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**Author/s:**

Kyrios, M;Mogan, C;Moulding, R;Frost, RO;Yap, K;Fassnacht, DB

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**The cognitive-behavioral model of Hoarding Disorder: Evidence from clinical and non-clinical cohorts**

Michael Kyrios<sup>1,2</sup>, Christopher Mogan<sup>2,3</sup>, Richard Moulding<sup>4</sup>, Randy O. Frost<sup>5</sup> & Keong Yap<sup>6</sup>, Daniel B. Fassnacht<sup>1</sup>

<sup>1</sup> Research School of Psychology, The Australian National University

<sup>2</sup> Department of Psychology, The University of Melbourne

<sup>3</sup> The Anxiety and OCD Clinic Melbourne

<sup>4</sup> Department of Psychology, Deakin University

<sup>5</sup> Department of Psychology, Smith College

<sup>6</sup> School of Psychology, Australian Catholic University

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## Abstract

The cognitive-behavioral model of Hoarding Disorder (HD) incorporates information processing difficulties, maladaptive attachment to possessions, erroneous beliefs about the nature of possessions and mood problems as etiologically significant factors, although developmental experiences such as a compromised early family environment have also been proposed in an augmented model. This study examined the specificity and relevance of variables highlighted in the augmented cognitive-behavioral model. Various clinical participants (n = 89) and community controls (n = 20) were assessed with structured clinical interviews to verify diagnosis. Participants completed self-report measures of hoarding severity, cognitions, meta-memory and early developmental experiences (e.g., memories of warmth and security in one's family). Hoarding cohorts (with and without Obsessive Compulsive Disorder [OCD]) reported poor confidence in memory but relative to other groups (OCD without HD, Anxiety Disorders, and healthy controls), hoarding-relevant cognitions, need to keep possessions in view and concerns about the consequences of forgetting were significantly higher. Hoarding groups reported the lowest recollections of warmth in their family, although no differences were found between hoarding and non-hoarding clinical cohorts for uncertainty about self and others. Nonetheless, clinical cohorts reported generally higher scores of uncertainty than healthy controls. When predicting hoarding severity, after controlling for age and mood, recollections of lack of warmth in one's family was a significant predictor of hoarding severity, with hoarding-related cognitions and fears about decision-making being additional unique predictors. The study

supports the augmented cognitive-behavioral model of hoarding, inclusive of the importance of early developmental influences in hoarding.

Keywords: Hoarding Disorder, compulsive hoarding, difficulty discarding, acquisition, cognitive-behavioral model

Hoarding Disorder (HD) is a common and debilitating psychiatric condition, characterized by high degrees of comorbidity, and is acknowledged as a separate diagnosis in the 5<sup>th</sup> edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5; American Psychiatric Association, APA, 2013). HD – or compulsive hoarding, as it has been frequently termed – is characterized by the strong urge to save items and/or distress associated with discarding them, giving rise to clutter (APA, 2013; Frost & Hartl, 1996). Without intervention, the accumulation of possessions fills and clutters active living areas so that their intended use is compromised significantly (APA, 2013). Impediment and concerns about safety and hygiene are characteristic of hoarding (Frost & Gross, 1993). The homes of individuals with hoarding problems range along a continuum from somewhat cluttered to neglected and typified by squalor (Frost, Steketee, Williams, & Warren, 2000; Kim, Steketee, & Frost, 2001), although not all domestic squalor is associated with hoarding, nor does all hoarding result in squalor (Snowdon, Pertusa, & Mataix-Cols, 2012).

Frost and Hartl (1996) proposed a cognitive-behavioral model of HD that highlighted information processing and decision-making difficulties, maladaptive attachment to possessions and erroneous beliefs about the nature of possessions as key factors in hoarding. Given the high degree of comorbidity with major depression (e.g., Frost, Steketee, & Tolin, 2011), mood factors are considered important in the etiology and maintenance of hoarding, while negative emotional states such as anxiety, grief, guilt, and anger are also common. In an attempt to avoid such negative emotions, those with hoarding problems avoid discarding (Wheaton, Abramowitz, Franklin, Berman, & Fabricant, 2011) and, therefore, prevent the processing of corrective feedback, thus maintaining dysfunctional beliefs.

Elements of the cognitive-behavioral model of HD have been examined separately in various studies (for a review see Woody, Kellman-McFarlane, & Welsted, 2014). For example, Steketee, Frost, and Kyrios (2003) identified a range of erroneous beliefs associated with hoarding. Emotional attachment to possessions, concerns about remembering information about possessions, an inflated sense of responsibility for possessions and the need to control possessions were found to differentiate a hoarding cohort from OCD and community controls. Furthermore, along with age and OCD symptoms, beliefs about memory, control, responsibility, and decision-making fears in relation to objects demonstrated significant unique predictive utility with respect to hoarding severity.

While information processing difficulties were implicated in the Frost and Hartl (1996) model, this continues to be an under-researched and complex area of enquiry. Memory and other cognitive deficits, selective attention, decision-making processes, metacognitive factors, beliefs and cognitive styles, and attachment to possessions, amongst other factors, may all contribute to information processing difficulties. Woody et al. (2014) recently reviewed the contribution of specific cognitive processes, such as decision-making, categorization, and attention, in HD. They concluded that hoarding is consistently associated with planning/problem-solving decisions, visuospatial learning and memory, sustained attention/working memory, and organization deficits, although further research is required to understand inconsistent findings in areas such as categorization/concept formation, visuospatial processing, and inhibitory control.

