; BART = Balloon Analogue Risk Task; LH = Low Hoarding Group; HH = High Hoarding Group

4. DISCUSSION

4.1 Main Findings

4.1.1 Overview of Study Purpose and Results

Hoarding is a multi-faceted problem that is characterized by significant difficulty discarding personal possessions, resulting in the accumulation of clutter, and significant distress or functional impairment (American Psychiatric Association, 2013a). Many times a day, individuals make routine decisions, such as whether to keep or discard items in order to meet current needs without surpassing constraints such as physical space (Preston, Muroff, & Wengrovitz, 2009). Generally, individuals balance the perceived value of items (i.e., monetary, instrumental, or sentimental value) with the amount of space available to keep them. In the case of hoarding, however, these decision processes seem to be impaired such that items of apparently little use or value are retained to the point where clutter prevents the normal use of space to accomplish basic activities (Pertusa et al., 2010; Woody et al., 2014). Furthermore, hoarding symptoms significantly impede the afflicted individual's safety, health, social, occupational, and emotional well-being (Saxena et al., 2011; Tolin, Frost, Steketee, Gray, et al., 2008). Previous studies on hoarding symptoms have varied widely in terms of methodology and theoretical framework (i.e., various diagnostic and sample selection criteria, as well as various assessment measures; see Pertusa et al., 2010 for review) and there is a significant gap in research devoted to hoarding symptoms in childhood and adolescence (Grisham et al., 2006; Morris et al., 2015).

In an influential paper, Frost & Hartl (1996) proposed the Cognitive-Behavioural Model of Hoarding, which emphasizes impairments in decision-making as central to the development and maintenance of hoarding symptoms. However, the literature on decision-making processes in hoarding presents inconsistent findings (see Woody et al., 2014 for review). Preliminary cognitive studies of hoarding in adults suggest that hoarding symptoms may be associated with specific deficits in decision-making about discarding or replacing personally owned items (Tolin et al., 2009; Tolin et al., 2012). Thus, the overarching goal of this study was to investigate cognitive aspects of ownership in hoarding. The primary purpose of this study was to examine, for the first time, whether youth with hoarding symptoms manifest a higher EE (a bias in which ownership of an item increases its perceived value) than youth without hoarding symptoms.

Our findings support the primary hypothesis of the study, that youth with OCD who are high in hoarding symptoms (HH) would exhibit a higher endowment boost (EB) than youth with OCD who are low in hoarding symptoms (LH). Furthermore, an increased EB in HH youth was not accounted for by deficits of cognitive flexibility or risky decision-making processes, as evidenced by our WCST and BART findings, respectively. Thus, we propose that hoarding symptoms may be associated with a specific decision-making deficit related to personally owned items; namely, a stronger EE.

4.1.2 Discussion of Sample Characteristics

We found no significant sex or age differences between the LH and HH groups, which is important because decision-making processes tend to vary with age

(Blakemore & Robbins, 2012). The LH and HH groups were also comparable on severity of obsessions/compulsions and depressive symptoms, as well as prevalence of anxiety disorders. It should be noted that prevalence of GAD was higher in the HH group, but this difference was not significant. This is not surprising given that GAD appears to be highly comorbid with hoarding symptoms (comorbidity rates range from 23.8% to 42%; Tolin, Meunier, et al. 2011; Samuels et al., 2007). The HH group had a significantly higher prevalence of ADHD. ADHD is highly comorbid with hoarding symptoms (Frost et al., 2011). A study by Hacker and colleagues (2012) reported that 29% of children with ADHD experienced hoarding symptoms, which is similar to the frequency of hoarding symptoms in pediatric OCD samples. It has been suggested that hoarding and ADHD may share some underlying information-processing deficits, such as planning, organization, and sustained attention (Hacker et al., 2012). Although the above findings provide some evidence that hoarding symptoms and ADHD have high rates of comorbidity, the question about whether or not they share some underlying information processing deficits has yet to be answered. Furthermore, these ADHD findings are by no means specific to hoarding symptoms. ADHD has high rates of comorbidity with a variety of psychiatric disorders, such as oppositional defiant and conduct disorders, learning disorders, affective and anxiety disorders, as well as borderline personality disorder, Tourette's syndrome, and intellectual developmental disorder (Biederman, Newcorn, & Sprich, 1991; Pliszka, 1998). In fact, ADHD and mood disorders have been found to occur together in 15% to 75% of cases in clinical samples of youth (Biederman et al., 1991; Jensen, Burke, & Garfinkel, 1988; Munir, Biederman, & Knee, 1987;

Woolston et al., 1989). Thus, it is difficult to say whether ADHD shares a specific common causal mechanism with hoarding.

