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# An Exploration of Comorbid Symptoms and Clinical Correlates of Clinically Significant Hoarding Symptoms

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## Abstract

**Background**—Hoarding Disorder is currently being considered for inclusion in the *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition*, yet remains poorly understood. Consensus is building that hoarding may constitute a separate disorder, although comorbidity remains high and complicates the diagnostic picture. The purpose of this investigation was to explore patterns of comorbidity among people who engage in hoarding behavior in order to better understand its clinical presentation and phenomenology.

**Methods**—Data were collected from a large internet sample (N = 363) of people who self-identified as having hoarding problems, met criteria for clinically significant hoarding, and completed all measures for this study. Participants self-reported their symptoms of disorders commonly co-occurring with hoarding (obsessive compulsive disorder [OCD], depression, and attention deficit hyperactivity disorder [ADHD]), along with other clinical problems. Results: Latent class analysis results indicated that the participants were grouped into three classes: "non-comorbid" hoarding (42%), hoarding with depression (42%), and hoarding with depression and inattention (16%).

**Conclusions**—Depression symptoms were the most commonly co-occurring symptom in this sample. Contrary to previous theory relating to hoarding etiology, OCD symptoms were not significantly co-occurring and a large percentage of the study participants were free from comorbid symptoms of OCD, depression, and ADHD. This suggests that hoarding disorder is not primarily the consequence of other psychiatric conditions. Implications for *DSM-5*, clinical treatment, and future research directions are discussed.

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## Keywords

Hoarding disorder; Obsessive Compulsive Disorder; Depression; Attention Deficit Disorder; DSM-5

## Rationale for Exploring Symptoms Co-occurring with Hoarding

Although hoarding disorder (HD) is being considered for inclusion in *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition*[1], it remains poorly understood. The disorder occurs in 2–5% of the population[2,3] and is associated with high levels of functional impairment [4,5]. Comorbidity occurs in up to 92% of individuals meeting proposed diagnostic criteria for HD[6,7]. Studies are needed to further delineate diagnostic co-occurrence and identify meaningful patterns of comorbidity among those who hoard. Of particular importance is better understanding heterogeneity within the clinical presentation of hoarding patients and how this might affect treatment progress and adherence. For example, some patients may engage in repetitive checking, or become easily distracted, or experience depression-related anhedonia or fatigue; any of these patterns of co-occurring symptoms could contribute to the difficulty discarding (and subsequent clutter) characteristic of HD. Patients have a mixed treatment response as some patients respond well but others have more entrenched behaviors that are more resistant to change. Understanding the challenges comorbidity can pose is an important area of inquiry. Below, we review four hypothesized patterns of comorbidity in hoarding and investigate associations of these comorbid patterns with behaviors and clinical features complicating the clinical picture.

### OCD and Hoarding comorbidity

Hoarding has historically been considered a subtype or dimension of obsessive compulsive disorder (OCD) and treatment seeking individuals in OCD clinics have reported hoarding symptoms[7–11]. However, these findings might be misleading for several reasons. The prevalence of hoarding has been estimated to be as much as twice that of OCD [3], which argues against the conceptualization of hoarding as a *subtype* of OCD. In samples with hoarding problems, fewer than 20% meet criteria for non-hoarding OCD[6,12]. Recent studies suggest individuals with HD are more likely to meet criteria for depression or other anxiety disorders than OCD[6] and anxiety disorder patients are more likely to endorse hoarding symptoms[13]. This does not suggest that hoarding and OCD are unrelated, as hoarding can be a symptom specific to OCD in some cases[14] and nearly 20% of individuals with HD have comorbid OCD[6]. For some, these symptoms may reflect HD or may be due to other OCD symptoms such as contamination concerns, checking compulsions or symmetry obsessions[12,15]. Symptoms of incompleteness, not just right experiences, and ordering and arranging compulsions have been found to correspond to hoarding among patients with OCD[16,17] and hoarding symptoms due to OCD[18]. OCD and hoarding also share perfectionism[19,20], poor memory confidence[21–23], and indecisiveness[16,19].