Decision-making difficulties are described in the Frost model as reflecting indecisiveness derived from concerns about making mistakes, especially with regard to the consequences of

discarding, and have been reported consistently as being associated with hoarding. Decision-making fears have been linked empirically with poor confidence in memory (Nedeljkovic, Moulding, Kyrios, & Doron, 2009) and hoarding phenomena such as difficulties with discarding (Frost & Gross, 1993; Frost & Shows, 1993; Steketee et al., 2003; Wincze et al., 2007). In a study of the neural mechanisms of impaired decision making in HD, Tolin et al. (2012) reported that, compared to participants with OCD and healthy controls, those with HD demonstrated stimulus-dependent abnormal brain activity, suggesting that information processing may be associated with the personal meaning of objects rather than global impairment per se. Overall, Steketee et al. (2003) further support the importance of both beliefs about objects and decision-making difficulties in hoarding. Studies support that participants with hoarding problems report significantly less confidence in their memory, more concerns about the perceived serious and detrimental consequences of forgetting information, and a need to keep items in close proximity (Hartl et al., 2004; Steketee et al., 2003).

In addition, researchers have suggested that early developmental factors, such as trauma and early deprivation are important in understanding the etiology of hoarding (e.g., Cromer, Schmidt, & Murphy, 2007). Supporting Landau et al. (2011) who found a relationship between the number of traumatic events and hoarding severity, Hartl, Duffany, Allen, Steketee, and Frost (2005) linked traumatic experiences in people who hoard to greater comfort derived from possessions. Furthermore, Frost and Gross (1993) reported that almost one third of a hoarding cohort had experienced material deprivation, possibly supporting a “compensation” model of hoarding, although material deprivation was not significantly

greater among the hoarding cohort compared to a non-clinical one. While material deprivation may not constitute a specific vulnerability to hoarding as a number of studies have failed to find a notable association with hoarding severity (Landau et al., 2011; Seedat and Stein, 2002), the notion that hoarding of objects might constitute a compensatory defense for feelings of deprivation may be useful in understanding motivational factors in hoarding.

Similarly, attachment may also constitute a useful developmental construct that relates to hoarding in specific ways. For instance, compensatory attachment to objects and hoarding-related cognitions such as the sense of responsibility towards objects, the need to exercise control over possessions, and the focus on maintaining strong memories about objects (Steketee et al., 2003) may be aimed at defending individuals from uncertainty and threat related to the self, world and others and to be rooted in negative early developmental experiences and dysfunctional attachments (Guidano & Liotti, 1983; Moulding, Mancuso, Rehm, & Nedeljkovic, 2016).

Frost, Kyrios, McCarthy, and Matthews (2007) reported that hoarding was associated with an uncertain sense of self worth, previously associated with negative developmental influences (Bhar & Kyrios, 2007; Guidano & Liotti, 1983). In support, comparing hoarding and non-clinical cohorts, Medard and Kellett (2014) found significantly higher levels of attachment anxiety and avoidance, as well as lower levels of social support in hoarders. Bartholomew and Horowitz (1991) have previously proposed that attachment style is manifested in internal working models of self and others, and that these dimensions can vary from positive to negative. Kyrios (1998) developed a measure of early developmental influences in hoarding, which includes subscales of recollections of warmth in family and

beliefs about self and others that could be applied as a marker of attachment influences (i.e., the Hoarding Early Developmental Influences Inventory [HEDII], see section Measures). Using this measure, Frost et al. (2007) reported significant correlations between hoarding symptoms and beliefs about self and others, but not lower recollections of family warmth in a sample of college students. However, the non-clinical nature of the Frost et al. (2007) cohort may account for the latter finding which conflicts with anecdotal evidence of cold and conflicted family environments in people suffering from hoarding problems (Frost & Steketee, 2010).

While previous research has generally been supportive of the cognitive-behavioral model of HD (Frost & Hartl, 1996), it has been limited by the use of non-clinical samples or by limited clinical samples that are compared to non-clinical controls. Furthermore, no studies have examined the range of categories of factors in the model simultaneously, nor have factors been examined that are indicative of attachment and early developmental experiences which might be useful in extending the cognitive-behavioral model. This would be advantageous as it could identify specific or unique factors or predictors associated with hoarding and its severity in order to shape psychological treatments. As such, this study aimed to examine the range of variables in the cognitive-behavioral model of HD across relevant clinical and non-clinical cohorts in order to examine the specificity and relevance of these factors to hoarding. In the current study, we used cohorts with hoarding but not OCD, hoarding and OCD, OCD and anxiety disorders without hoarding, and non-clinical controls. The clinical characteristics and hoarding phenomenology of these samples are described in a previous publication (Mogan, Kyrios, Schweitzer, Yap, & Moulding, 2012). The present

paper goes on to investigate how these groups differed across the range of factors in the cognitive-behavioral model of hoarding, inclusive of mood, cognitive and selected developmental factors, and examined their predictive utility with respect to hoarding severity across the total sample.

It was hypothesized that the hoarding groups would show higher levels of cognitions theorized to be hoarding-relevant, greater need to hold possessions in view and greater consequences assigned to forgetting. In addition, it was expected that the hoarding groups would have generally poor mood, poor meta-memory beliefs and report compromised beliefs about self and others. Furthermore, given the clinical nature of the hoarding cohorts, lower levels of warmth in recollections of parenting were expected amongst hoarding groups. In order to examine the relative importance of these factors to hoarding symptoms, we also examined their combined prediction of hoarding severity in the combined sample. It was expected that negative mood, greater hoarding-relevant cognitions, factors indicative of poorer information processing, compromised views of self and others, and poorer recollections of family warmth would be significant unique predictors of hoarding severity.

## **Method**

### **Participants**

A total of 89 clinical participants and 20 community controls were recruited from clinical (e.g., University of Melbourne's Professorial and Psychology Clinics, community OCD support groups) and non-clinical populations (for more information see Mogan et al., 2012). Participants were screened to exclude those with psychosis, dementia, and related disorders. The age range of participants was 18-65 years ( $M=47.4$ ,  $SD=12.5$ ), with the majority of the

total sample being female (65%, n=71). Structured interviews were administered to verify diagnosis (see Measures section). Five groups participated with diagnostic status as indicated: 23 individuals diagnosed with hoarding and OCD; 26 individuals with hoarding and without OCD; 20 participants diagnosed with OCD but not hoarding; 20 participants fulfilling DSM-IV criteria for Panic Disorder or Social Anxiety Disorder but not OCD; along with a community control group of 20 participants, matched overall with the hoarding cohort for age, gender and level of education, with no DSM-IV (APA, 2000) diagnosis nor a psychiatric history as determined at screening.