4.1.3 The Endowment Effect

Turning to the endowment task, we found that youth in the HH group demonstrated a higher EB than youth in the LH group, which suggests that youth with high hoarding symptoms were more resistant to trade the item they were endowed with for another item of similar value than were youth with little to no hoarding symptoms. For the HH group, the likelihood of choosing an item increased when the participant was endowed with that item. Indeed, the HH group was on average 3.22 times more likely to choose the item they were endowed with than trade it for an item of similar value. Furthermore, Fisher's exact tests rejected the null hypothesis of no EE for the HH group. Thus, youth with hoarding symptoms are more likely to over-value an item that they own.

The EE is a universal bias that is relevant to psychology, economics, marketing, and behaviour (see Morewedge & Giblin, 2015 for review). Our findings are in line with suggestions that the EE is a universal and robust observation on market behaviour (Kahneman et al., 1990; Knetsch, 1989; Knez, Smith, & Williams, 1985), as both the HH and LH groups demonstrated an EB greater than 1, which, according to Harbaugh et al. (2001), suggests the existence of the EE (see section 2.2.5). That is, the LH group was on average 1.59 times more likely to choose the item they were endowed with than trade it for an item of similar value.

Moreover, the EE does not appear to be a mistake or a transitory abnormality related to inexperience (Harbaugh et al., 2001). Indeed, Harbaugh and colleagues (2001)

reported that the EB did not differ significantly between kindergartners, third-graders, fifth-graders, and undergraduates, despite differences in market experience (i.e. shopping, trading, buying, and giving up items) between the groups. In fact, children begin to identify items as belonging to themselves or another between 18 and 28 months of age (Fasig, 2000). Furthermore, 3- and 4-year olds understand rules of ownership (Friedman & Neary, 2008). Gelman et al. (2012) reported that children as young as two years show an EE; that is, 2-year-olds indicate that they prefer toys that belong to them—even when identical toys owned by an adult or no one are available. Another three-part study found that children (aged 3-4 years) consistently evaluated their own possessions, relative to other identical toys, more positively following a self-focus manipulation (Hood, Weltzien, Marsh, & Kanngiesser, 2016). That is, when the preschoolers' attention was focused on themselves (in a self-portrait construction task), preschoolers showed a higher EE (i.e., evaluated own possessions more positively compared to another's or no one's identical possession; Hood et al., 2016). These studies suggest that psychological ownership is significant from early on in development (Hood et al., 2016). As young children establish a sense of self, possessions are valued because they are seen as “extensions of the self” (Belk, 1988).

Interestingly, the observed EB in youth with hoarding symptoms suggests that the EE may be observed within seconds upon being endowed with an item. This finding is in line with other studies that have shown that the EE occurs instantaneously upon being endowed with an item for both adults (Kahneman et al., 1990) and children (Gelman et al., 2012; Harbaugh et al., 2001; Hood et al., 2016). Furthermore, object valuation is

influenced by both past and present ownership as well as duration of ownership (Strahilevitz & Loewenstein, 1998). Strahilevitz & Loewenstein (1998) reported that for items currently in one's possession, valuation increases with duration of ownership. Furthermore, for items no longer in one's possession, past ownership increases valuation, and this increase in valuation is associated with the duration of ownership before the loss (Strahilevitz & Loewenstein, 1998). It appears that a sense of ownership remains even after a possession is physically gone. Clearly, the impact of endowment extends beyond the effect of instantaneous ownership (Strahilevitz & Loewenstein, 1998).