### Depression and Hoarding Comorbidity

Major depression is the most common comorbid condition, occurring in over half of people with HD[24]. Wu and Watson[25] reported that hoarding symptoms correlated nearly as strongly

with depression (r = .38) as with non-hoarding OCD symptoms (average r = .42). Individuals with comorbid depression might display more sadness, anhedonia and other depressive symptoms. Depressed hoarders might react to discarding items with a feeling of loss or grief consistent with a sense of loss reported for people with hoarding problems[26,27]. Behaviorally, fatigue-related avoidance and apathy may dominate the clinical picture, which is likely to interfere with treatment[28].

### ADHD and Hoarding Comorbidity

Impaired cognitive function (particularly inattention) is common in hoarding [29,30], although some evidence of impaired executive function [29,30] and memory [31] has also been obtained. Self-report measures show a similar pattern, with 28% of people with HD compared to 3% of OCD patients meeting full DSM-IV-TR diagnostic criteria for ADHD (inattentive subtype)[6]. The risk of ADHD among OCD patients is nearly ten times higher than for those without hoarding[32]. Attention deficits are hypothesized as one of the information processing problems underlying hoarding[33].

Individuals with comorbid ADHD might demonstrate hoarding thoughts and behaviors that are more closely related to neurocognitive dysfunction. They may report high levels of cognitive failures and impulsivity and their efforts to organize and discard items would be primarily hampered by distractibility and difficulties with executive functioning.

### Hoarding without Comorbidity

Some studies suggest the existence of a non-comorbid group, relatively free from psychiatric comorbidity. In their study of hoarding patients with and without OCD, Grisham and colleagues[34] demonstrated that a "pure hoarding" group reported significantly less negative affect and greater positive affect than participants with co-morbid OCD suggesting that a non-comorbid group may provide support for a distinct clinical syndrome. In the recent London Field Trial for hoarding disorder, 31% of the sample diagnosed with hoarding disorder did not receive a comorbid diagnosis[35]. Conversely, however, Frost et al. (2011)[6] found that only a small subset of HD patients did not meet diagnostic criteria for at least one other psychiatric disorder.

A group of people with hoarding behavior but without other comorbidities would be expected to show only sub-clinical symptoms of typically co-occurring conditions. They would also be expected to evidence non-clinical elevations when compared to people diagnosed with these disorders. However, given the impairments noted in patients with hoarding problems, we would expect them to have more severe clinical problems than non-psychiatric community samples.

The purpose of the current investigation was to identify potential patterns of comborbidity and related clinical correlates of hoarding in a community sample. Based on the current literature, we tested the following hypotheses:

1. Three distinct comorbid hoarding groups will be identified: OCD, depression, and ADHD.

2. Each of these comorbid hoarding groups will be differentiated by clinical correlates related to those conditions.

3. A hoarding group will be identified that is not comorbid with OCD, depression or ADHD.

4. Compared to people who hoard with comorbid symptoms, the non-comorbid hoarding group will report lower levels of symptomatology across the three comorbid disorders and their clinical correlates.

5. Compared with non-psychiatric norms, the hoarding only group will report greater impairment in symptoms related to OCD, depression, and ADHD.

## Method

### Participants and procedure

Participants were recruited from a database of people who have contacted the researchers over the past 5 years for information about hoarding. Potential participants were invited to participate by e-mail. Online data collection occurred from September 15, 2009 to October 19, 2009. Of the 1695 respondents, 1639 (97%) consented to the study procedures and 852 (52%) self-identified as having hoarding symptoms. Thirty-one (4%) discontinued participation midway through the study procedure, leaving a sample of 821 people. Of this group, 535 met symptom criteria for clinically significant hoarding. Missing data reduced the sample to 363, the majority of whom were female (95%) and White (98%), with a mean age of 52.8 (SD=10.3, range=26 to 80). Little's missing completely at random (MCAR) test established that all data were missing completely at random, which allowed us to analyze this smaller sample without concern for bias in the parameter estimates ($\chi^2 = 159.37$, $p =.$ 09). When available cases were analyzed using t-tests and chi-square tests, the sample with missing data did not differ statistically from the analyzed sample with regard to demographic characteristics or symptoms of depression, OCD, or ADHD inattention (all $p$ values > .05). A trend was noted suggesting that the group with incomplete data reported higher levels of hyperactivity (9.17 versus 10.19; t =−1.94, $p$=.053). A flowchart of participation is shown in Figure 1.