As noted in a previous paper on the phenomenology of hoarding symptoms (Mogan et al., 2012), no significant differences were found between the cohorts on gender, marital status, or education status. There were significant but small magnitude age differences across the cohorts, with post hoc tests indicating that non-clinical controls were significantly older than the OCD cohort. As is typical in hoarding studies, the hoarding without OCD cohort was significantly older than the anxiety and OCD cohorts (Pertusa et al., 2008). Expected differences were found across the groups on hoarding symptom and severity measures, with post hoc tests showing that the hoarding with and without OCD cohorts had similar scores, but that they scored significantly higher than the other groups on hoarding measures (Mogan et al., 2012).

### **Procedure**

The general procedure is described in detail elsewhere (Mogan et al., 2012). In summary, following a media campaign and promotions within relevant clinics, participants made contact with the research team to indicate interest in the study. Participants were then

contacted by the research team who arranged interviews, including structured diagnostic interviews, whether face-to-face for metropolitan-based enquirers or through the telephone for rural or interstate respondents. Each participant was provided with an information pack comprising: (1) a description of the study, a consent form, and detailed explanatory material on the study written in plain English; and (2) demographic questionnaire packages with replied paid envelopes. Ethical approval was granted by the relevant university Human Research Ethics Committee.

## **Measures**

### **Diagnostic Screening**

The Anxiety Disorders Interview Schedule was used to establish DSM-IV diagnostic criteria for OCD and Anxiety Disorders (i.e., Panic Disorder or Social Anxiety Disorder). As the study was conducted prior to the release of DSM-5 (APA, 2013), formal diagnoses of HD could not be made. However, the structured Hoarding Interview, which was used, assesses all aspects relevant to the hoarding criteria later incorporated into the DSM-5 [i.e., excessive acquisition, difficulty discarding, excessive clutter and psychological and environmental impact (APA, 2013)].

*The Anxiety Disorders Interview Schedule for DSM-IV (ADIS-IV; Adult Version)*. The ADIS (DiNardo, Brown, & Barlow, 1994) is a much-utilized anxiety disorders semi-structured clinical interview covering DSM-IV criteria for anxiety and related disorders. Interviewers assess the presence of symptoms and rate severity, distress level and interference. The ADIS-IV has been associated with excellent diagnostic reliability for various anxiety disorders (Brown, Di Nardo, Lehman, & Campbell, 2001).

***The Hoarding Interview.*** The Hoarding Interview (HI; Steketee & Frost, 2007) is a 13-item interviewed-based screening schedule providing descriptive information on the phenomenology of hoarding, and includes an initial enquiry about cluttering of rooms, whether others had suggested reduction of clutter, specific questions about the severity of clutter, impaired functionality of different rooms, distress caused, and whether or not clutter presented a safety or health risk. Other issues covered include age of onset of hoarding, difficulties in acquiring and discarding things, and interviewee appraisal of whether or not clutter creates personal or social problems. The HI was used to confirm diagnosis of HD.

### **Hoarding Severity Measure**

***The Saving Inventory – Revised (SI-R).*** The SI-R (Frost, Steketee, & Grisham, 2004) is a 23-item self-report scale designed to measure severity of each of the three major features in the definition of HD (Frost & Hartl, 1996), i.e., severity of acquisition, amount of clutter, and difficulty discarding possessions, as well as the distress and interference caused by these phenomena. The presence of HD phenomena are scored on a rating scale of 0 (no distress) to 4 (extreme distress). Frost et al. (2004) reported good internal consistencies of the measure. As reported in Mogan et al. (2012), excellent internal consistency was shown for the SI-R in the current cohort, with a Cronbach's  $\alpha$  of 0.98 Internal consistencies for all other measures were also  $> .90$  (see Table 1).

### **Affect Measures**

***The Beck Depression Inventory – II (BDI-II).*** The BDI-II (Beck, Steer, & Brown, 1996) is a well-established clinical tool for measuring unipolar depression in adults and adolescents. The 21 self-report items are measured on a 4-point severity scale, with higher scores

indicating more severe depression. Beck et al. (1996) reported satisfactory internal consistency and good construct validity of the BDI-II.

***The Beck Anxiety Inventory (BAI)***. The BAI (Beck, Epstein, Brown, & Steer, 1988) is a 21-item measure of common symptoms of anxiety, with an emphasis on physiological symptoms of anxiety. Respondents rate the symptoms over the past week, with higher scores indicating more severe anxiety. Adequate internal consistency and validity have been reported for both clinical and non-clinical participants (Beck & Steer, 1991).

### **Cognitions and Meta-Memory Measures**

***The Saving Cognitions Inventory (SCI)***. The SCI (Steketee et al., 2003) is a 31-item measure of the beliefs underpinning the Frost and Hartl (1996) model of HD. The measure comprises of four subscales, including memory concerns, perceived value, and sense of responsibility associated with possessions, the emotional attachment to possessions, and fears about losing control over possessions. All items are scored on a 7-point Likert scale. Internal consistency was satisfactory for the total scale and the subscales (Steketee et al., 2003). As Steketee et al. (2003) indicated substantial correlations between all SCI subscales and hoarding severity, the SCI total score was to be used to examine group differences in the current study.

***Possessions in View Scale (PIVS)***. The PIVS (Hartl et al., 2004) is an 11-item self-report questionnaire that assesses how much keeping possessions in view serves as a retrieval cue on a 5-point Likert scale. Higher scores indicate stronger need to keep possessions in view. Internal consistency of the PIVS was reported to be adequate (Hartl et al., 2004).