Our findings highlight the significance of ownership for individuals with hoarding symptoms. Given that hoarding symptoms revolve around personal possessions (Tolin & Villavicencio, 2011), a stronger EE might contribute to the extreme difficulty in discarding possessions, characteristic of hoarding, and may lead to the accumulation of clutter.

4.1.4 Cognitive Flexibility

The present study explored the possibility that cognitive factors may account for the finding of increased EB in the HH group. Our study was the first to examine cognitive flexibility in youth with hoarding symptoms. Given the nature of our paradigm (a game-script of trading items), it was plausible that an increased EB in the HH group could be associated with deficits in cognitive flexibility (i.e., HH group merely tends to keep the endowed item). This hypothesis, however, stands in contrast to two findings from the present study. First, Fisher's exact tests rejected the null hypothesis of no EE for the HH group, suggesting that the EE was significant for the HH group. Second, in line with two

previous studies of adult hoarding participants (Lawrence et al., 2006; Tolin et al., 2011), we found no statistically significant between-group differences on the WCST's 'number of perseveration errors' variable (i.e., the participant persists in using the "old" sorting rule after a shift). Together, these two findings suggest that the higher EB in the HH group is the result of a higher EE, and is not simply accounted for by cognitive flexibility deficits (i.e. reluctance to change cognitive strategies). Indeed, the literature on cognitive flexibility in hoarding is inconclusive (Lawrence et al., 2006; Mcmillan et al., 2013; Tolin et al., 2011).

Our results are in line with two studies that found no differences among adult hoarding participants on WCST performance (Lawrence et al., 2006; Tolin et al., 2011). Lawrence et al. (2006) revealed some differences between WCST performance (categories completed, nonperseverative errors, and perseverative errors) of OCD participants and healthy controls, but hoarding symptoms were not significantly related to performance. Tolin et al. (2011) reported no significant differences between HD patients, OCD patients, and healthy controls for 'total errors' (sum of all errors, including perseverative errors) on the WCST. In contrast, McMillan et al. (2013) reported that adult participants with hoarding symptoms had a significantly higher number of perseverative errors and significantly lower numbers of categories completed than age-adjusted test norms. However, the authors did not include tests for concurrent anxiety or depression, making it difficult to conclude whether these findings are specific to hoarding symptoms. Hoarding is associated with high rates of comorbidity with anxiety and depressive symptoms (Frost et al., 2011; Wheaton et al., 2008; see section 1.1.2) and other studies

(Grant, Thase, & Sweeney, 2001; Martin, Oren, & Boon, 1991) have found that depressive symptoms significantly predict worse performance on the WCST (total errors, perseverative responses and errors, failure to maintain set). In another study, Grisham et al. (2010) compared individuals with hoarding symptoms, individuals with an Axis I mood or anxiety disorder, and non-clinical controls on a different neuropsychological test of cognitive flexibility, the Intra-Extra Dimensional Set-Shifting Task (IED). The IED is similar to the WCST in that participants must learn to sort coloured shapes according to a rule and then contingencies change and participants must shift sorting to a new rule. The IED measures participants' ability to flexibly shift between concepts and maintain attention (Grisham et al., 2010). The authors reported no significant between-group differences with respect to performance on the IED (Grisham et al., 2010).

In summary, our findings are in line with other studies of cognitive flexibility in hoarding using adult samples (Grisham et al., 2010; Lawrence et al., 2006; Tolin et al., 2011). Our findings suggest that the higher EB in the HH group is not simply accounted for by cognitive flexibility deficits.

4.1.5 Risky Decision-Making

Current models of hoarding emphasize impairments in decision-making (Gilliam & Tolin, 2010; Steketee & Frost, 2007; Steketee & Frost, 2003). Typically, decision-making in hoarding is assessed by risk-related decision-making tasks; however, studies' utilizing these tasks in adult samples present inconsistent findings (Blom et al., 2011; Grisham, Brown, Savage, Steketee, & Barlow, 2007; Tolin & Villavicencio, 2011). Our study was the first to examine risky decision-making in youth with hoarding symptoms.

We found no statistically significant between-group differences on the BART's 'adjusted average number of pumps' variable (i.e., average number of pumps excluding the balloons that randomly exploded). Thus, our findings suggest that the increased EB in the HH group is not simply accounted for by deficits in ability to make advantageous decisions.