This study was approved by the Institutional Review Boards at Hartford Hospital, Smith College, and Boston University. Recommendations for human subjects' protection for web-based studies were followed[36] and informed consent was obtained before data collection began. As incentive, participants were given an email address to enroll in a raffle to receive a self-help book on compulsive hoarding.

### Instruments

Hoarding was determined using the Hoarding Rating Scale-Self Report (HRS-SR[4]). The scale consists of 5 Likert-type ratings from 0 (none) to 8 (extreme) of clutter, difficulty discarding, excessive acquisition, distress, and impairment. The self-report version correlated highly with the interview version ($r$=.74–.92) and demonstrated 73% diagnostic agreement[37]. Participants were classified as having clinically significant hoarding if they reported moderate (score of 4) or greater for difficulty discarding and clutter, and moderate

or greater distress or impairment in functioning related to hoarding symptoms. It should be noted that the classification was of clinically significant hoarding rather than HD since the necessary exclusion criteria could not be evaluated using the survey format.

Depression, anxiety, and stress was measured using the 21-item version of the Depression, Anxiety, and Stress Scales (DASS[38]) for which item responses indicated the severity and frequency of symptoms on a Likert-type scale ranging from 0 (did not apply to me at all) to 4 (applied to me very much). The *depression scale* assessed depressed affect and the Cronbach's alpha was α=.93. Individuals were classified as having depression if their ratings exceeded 21, which indicates severe depression[39]. The *anxiety scale* assesses autonomic arousal, physiological hyperarousal, and the subjective feeling of fear (α=.83). The *stress scale* items measure tension, agitation, and negative affect (α=.87).

ADHD symptoms were measured using the ADHD Symptom Scale (ADHDSS)[40], which contains the 18 symptoms for ADHD found in the *DSM-IV-TR.* Items were answered on a Likert-type scale from 0 (rarely) to 3 (very often). Both inattention (α=.88) and hyperactivity (α= .83) were measured. Individuals who endorsed six or more inattentive symptoms as occurring "often" were classified as having ADHD-inattentive type. If six or more hyperactivity symptoms were endorsed as "often" occurring they were classified as having ADHD-hyperactivity type. When both were present, they were classified as having ADHD-combined type.

OCD symptoms were measured with the Obsessive-Compulsive Inventory-Revised (OCI-R)[41]. This 18-item instrument contains six 3-item subscales that assess checking, washing, ordering, obsessing, neutralizing, and hoarding. Responses were made on 5-point Likert-type scales that ranged from 0 (not at all) to 4 (extremely). Hoarding items were excluded from the summed scale (α=.89). Participants with scores higher than 21were classified as having OCD, a score that has differentiated people with and without OCD[41]. In addition to the summed score, the five 3-item subscales of checking (α=.79), washing (α=.75), ordering (α=.84), obsessing (α=.82), and neutralizing (α=.68) were used to assess these symptoms.

Fears about making wrong decisions were measured using the 9-item *Frost Indecisiveness Scale* (FIS)[42] (α=.87). Excessive concern and focus on thoughts was measured by the 14-item *Cognitive Self-Consciousness Scale* (CSCS)[43]. The 25-item *Cognitive Failures Questionnaire* (CFQ)[44] was used to assess failures in perception, memory, and motor function, including 'slips of the mind' and lapses in concentration (α=.92). The 15-item *Confidence in Memory Scale*[45] measured concern about one's own recollections (α=.96). The 16-item Obsessional Beliefs Questionnaire-Perfectionism subscale[46] was used to measure perfectionistic thinking and beliefs (α=.95).

The 13-item *Brief Self Control Scale* (BSCS)[47] was used to measure five domains of self-control: controlling thoughts, controlling emotions, controlling impulses, regulating behavior/performance, and habit-breaking (α=.82).