*Memory and Cognitive Confidence Scale (MACCS)*. The MACCS (Nedeljkovic & Kyrios, 2007; Nedeljkovic et al., 2009) is a 28-item self-report questionnaire designed to evaluate confidence in one's memory, planning, concentration and decision-making. Items relating to visual and verbal memory, memory for actions and reality monitoring, planning, and decision-making and memory performance are included. Items are scored on a 5-point Likert scale, with higher scores indicating less confidence in memory. Nedeljkovic and Kyrios (2007) reported satisfactory internal consistency coefficients for both total and subscales score.

*Consequences of Forgetting Scale (COFS)*. The COFS (Hartl et al., 2004) is a 10-item self-report questionnaire assessing the perceived consequences and severity of consequences of forgetting information. Items are scored on a 5-point Likert scale, with greater scores indicating more perceived consequences and severity of consequences of forgetting information. Satisfactory internal consistency was previously reported (Hartl et al., 2004).

*Frost Indecisiveness Scale (FIS)*. The FIS (Frost & Shows, 1993) is a self-report scale with 15 items designed to measure experiences of decision-making. There are two subscales representing fears about decision-making (nine items), and positive attitudes towards making decisions (six items); for the current study only the fear about decision-making subscale was used. Adequate internal consistency has been shown previously in clinical and non-clinical cohorts (Frost & Shows, 1993; Kyrios, Steketee, Frost, & Oh, 2002).

### **Developmental Measure**

*The Hoarding-Related Early Developmental Influences Inventory (HEDII)*. The HEDII (Frost, McCarthy, Matthews, & Kyrios, 2005; Kyrios, Frost, Steketee, & Mogan, 2005) is a

21-item scale derived from the Early Developmental Influences Inventory (EDII; Kyrios, 1998), an inventory developed to assess individuals' perceptions about early family experiences, attachment styles and current interpersonal relationships, and self-image. The HEDII consists of two subscales: (a) 'Uncertainty', which aims to assess ambivalent patterns of attachment, such as uncertainty about oneself and others – e.g., “*Ever since I can remember, I have found it difficult to trust myself*”; “*As far back as I can remember, I have wondered what others really think of me*”; and (b) 'Warmth', assessing memories of warmth and security in one's family – e.g., “*My early childhood featured a constant sense of support*”; “*Love was always expressed openly in my family.*”. Frost et al. (2007) reported satisfactory internal consistency for both Uncertainty and Warmth factors.

## Results

### Statistical Analyses

Analyses were performed using SPSS version 22.0. In order to examine differences on variables across the five cohorts, a series of one-way ANOVAs was utilized using planned contrasts. The following orthogonal pairwise comparisons were tested: all clinical groups vs. non-clinical controls,<sup>1</sup> the two hoarding groups vs. the two clinical non-hoarding (OCD and anxiety) groups, and the one hoarding with OCD vs. the other hoarding group without OCD. Before ANOVAs were conducted, assumptions were tested including normality distribution of dependent variables, and homogeneity of variances. Power transformations were used to account for violation of normality distributions (e.g., BAI, SCI, Uncertainty, Warmth), and

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<sup>1</sup> Although it was expected to find differences on measures of hoarding, mood and anxiety between clinical groups and non-clinical controls, predictions of group differences on the developmental variables was less clear.

violation of homogeneity of variances (e.g., BDI, BAI, SCI, PIVS); however, these did not change any of the outcomes of the tests. Previous analyses reported significant age differences across the five different cohorts (Mogan et al., 2012); therefore, all ANOVA analyses were also conducted while controlling for age; however, these did not change any of the outcomes of the tests.

In addition, to examine the extent to which cognitive and developmental factors predicted hoarding severity (measured with the SI-R total score), a hierarchical multiple regression analysis was conducted across the combined samples.<sup>2</sup> As previous analyses found significant age differences across the different cohorts (Mogan et al., 2012), indicating a potential association between age and hoarding severity, age was entered as a first step in the model. Subsequently, to control for the effects of depression severity on other variables, the BDI total score was entered in the model.<sup>3</sup> Following this, the two developmental variables were entered in one step (Warmth and Uncertainty), and finally the cognitive and meta-memory measures (SCI total,<sup>4</sup> FIS Fears subscale, and MACCS, PIVS, and COFS totals). No uni- or

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<sup>2</sup> Homoscedasticity of error variances for all predictor variables was tested across the five cohorts; no statistically significant differences were found (all  $p > .05$ ). Normality distributions of all dependent variables were assessed and confirmed. Thus it was decided to combine the five cohorts in order to increase statistical power.

<sup>3</sup> To control for the effects of anxiety severity on other variables, the BAI total score was included in a separate regression model; as the BAI total score was not a significant predictor of hoarding severity, nor did its inclusion substantially change any of the other results, for the purposes of parsimony, only the regression model controlling for depression severity is presented.

<sup>4</sup> As results for the SCI subscales did not differ from those for the SCI total, for the purposes of parsimony, only the latter are presented.

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multivariate outliers were detected and homoscedasticity of error variance could be assumed; bootstrapping with 2,000 iterations was performed, and supported the pattern of results.

### **Group differences**

Table 1 shows means and standard deviations for the relevant measures, with results from the univariate ANOVAs and planned pairwise comparisons.

*Affect measures.* For the BDI and BAI, there were significant between-group main effects; planned pairwise comparisons revealed large effect sizes where the clinical groups were more anxious and depressed than were the non-clinical groups, and the hoarding with OCD group was more anxious and depressed than the hoarding without OCD group. An additional significant medium effect was found for anxiety (BAI) comparing hoarding and non-hoarding clinical participants, indicating that the non-hoarding clinical group was more anxious compared to the hoarding cohort, although this seemed primarily due to the lower scores in the non-OCD hoarding group.