The use of gambling tasks (IGT and CGT) for the study of decision-making in hoarding has yielded inconclusive results. Our results are in line with four studies of decision-making in hoarding that have utilized gambling tasks (IGT and CGT) as indicators of decision-making ability and have found no between-group differences in performance between adults who hoard and those who do not (see section 1.3.2; Blom et al., 2011; Grisham et al., 2007, 2010; Tolin et al., 2011). On the other hand, our results are in contrast with two other adult studies (Lawrence et al., 2006; Rasmussen et al., 2013). Rasmussen et al. (2013) found that adult hoarding participants were more cautious on the BART (i.e. fewer average balloon pumps and explosions) than were participants with anxiety disorders. However, hoarding participants were approximately 25 years older than those with anxiety disorders and these findings disappeared when analyses controlled for age (Rasmussen et al., 2013). Lawrence et al. (2006) found that OCD patients with high hoarding symptoms performed worse than OCD patients with low hoarding symptoms and healthy controls on the IGT. That is, the hoarding group made riskier choices on the IGT, resulting in poorer scores (Lawrence et al., 2006). It is important to note, however, that medication use in the clinical group was high (Lawrence et al., 2006).

Gambling tasks, such as the BART, require the participant to be able to balance immediate rewards against longer-term negative consequences in an ambiguous situation (Lawrence et al., 2006; Starcke, Tuschen-Caffier, Markowitsch, & Brand, 2010; Woody et al., 2014). However, gambling tasks are sensitive to risk tolerance, and thus decision-making, as measured by these tasks, is often impaired among participants with risky behaviours, such as addicts (Bechara et al., 2001; Toplak, Sorge, Benoit, West, & Stanovich, 2010). Although hoarding patients often exhibit problems with response inhibition and impulse control (Grisham et al., 2007; MacKin, Areán, Delucchi, & Mathews, 2011; Rasmussen et al., 2013), hoarding is also associated with risk-averse behaviour, such as saving a wide variety of items for future use (Blom et al., 2011). Such risk aversion would improve performance on these gambling tasks (Blom et al., 2011; Grisham et al., 2007), contrary to the findings by Lawrence et al. (2006). Clearly, different factors related to risk tolerance predict different outcomes on these gambling tasks. Thus, we argue that gambling tasks are probably not the best assessment tools for investigating decision-making in the context of hoarding. Rather, we propose that the field of behavioural economics has identified other aspects of decision-making that might be impaired in individuals with hoarding symptoms; namely, the EE.

4.2 Strengths and Limitations

To our knowledge, our study is the only study to date of the EE in youth with hoarding symptoms. Our study was also the first to examine cognitive flexibility and risky decision-making in youth with hoarding symptoms. Our sample was well ascertained- participants were rigorously diagnosed using valid and reliable assessment

tools. The HH and LH groups were very similar (i.e., no significant differences in terms of age, sex, prevalence of anxiety disorders, and severity of obsessions/compulsions and depressive symptoms), allowing for a more accurate comparison of differences related to hoarding symptoms. Finally, our study takes an innovative approach to the study of hoarding symptoms by investigating decision-making processing using a youth-friendly task rooted in behavioural economics. While this study has several strengths, there were nonetheless several limitations that should be considered.

First, the most significant limitation of our study is the lack of a healthy control group. The present study focused on a clinical population (youth with OCD). However in order to further assess the association between the EE and hoarding symptoms, future research should compare youth with hoarding symptoms (either with or without OCD) to a healthy control group. A second limitation of our study is its small sample size. In part, this was because of our choice to compare the two extreme thirds of total CSI scores (i.e. youth with the most severe hoarding symptoms {HH} to youth with little to no hoarding symptoms {LH}). Clearly future studies of the endowment effect will have to depend on larger samples in both adults and youth. Third, our measure of hoarding symptoms relies on a parent- (as opposed to self-) scored questionnaire. Parents may misidentify developmentally normative collecting behaviours as pathological. Furthermore, hoarding symptoms, such as clutter, may be more challenging to identify in children, since parents are often in charge of what their child acquires and discards (Storch, Rahman, et al., 2011). To date, however, no psychometrically-sound self-report hoarding instrument exists for youth. Fourth, our sample is limited to youth with a