*Cognitions and meta-memory measures.* There were significant group differences between the clinical and non-clinical groups, and the hoarding and non-hoarding groups, respectively, on all cognitions and memory measures. Comparing the clinical with the non-clinical groups and the hoarding with the non-hoarding groups, overall, the clinical groups and the hoarding groups reported more extreme saving cognitions (SCI), greater need for possessions in view (PIVS), less confidence in memory (MACCS), greater perceived negative consequences of forgetting (COFS), and greater fears about decision-making (FIS Fears). Effect sizes were in the medium-to-large range (Hedges  $g$ : 0.47 – 1.90). Comparing hoarding groups with and without OCD, the only significant difference was found on the

saving cognition measure (SCI total), whereby those with comorbid hoarding and OCD reported significantly more extreme saving cognitions of a moderate magnitude. Overall, it can be concluded that both the clinical groups in general, and the hoarding groups in particular showed poorer meta-memory beliefs and greater decision-making difficulties than the non-clinical controls or non-hoarding participants, respectively, with the hoarding cognitions and possessions in view measures constituting the clearest discriminators.

**Developmental measure.** Again, for both developmental subscales, there were large, significant between-group differences. Planned pairwise comparisons indicated, firstly that the clinical groups scored higher on the measure of uncertainty about self and others in comparison to the non-clinical control group and, secondly, that the hoarding with OCD group reported higher scores in comparison to the hoarding without OCD group. On recollection of warmth in one's family, the clinical groups in contrast to the non-clinical groups, as well as the hoarding groups in contrast to than the clinical non-hoarding groups scored significantly lower; however, the two hoarding groups (with vs. without OCD) did not differ from each other.

### **Predicting hoarding severity**

Correlational analyses in the whole sample indicated that hoarding severity demonstrated high magnitude correlations with both the total ( $r = .79, p < .001$ ) and subscale saving cognitions (emotional attachment to possessions:  $r = .76, p < .001$ ; memory concerns:  $r = .69, p < .001$ ; sense of responsibility associated with possessions:  $r = .69, p < .001$ ; fears about losing control over possessions:  $r = .64, p < .001$ ). Furthermore, information processing (PIVS  $r = .63, p < .001$ ; MACCS  $r = .44, p < .001$ ; COFS  $r = .45, p < .001$ ) and decision-

making (FIS Fear  $r = .53, p < .001$ ) measures exhibited moderate magnitude correlations with hoarding severity. Recollections of warmth in one's family was also moderately correlated with hoarding severity ( $r = -.49, p < .001$ ), while uncertainty about self and others demonstrated a low magnitude but significant association with hoarding severity ( $r = .21, p = .034$ ).

In order to predict hoarding severity, a hierarchical multiple regression analysis was conducted using age, mood, developmental, and cognitive and meta-memory variables (see Table 2). For the purposes of parsimony, results with the SCI total score are reported in this paper rather than the individual SCI subscales. After controlling for age and depression severity which together explained a non-significant 4.7% of variance in hoarding severity [ $F(2,100) = 2.48, p = .089$ ], the two developmental measures (Warmth and Uncertainty) were entered and explained an additional significant 19.8% of variance [ $\Delta F(2,98) = 12.84, p < .001$ ]. However, only warmth was a significant unique predictor of hoarding severity indicating that participants who reported fewer recollections of warmth and security in one's family scored higher on the SI-R. As a final step, the cognitive and meta-memory variables were entered together and explained an additional significant and substantial 46.3% of variance in hoarding severity [ $\Delta F(5,93) = 29.48, p < .001$ ]. However, only saving cognitions and fears about decision-making emerged as additional significant predictors indicating that participants who reported greater saving cognitions and fears about decision-making scored higher on the SI-R. The final model explained 70.8% of the variance in hoarding severity [ $F(9,93) = 25.06, p < .001$ ]; saving cognitions, recollections of a lack of warmth in one's

family and fears about decision-making emerged as unique predictors of hoarding severity while controlling for age and depression severity.

### **Discussion**

This paper presents evidence supporting the cognitive-behavioral model of HD (Frost & Hartl, 1996). While the model is both explanatory and descriptive, more recently, it has been augmented with an understanding of selected developmental and attachment-related factors that are thought to have etiological significance (Frost et al., 2007; Kyrios, 2013). The model predicts that people with hoarding problems will report greater mood difficulties, maladaptive saving-related cognitions, need to keep possessions in view, negative consequences of forgetting, decision-making difficulties, lower confidence in their memory, attachment-related issues, and will report negative developmental and attachment influences. This study aimed to examine the extent to which these characteristics are specific to hoarding by comparing various cohorts, including those with hoarding, OCD, comorbid hoarding and OCD, anxiety disorders, and non-clinical controls. Furthermore, the study aimed to examine predictors of hoarding severity across the combined groups. While the study focuses essentially on psychosocial factors, and uses a cross-sectional design, it is acknowledged that other etiologically relevant influences such as genetic and neurocognitive factors may need to be considered in future research.

In support of the hypotheses and previous literature (Frost et al., 2011), we found that, along with the other clinical groups, hoarding cohorts reported greater depression and anxiety than non-clinical controls. The hoarding groups did not differ from the non-hoarding clinical groups regarding their depressive symptoms; this is in line with previous research that found

a marginal trend for greater prevalence of bipolar I disorder but not major depressive disorders when comparing OCD patients with and without hoarding (Wheaton, Timpano, LaSalle-Ricci, & Murphy, 2008). Interestingly, the hoarding groups reported less anxiety (measured with the BAI) compared to the clinical non-hoarding cohorts, although this was due to the generally low anxiety levels in the hoarding without OCD cohort. Given the association of anxiety and depression (Cummings, Caporino, & Kendall, 2014), and the high degree of comorbidity of depression and anxiety disorders in patients with OCD and hoarding (Kessler, Chiu, Demler, Merikangas, & Walters, 2005), it is not clear as to why the hoarding without OCD cohort in the present study exhibited lower anxiety levels. The nature of the recruitment might explain the finding; perhaps the hoarding without OCD group might have been less anxious and thus more likely to volunteer to participate in the study, while those with comorbid hoarding and OCD who volunteered reported high anxiety levels due to the nature of the comorbidity. Alternatively, the focus of the BAI on physiological symptoms might indicate the need to examine differential cognitive, behavioral and affective aspects of anxiety in future research. For instance, high levels of comorbid generalized anxiety disorder (GAD) in hoarding disorder (Moulding, Nedeljkovic, Kyrios, Osborne, & Mogan, 2016) could be indicative of cognitive elements of worry associated with anxiety.

As expected, the hoarding cohorts differed from the clinical and non-clinical controls on cognitions theorized to be hoarding-relevant (Steketee et al., 2003). Hoarding groups alone reported greater saving cognitions, although participants with comorbid hoarding and OCD exhibited higher scores compared to those without OCD. Higher saving cognition scores in those with comorbid hoarding and OCD might be indicative of greater general disability

(Lochner et al., 2005). Hoarding participants also reported greater need for keeping possessions in view than the other cohorts with no differences found between hoarding cohorts with and without OCD. Confidence in memory was lower in the hoarding groups than the clinical non-hoarding and the non-clinical controls, although this seemed largely due to the higher confidence in memory in the anxiety disorder controls; again, there were no differences between hoarding participants with and without OCD. Hoarding groups rated the consequences of forgetting information as more serious and detrimental relative to non-hoarding clinical individuals and non-clinical controls. Hoarding groups also differed from clinical non-hoarding and non-clinical controls on decision-making fears. The specificity of hoarding-related cognitive factors to hoarding cohorts is consistent with the literature (Kyrios, 2013) and supports the need to target these in hoarding-specific psychological treatments (Steketee & Frost, 2007).

With respect to “developmental” influences, the hoarding groups recollected fewer experiences of warmth in their family environment, even relative to the other clinical groups. While reporting bias may account for some of these findings, (i.e., those with psychopathology perceive and/or report more childhood adversities, whether they in fact actually occurred), the distinctiveness of the poorer reported experiences of warmth amongst the hoarding cohorts is notable. Frost and Gross (1993) had previously reported that emotional deprivation in childhood was seen by affected individuals as contributing to their hoarding. It is possible that possessions might help people with hoarding problems compensate for negative early developmental influences by helping them experience a sense of security and safety to counteract early feelings of a lack of warmth (Cherrier & Ponnor,

2010). Alternatively, it could be that such a lack of warmth generally reflects a family environment that supports dysfunctional cognitions such as perfectionism and intolerance for uncertainty and their impact on the phenomenology of hoarding (Frost & Gross, 1993). The reported early onset of hoarding symptoms (Tolin, Meunier, Frost, & Steketee, 2010), in addition to previously reported early traumatic events in those affected by hoarding difficulties (Hartl et al. (2005), as well as our finding that the recollection of an absence of family warmth was a significant unique predictor of hoarding severity across the combined study groups, adds impetus to the need for longitudinal studies on the emergence of hoarding.

Frost et al. (2007) previously reported the association of self-ambivalence (i.e., uncertainty about self-worth; Bhar & Kyrios, 2007; Guidano & Liotti, 1983) and attachment uncertainty to materialism, hoarding severity, and compulsive buying. However, they used a non-clinical female student sample. The present study is the first to use clinical cohorts to support the importance of ambivalence (related to uncertainty both about self and others) and perceptions of early family experiences to hoarding. Hence, our study strengthens the view that, strong attachments to possessions seen in clinical hoarding might be derived from an early compromised developmental environment and emotionally driven processes that trigger compensatory strategies designed to defend the individual from uncertainty and threat (Kyrios, 2013) as well as helping them define their identity (Frost & Steketee, 2010; Moulding, Nedeljkovic et al., 2016; Moulding, Mancuso et al., 2016). Our findings strengthen the case for further exploration of motivational factors and their prequalae underpinning hoarding.

While the present findings implicate the importance of insecure attachments to hoarding, they do not support the specificity as all clinical groups differed from the non-clinical controls on the extent of uncertainty about self and others. The experiential qualities generally associated with negative views of self and others are related to anxiety and avoidance (Griffin & Bartholomew, 1994), although compromised self views are seen across all psychological disorders (Kyrios, Moulding et al, 2016). While insecure attachments are likely to be a general vulnerability across disorders (Mikulincer & Shaver, 2012), in hoarding, they may manifest in a tendency to acquire possessions in order to compensate for feelings of insecurity and hanging on to those possessions (i.e., failure to discard) in order to maintain a sense of security (Kyrios, 2013). Given that adult attachment is conceived as an emotion regulation system, it is not surprising that poor attachment is associated with higher levels of anxiety and mood dysregulation (Shaver & Mikulincer, 2014). This may account for consistent evidence of high levels of comorbid GAD in hoarding disorder (Moulding, Nedeljkovic et al., 2016), along with research implicating anxiety sensitivity and emotional regulation difficulties in hoarding (Coles, Frost, Heimberg, & Steketee, 2003; Phung, Moulding, Taylor, & Nedeljkovic, 2015; Timpano, Buckner, Richey, Murphy, & Schmidt, 2009). The inability to stop acquiring, to put things away or to discard things might relate to the symbolic representation of the self in the possessions that people with hoarding problems acquire and maintain. For instance, Cherrier and Ponnor (2010) concluded that motivations to accumulate, keep and avoid disposal of desired objects may reflect attempts to construct and maintain one's experiences in an integrated manner (see also Moulding, Mancuso et al., 2016), thus compensating for uncertainty about one's self worth (Guidano & Liotti, 1983).