primary diagnosis of OCD. Although HD was recognized as a separate diagnosis in the DSM-5, hoarding symptoms, even when present, are rarely the main reason for referral in youth (Burton et al., 2015; Hacker et al., 2012; Samuels et al., 2014). Hoarding has been previously linked to poor insight in adults (Seedat & Stein, 2002; Tolin, Fitch, Frost, & Steketee, 2010). Furthermore, Storch et al. (2007) reported that youth with hoarding symptoms have worse insight into their symptoms than their non-hoarding OCD counterparts. Thus, when children who hoard enter a clinic, symptoms of comorbid OCD or ADHD often take precedence over symptoms of hoarding (e.g. Hacker et al., 2012; Samuels et al., 2014). Fifth, although participants in the HH group had hoarding symptoms that were severe, the number of cases that would meet criteria for DSM-5 HD, as specified for adults, is uncertain (American Psychiatric Association, 2013a). This is mostly due the fact that recruitment for the study had begun prior to the use of DSM-5 criteria at our clinic. To partially address this issue, we chose to use only those CSI factors that adhered to DSM-5 HD terminology. Thus, given that ‘Excessive acquisition’ is not a DSM-5 HD criterion, we omitted the CSI ‘Acquisition’ factor from the CSI total score calculation. Indeed, when hoarding is subdivided into its central symptoms of difficulty discarding, clutter and acquiring, symptoms of excessive acquiring appear to have a later onset than the other symptoms (Grisham et al., 2006). To be sure, we generated HH and LH groups based on CSI total scores (with the Acquisition factor included) and repeated the same analyses (data not shown). Interestingly, we obtained similar findings (higher EB for the HH group and no significant between-group differences on the WCST and BART). Finally, although between-group differences in EB

were prominent, it is difficult to estimate the statistical significance of our findings.

However, Fisher's exact tests established the significance of the EE for the HH group but not in the LH group.

4.3 Study Implications

Hoarding affects approximately 2-6% of adults (Mataix-Cols & Pertusa, 2012; Steketee & Frost, 2014) and often begins in childhood and adolescence (Ayers et al., 2010; Grisham et al., 2006). Hoarding is associated with many personal negative outcomes, such as increased risk for medical issues and eviction (Tolin et al., 2008), but the consequences of hoarding extend beyond the afflicted individual to their families and community (Pertusa et al., 2010). Furthermore, the impact of hoarding in youth is still unknown and there have been few reports of the treatment of youth with hoarding symptoms (Storch, Rahman, et al., 2011). Although the etiology and cognitive factors underlying hoarding symptoms remain unknown, our findings highlight the potential significance of focusing on cognitive aspects of ownership in hoarding (see Tolin et al., 2009; Tolin et al., 2012).

Traditionally, the EE has been attributed to loss aversion, where relinquishing an item moves one from a reference point of owning to not owning the item (Novemsky & Kahneman, 2005; Tversky & Kahneman, 1991). People tend to be loss averse; thus the psychological consequence of a loss is greater than an equivalent gain (Kahneman & Tversky, 1979; Tversky & Kahneman, 1991). Conditions of negative mood actually increase the anticipated negative response to a loss, further deterring people from giving up an endowed item, and thus increasing the EE (Zhang & Fishbach, 2005). This is

relevant to individuals with hoarding symptoms because there is evidence that hoarding symptoms are associated with experiencing negative emotions more intensely and reporting lowered tolerance of negative emotions (Timpano et al., 2014). Nevertheless, the EE can no longer solely be attributed to a loss aversion account (Morewedge & Giblin, 2015). In fact, mere ownership alone is adequate to increase the perceived value of an item (Beggan, 1992).