With respect to the degree of association between hoarding severity and variables in the cognitive-behavioral model, as predicted, saving cognitions exhibited high magnitude correlations with hoarding severity measures (especially emotional attachment to possessions), while information processing and decision-making measures showed moderate magnitude correlations. The importance for keeping possessions in view may be related to emotional attachment to possessions (Phung et al., 2015) and also confidence in memory (i.e., beliefs about memory rather than memory performance per se). For example, Steketee et al (2003) reported that concern about memory was one of the strongest predictors of hoarding severity, even after controlling for relevant covariates. With regard to decision-making difficulties in individuals with hoarding, a recent systematic review summarizing evidence of cognitive deficits in hoarding (Woody, et al., 2014) concluded that it remains unclear whether indecisiveness is an issue that is specific to hoarding, especially as depressive symptoms are a strong confound in the relationship between indecisiveness and hoarding. Lower recollections of warmth in one's family were also moderately correlated with hoarding severity, while lowered mood and uncertainty in self and others and mood factors exhibited low magnitude or non-significant associations with hoarding severity. A study by Alonso et al. (2004) examining relationships between parental child-rearing practices and OCD symptom dimensions found that hoarding was the only dimension that could be predicted by parental factors, specifically by low parental emotional warmth, further supporting the present finding regarding the association between hoarding severity and recollections of lower early experiences of warmth in one's family.

With respect to the prediction of hoarding severity across the total sample, recollections about lower warmth in one's family, higher saving cognitions, and greater fears about decision-making were consistently significant and unique predictors of hoarding severity. No other cognitive variables emerged as significant unique predictors of hoarding severity, although this is likely due to the strong associations between the various cognitive factors. For instance, the need to keep possessions in view, which is related to "churning" behavior (Frost & Hartl, 1996) is highly associated with poor confidence in memory which, in turn, compromises decision-making and increases fears about the consequences of discarding (Kyrios, 2013; Steketee et al., 2003). Similarly, strong attachment to possessions is likely to impact on the need to keep possessions in view, the need to keep them in close proximity and fears about forgetting information or discarding them.

Overall, support was found for the cognitive-behavioural model of hoarding, although alternative models and variables were not compared (e.g., neurocognitive factors). Furthermore, the study exhibited some limitations. First, the study was conducted prior to the release of the DSM-5 (APA, 2013) and formal diagnoses could not be made. However, the structured hoarding interview we used discusses all aspects relevant to the hoarding criteria later incorporated into the DSM-5 [i.e., excessive acquisition, difficulty discarding, excessive clutter and psychological and environmental impact (APA, 2013)]. Second, another limiting fact is related to the difficulty in differentiating between individuals with OCD who hoarded as part of their OCD and individuals with OCD who had comorbid hoarding disorder. However, as we used clinical interviews, we are reasonably confident that all participants in the hoarding and OCD groups demonstrated only relevant symptoms, especially given the use

of disorder-specific measures of hoarding and obsessional phenomena. Nonetheless, studies comparing hoarding cohorts with a range of other clinical and non-clinical controls are rare in the literature, even rarer are those using the relatively new hoarding diagnostic criteria. Replications of such studies using DSM-5 diagnostic criteria for HD are warranted. Thirdly, the use of a cross-sectional/correlational design precluded the ability to examine the directionality of relationships; thus, investigating causal pathways of pathological hoarding was not possible with the current study. Fourthly, recruitment of participants following a media campaign may result in individuals with HD (or other mental disorders) who differ in important ways from those who are treatment seeking (e.g., less distressed regarding their symptoms). Lastly, with respect to the recollection of warmth and security in one's family, no secondary source confirmation of the family environment (e.g., description by siblings) was available, making it difficult to disentangle the HD participants' retrospective reports of their families and the current stress and conflict they may have with their family members as a result of their extreme clutter and possible treatment resistance. In addition, the uncertainty subscale of the HEDII which aimed to assess ambivalent patterns of attachment was not designed to operationalize to measure insecure attachment directly but might rather act as a marker of this construct. Furthermore, as the study did not control for mental health history of parents (e.g., hoarding), future research could include such additional variables.

In summary, the current study lends further support to the cognitive-behavioral model of hoarding. Furthermore, the findings extend the model to early developmental factors (i.e., recollections of family warmth), which may lead to compensatory emotional attachment to objects in individuals with hoarding. From a clinical perspective, it seems crucial to include

such developmental issues in case formulations and to incorporate the range of unique predictors and significant correlates of hoarding into treatment plans. Effective treatments for hoarding are emerging that target saving cognitions and hoarding-related information processing styles (Steketee & Frost, 2007; Moulding, Nedeljkovic et al., 2016). Early developmental factors and attachment patterns are likely to impact on therapeutic alliance, while identity issues are also important in etiological, maintenance and treatment processes (Kyrios, 2016). Consideration of the findings from the study may be important in fine-tuning treatments for HD.

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**Table 1: Mean scores on variables in the CBT model of hoarding across groups (standard deviations in parentheses)**

	5 cohorts					<i>F</i> Statistic	$\alpha$	Planned contrasts ( <i>Hedges' g</i> ; 95% CI)
	Clinical groups (C)		Non-clinical group (NC)					
	Hoarding groups (H)	Non hoarding groups (NH)						
Hoarding without OCD (HN) (n = 26)	Hoarding with OCD (HO) (n = 23)	OCD (O) (n = 20)	Anxiety disorder (A) (n = 20)	Controls (n = 20)			Clinical (C) vs non-clinical (NC) Hoarding (H) vs non hoarding clinical (NH) Hoarding with OCD (HO) vs hoarding without OCD (HN)	
Affect measures								
BDI	16.23 (12.31)	26.48 (14.48)	20.75 (13.64)	22.10 (13.01)	4.65 (3.66)	9.76***	.94	C > NC*** (1.32; 0.80-1.83) H = NH (0.03; -0.39, 0.45) HO > HN* (0.75; 0.17, 1.33)
BAI	10.04 (10.38)	17.78 (11.43)	16.30 (10.11)	22.10 (15.77)	4.75 (5.06)	7.90***	.94	C > NC*** (0.97; 0.47, 1.48) H < NH* (0.44; 0.02, 0.87) HO > HN* (0.70; 0.12, 1.28)
Cognitions and meta-memory measures								
SCI	95.54 (34.73)	111.48 (23.87)	54.95 (27.67)	42.40 (20.76)	42.85 (21.64)	31.69***	.97	C > NC*** (0.97; 0.47, 1.47) H > NH*** (1.90; 1.40, 2.40) HO > HN* (0.52; 0.05, 1.09)
PIVS	33.08 (10.33)	33.70 (7.46)	24.25 (9.18)	20.15 (5.91)	16.90 (5.36)	19.63***	.92	C > NC*** (1.20; 0.69, 1.71) H > NH*** (1.30; 0.84, 1.76) HO = HN (0.07; -0.49, 0.63)
MACCS	82.15 (21.75)	88.30 (23.24)	81.90 (24.11)	66.35 (21.22)	48.15 (15.30)	12.09***	.96	C > NC*** (1.42; 0.90, 1.94) H > NH* (0.47; 0.05, 0.89) HO = HN (0.27; -0.29, 0.83)
COFS	31.92 (8.22)	34.78 (6.75)	28.95 (10.02)	23.55 (9.15)	18.45 (7.24)	13.37***	.92	C > NC*** (1.29; 0.77, 1.80) H > NH*** (0.80; 0.37, 1.23) HO = HN (0.37; -0.19, 0.94)
FIS Fears	29.50 (8.04)	32.74 (8.52)	26.70 (7.93)	26.60 (6.38)	15.70 (6.42)	15.10***	.90	C > NC*** (1.70; 1.16, 2.23) H > NH** (0.55; 0.13, 0.98) HO = HN (0.39; -0.18, 0.95)
Developmental measures								
HEDII Uncert	29.28 (11.00)	39.27 (10.59)	35.40 (12.60)	36.63 (11.64)	16.80 (6.03)	14.56***	.92	C > NC*** (1.63; 1.09, 2.16) H = NH (0.17; -0.26, 0.60) HO > HN** (0.91; 0.31, 1.51)

HEDII	18.36 (7.57)	20.05 (10.37)	31.50 (9.46)	25.58 (11.72)	30.32 (9.10)	8.12***	.92	C < NC** (0.64; 0.14, 1.15)
Warmth								H < NH*** (0.95; 0.50, 1.40)
								HO = HN (0.18; -0.39, 0.76)

*Note:  $\alpha$ =Cronbach's alpha; CI = Confidence Interval; BDI=Beck Depression Inventory Total; BAI=Beck Anxiety Inventory Total; SCI=Saving Cognitions Inventory Total; PIVS=Possessions in View Scale Total; MACCS=Memory And Cognitive Confidence Scale Total; COFS=Consequences of Forgetting Scale Total; FIS-fears=Frost Indecisiveness Scale – Fears of making decisions; HEDII=Hoarding Early Developmental Influences Inventory; Uncert=Uncertainty about self and others subscale; Warmth=Absence of warm family experiences.*

\*\*\*  $p < .001$ ; \*\*  $p < .01$ ; \*  $p < .05$ .

**Table 2: Summary of hierarchical multiple regression for variables predicting SI-R Total scores (n = 109)**

Predictors	B	SE	$\beta$	<i>t</i>	<i>p</i>	Correlations		<i>R</i> <sup>2</sup>
						Zero-order	Semi-partial	
Model 1								.008
Age	-0.19	0.21	-0.09	-0.91	.364	-0.09	-0.09	
Model 2								.047
Age	-0.17	0.20	-0.08	-0.82	.415	-0.09	-0.08	
BDI	0.38	0.19	0.20	2.03	.045	0.20	0.20	
Model 3								.245 ***
Age	-0.16	0.18	-0.08	-0.85	.396	-0.09	-0.07	
BDI	0.11	0.21	0.06	0.52	.604	0.20	0.05	
HEDII Uncert	0.05	0.23	0.02	0.20	.843	0.21	0.02	
HEDII Warmth	-1.10	0.23	-0.46	-4.90	< .001	-0.48	-0.43	
Model 4								.708 ***
Age	-0.04	0.12	-0.02	-0.30	.767	-0.09	-0.02	
BDI	0.04	0.14	0.02	0.30	.763	0.20	0.02	
HEDII Uncert	-0.28	0.16	-0.14	-1.73	.088	0.21	-0.10	
HEDII Warmth	-0.54	0.16	-0.23	-3.50	.001	-0.48	-0.20	
SCI	0.39	0.06	0.58	6.79	< .001	0.79	0.38	
PIVS	0.32	0.24	0.13	1.33	.186	0.63	0.07	
MACCS	-0.05	0.10	-0.05	-0.53	.597	0.44	-0.03	
COFS	-0.11	0.22	-0.04	-0.48	.632	0.45	-0.03	
FIS Fears	0.70	0.25	0.24	2.78	.007	0.51	0.16	

*Note: BDI=Beck Depression Inventory Total; SCI=Saving Cognitions Inventory Total; PIVS=Possessions in View Scale Total; MACCS=Memory And Cognitive Confidence Scale Total; COFS=Consequences of Forgetting Scale Total; FIS-fears=Frost Indecisiveness Scale – Fears of making decisions; HEDII=Hoarding Early Developmental Influences Inventory; Uncert=Uncertainty about self and others subscale; Warmth=Absence of warm family experiences.*

\*\*\* *p* < .001; \*\* *p* < .01; \* *p* < .05