Hoarding is characterized by extreme difficulty discarding, which is commonly more severe for personal possessions than for other people's items (Tolin et al., 2009; Tolin et al., 2012). In fact, we found that "difficulty discarding" was the most significant symptom of hoarding in our sample (see Figure 2). Clearly, aspects of ownership are significant to hoarding. Giving items to participants and allowing them to examine them for a minute combined with a statement of ownership (i.e., "this is yours; it belongs to you"), as was done in the current study, was sufficient to induce observable ownership effects. Youth with hoarding symptoms were on average 3.22 times more likely to choose the item they owned than the item they did not own. Furthermore, ownership was established almost instantaneously. According to the 'ownership account' of the EE (Morewedge, Shu, Gilbert, & Wilson, 2009), people are resistant to discard their possessions because they treat their possessions as social entities and associate those possessions with themselves. Furthermore, increasing the level of involvement enhances the EE (Saqib et al., 2010) and the EE is associated with the tendency of sellers, in comparison to buyers, to overemphasize the positive attributes and underemphasize the

negative attributes of an item (Nayakankuppam & Mishra, 2005). These phenomena are all relevant to observations of individuals with hoarding symptoms.

Thus, we propose that the EE plays a significant role in deciding whether or not to discard possessions and this effect is quantitatively different in youth with hoarding symptoms. That is, the EE is more pronounced in hoarding, thus contributing to the persistent difficulty discarding possessions that is characteristic of hoarding. Indeed, the focus on cognitive aspects of ownership in hoarding could lead the way to the development of innovative behavioural approaches and cognitive remediation interventions for HD.

4.4 Directions for Future Research

Several future research directions are suggested by the results of this study and are elaborated upon below.

4.4.1 The Sample

There are several aspects of the sample used in the current study that indicate directions for future research. First, given the small sample size of our study, there is a need for reproduction with a larger sample size. Clearly future studies of the EE will have to depend on larger samples in both adults and youth. Second, future research should compare youth with hoarding symptoms (either with or without OCD) to a healthy control group. Although both the HH and LH groups demonstrated an EE, the EB in the LH group was lower than the EBs of healthy children and adults reported by Harbaugh et al. (2001). This could be due to our small sample size and/or our use of a clinical sample (youth with OCD). Third, it would be informative to replicate our study using a sample of

youth with hoarding symptoms without comorbid OCD. Until recently, hoarding was considered a manifestation of OCD, and thus the majority of studies on hoarding symptoms have been based on this assumption (Pertusa et al., 2010). However, HD is now an established disorder in the DSM-5 (American Psychiatric Association, 2013a) and has been reported in a variety of Axis I disorders and impulse control disorders (see section 1.1.2). Fourth, there is a need for future research on hoarding symptoms in children and adolescents. The majority of studies on age of onset of hoarding symptoms rely on retrospective recall of hoarding symptoms that occurred sometimes decades earlier (e.g. Ayers et al., 2010; R. O. Frost & Gross, 1993; Grisham et al., 2006; Pertusa et al., 2008; Samuels et al., 2002; Seedat & Stein, 2002). This is problematic because inaccuracies can easily result from retrospective reports. Thus, there is a need for research using pediatric samples in order to better understand the age of onset of hoarding and its etiology. Furthermore, the clinical manifestation of hoarding symptoms in youth may differ from that of adults as parents are often in control of what their child acquires and discards (Storch, Rahman, et al., 2011). Moreover, the limited research on hoarding symptoms in youth translates into fewer research-supported assessment tools and youth-specific treatments methods (Storch, Rahman, et al., 2011). Fifth, there is currently no psychometrically-sound self-report measure of hoarding symptoms in youth. It might, therefore, be useful in future research to develop a self-report version of the CSI to be administered in addition to the parent-scored version of the CSI. Employing both the child and the parent as informants might provide a more accurate assessment of the severity of hoarding symptoms. Finally, future research should also continue to consider

the diagnostic criteria for HD in youth. As was previously mentioned, there are critical differences in hoarding symptoms between adults and children. Future research should continue to investigate the difference between developmentally normative collecting behaviours and subclinical hoarding symptoms in youth. This will help to specify clinically significant HD and could contribute to a better understanding of risk factors.

4.4.2 Behaviour Economics Principles

Although the validity of the EE has been strongly supported by a series of studies (see section 1.5), there are still few methodologies to choose from when considering how to operationalize the EE in laboratory experiments. Future research could expand on the exchange paradigm methodologies. Furthermore, statistical tests of the EE in economics are less rigorous than standard psychology tests. For instance, the EE is tested based on any difference between two endowment boosts (in the exchange paradigm) or between consumers' selling prices and buying prices (in the valuation paradigm). In psychology, however, between-group differences are considered valid when these differences are statistically significant. Thus, future research should focus on empirical investigation of the EE. Furthermore, although there is evidence that the EE appears to be stable across age groups (Harbaugh et al., 2001), there is a need for true longitudinal follow-up of the EE in order to establish that the EE is a valid aspect of preferences and not significantly impacted by market experience. Finally, future research should investigate other factors that might contribute to the EE. In addition to loss aversion and psychological ownership, a recent review by Morewedge & Giblin (2015) outlined evolutionary, strategic and cognitive findings that may contribute to the EE.

4.4.3 Ownership

The results of this thesis suggest that psychological ownership plays an important role in the manifestation of hoarding symptoms. Thus, factors that contribute to and diminish psychological ownership require further research. This would help inform researchers/clinicians of how psychological ownership might be different among individuals with hoarding symptoms. An important consideration for future research methodologies is that duration of ownership increases the value attributed to possessions (Strahilevitz & Loewenstein, 1998). Thus, it might be useful to study the EE using participants' own items brought into the lab. Furthermore, in order to get a better idea of ownership effects on the valuation of items, it might be interesting to assess whether or not hoarding participants still manifest a higher EB when they are endowed with a low value item, and then are offered the opportunity to trade their low-value item for a high-value item that does not belong to them.

Future research should also focus on whether or not the EE is a bias that is consistently found across cultures. In individualistic societies, such as Western cultures, we tend to view possessions as extensions of self (Belk, 1988). Material possessions are highly valued from a young age (Fasig, 2000; Gelman et al., 2012; Hood et al., 2016). In contrast, collectivist societies, such as Eastern cultures, tend to deemphasize individual expression; rather, there is an emphasis on interdependent self-concepts (Maddux et al., 2010). For example, Maddux et al. (2010) found that East Asian students had a lower EE than Western students. It is possible that a higher EE might be obtained by priming East Asian participants with an interdependent self-focus manipulation (Hood et al., 2016).

Therefore, future research should identify a comparative understanding of psychological ownership between Eastern and Western cultures. Then, subsequent research could investigate the role of psychological ownership on differences in the clinical manifestation of hoarding symptoms between Eastern and Western cultures.

Finally, given that the underlying factors that contribute to hoarding symptoms remain largely unknown, future research should investigate the underlying neural processes associated with psychological ownership in youth with hoarding symptoms. So far, we have developed a youth-friendly neuroimaging paradigm of the endowment task. This paradigm was designed for functional magnetic resonance imaging (fMRI) in order to investigate brain activation patterns associated with the EE.

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APPENDIX A

DSM-5 Diagnostic Criteria for Hoarding Disorder

Retrieved From:

American Psychiatric Association. (2013). Obsessive-Compulsive and Related Disorders. In *Diagnostic and Statistical Manual of Mental Disorders*. American Psychiatric Association. <http://doi.org/doi:10.1176/appi.books.9780890425596.dsm06>

Diagnostic Criteria

300.3 (F42)

1. Persistent difficulty discarding or parting with possessions, regardless of their actual value.
2. This difficulty is due to a perceived need to save the items and to distress associated with discarding them.
3. The difficulty discarding possessions results in the accumulation of possessions that congest and clutter active living areas and substantially compromises their intended use. If living areas are uncluttered, it is only because of the interventions of third parties (e.g., family members, cleaners, authorities).
4. The hoarding causes clinically significant distress or impairment in social, occupational, or other important areas of functioning (including maintaining a safe environment for self and others).
5. The hoarding is not attributable to another medical condition (e.g., brain injury, cerebrovascular disease, Prader-Willi syndrome).
6. The hoarding is not better explained by the symptoms of another mental disorder (e.g., obsessions in obsessive-compulsive disorder, decreased energy in major depressive disorder, delusions in schizophrenia or another psychotic disorder, cognitive deficits in major neurocognitive disorder, restricted interests in autism spectrum disorder).

Specify if:

- **With excessive acquisition:** If difficulty discarding possessions is accompanied by excessive acquisition of items that are not needed or for which there is no available space.

Specify if:

- **With good or fair insight:** The individual recognizes that hoarding-related beliefs and behaviors (pertaining to difficulty discarding items, clutter, or excessive acquisition) are problematic.
- **With poor insight:** The individual is mostly convinced that hoarding-related beliefs and behaviors (pertaining to difficulty discarding items, clutter, or excessive acquisition) are not problematic despite evidence to the contrary.
- **With absent insight/delusional beliefs:** The individual is completely convinced that hoarding-related beliefs and behaviours (pertaining to difficulty discarding items, clutter, or excessive acquisition) are not problematic despite evidence to the contrary.

APPENDIX B

Table 1

Pairs of Items used in the Endowment Task

Pair	ID Letter	Description
1	A	Keychain
	B	Yellow happy face ball
2	C	Highlighter
	D	Pen
3	E	Notepad
	F	Sticky Notes
4	G	Deck of Cards
	H	Rubik's Cube

Table 2.1

HH Group Pair 1 (Ages 7-11 only)

		Item Kept		Total
		A	B	
Endowed Item	A	2 ($p_{A A} = 0.667$)	1 ($p_{B A} = 0.333$)	3
	B	0 ($p_{A B} = 0$)	3 ($p_{B B} = 1$)	3
Total		2	4	6

EB = undefined, because $n_{A|B}=0$, but $p_{B|B}/p_{B|A}=3.00$

Table 2.2

HH Group Pair 2

		Item Kept		Total
		C	D	
Endowed Item	C	5 ($p_{C C} = 0.714$)	2 ($p_{D C} = 0.286$)	7
	D	1 ($p_{C D} = 0.2$)	4 ($p_{D D} = 0.8$)	5
Total		6	6	12

EB = 3.18

Table 2.3

HH Group Pair 3

		Item Kept		Total
		E	F	
Endowed Item	E	5 ($p_{E E}=0.833$)	1 ($p_{F E}=0.167$)	6
	F	2 ($p_{E F}=0.333$)	4 ($p_{F F}=0.667$)	6
Total		7	5	12

EB = 3.25

Table 2.4

HH Group Pair 4 (Ages 12-18 only)

		Item Kept		Total
		G	H	
Endowed Item	G	1 ($p_{G G}=0.5$)	1 ($p_{H G}=0.5$)	2
	H	1 ($p_{G H}=0.25$)	3 ($p_{H H}=0.75$)	4
Total		2	4	6

EB = 1.75

Table 3.1

LH Group Pair 1 (Ages 7-11 only)

		Item Kept		Total
		A	B	
Endowed Item	A	1 ($p_{A A}=0.5$)	1 ($p_{B A}=0.5$)	2
	B	0 ($p_{A B}=0$)	1 ($p_{B B}=1$)	1
Total		1	2	3

EB = undefined, because $n_{A|B} = 0$, but $p_{B|B}/p_{B|A} = 2.00$

Table 3.2

LH Group Pair 2

		Item Kept		Total
		C	D	
Endowed Item	C	4 ($p_{C C} = 0.8$)	1 ($p_{D C} = 0.2$)	5
	D	3 ($p_{C D} = 0.6$)	2 ($p_{D D} = 0.4$)	5
Total		7	3	10

EB = 1.67

Table 3.3

LH Group Pair 3

		Item Kept		Total
		E	F	
Endowed Item	E	3 ($p_{E E} = 0.6$)	2 ($p_{F E} = 0.4$)	5
	F	2 ($p_{E F} = 0.4$)	3 ($p_{F F} = 0.6$)	5
Total		5	5	10

EB = 1.50

Table 3.4

LH Group Pair 4 (Ages 12-18 only)

		Item Kept		Total
		G	H	
Endowed Item	G	3 ($p_{G G} = 0.75$)	1 ($p_{H G} = 0.25$)	4
	H	1 ($p_{G H} = 0.333$)	2 ($p_{H H} = 0.667$)	3
Total		4	3	7

EB = 2.46