Emotional reactivity was measured by the *Emotional Reactivity Scale* (ERS)[48], a 21-item self-report measure assessing domains of emotional sensitivity, arousal/intensity, and persistence. A modified version was used to measure participants' mean expectations for

feeling sadness (α=.86), fear (α=.91), disgust (α=.88), anger (α=.90), and not just right feelings (α=.91) when discarding a variety of household objects (clothing, food, housework-related items, sentimental possessions, craft-related items, office supplies, and paper items).

The 23-item *Saving Inventory-Revised* (SI-R) [27] assessed the severity of clutter (α=.90), difficulty discarding (α=.83) and problems with acquiring (α=.84 respectively). The 16-item *Activities of Daily Living Scale-Hoarding* (ADL-H) [49] examined impairment (e.g., use refrigerator, use stove, sit on sofa/chair) related to hoarding behavior (α=.91).

The 15-item *Home Environment Index* (HEI; [50] measured squalor in the home (e.g., exposed wiring, moldy or rotten food, or presence of insects) (α=.89).

Hoarding behaviors were measured with a 31-item *Hoarding Behavior Inventory* (HBI), developed for the current study. The scale was based on expert agreement regarding behaviors typically seen in hoarding patients. A principal components analysis with Oblimin rotation was conducted on the 31 hoarding behaviors. The KMO index of sampling adequacy was .88, indicating that the correlation matrix was suitable for factor analysis[51]. Parallel analysis[52,53] and visual examination of the scree plot suggested that a solution of no more than 3 components fit the data. Therefore, a 3-component solution was used (eigenvalues 9.04, 3.06, and 2.15); these components accounted for 45.99% of the variance. Correlations among the 3 components ranged from .09-.36. The first component (29.17% of variance, α =86) included items related to the proximity to and time spent with possessions and was therefore labeled *connectedness*. The second component (9.88% of variance, α =. 87) included descriptions of becoming cognitively or behaviorally distracted, as well as slowness and reduced productivity and was therefore labeled *distractibility*. The third component (6.95% of variance, α =.75) listed various attempts to cognitively or behaviorally avoid the clutter and was therefore labeled *avoidance.*

## Data Analyses

**Latent Class Analysis**—Latent class analysis[54] (LCA) was used to identify comorbid hoarding groups using the five dichotomous categorical variables of Depression, OCD, ADHD-inattentive type, ADHD-hyperactive type, and ADHD-combined type. LCA estimates the number of latent homogeneous classes in a heterogeneous sample by assessing the pattern of responses on a set of observed categorical variables. LCA is an iterative approach to model identification. First, we specified a one-class model that assumed sample homogeneity. Second, we specified models with an increasing number of latent classes, allowing for comparisons between models in order to find the best fitting model.

Model fit was evaluated using the Bayesian Information Criterion[55] (BIC), the adjusted BIC, the Lo–Mendel–Rubin likelihood ratio test[56] and the model entropy. Significantly lower BIC values reflect relatively better model fit. Lo–Mendel–Rubin likelihood ratio test is used to test models with different numbers of classes. Non-significant values indicate that a model with fewer classes ($K - 1$) is a better fit to the data. The entropy value ranges from $0 - 1$ and higher values indicate greater classification accuracy. LCA analyses were conducted in M*plus* version 6.1[57] using the default robust maximum likelihood (MLR) estimator using 500 random sets of starting values and 10 optimizations. A series of multinomial logistic

regression models were utilized to assess the clinical associations of each of these latent classes using PASW version 18[58]. Analyses were organized by theoretically related domains, testing six different models: Cognitive Concerns; Impulsivity, Obsessionality, Distress, Hoarding Severity, and Hoarding Topography.

## Results

### Latent Class Analysis

Four latent class models were tested. Table 1 displays the fit statistics of these models. The Lo–Mendel–Rubin likelihood ratio test demonstrated that the 3-class solution showed superior fit to the 2-class solution. Given the negligible difference in model BIC, a 3-class solution was selected. The entropy value (the total proportion of correct classification) was .81.

Figure 2 displays the latent classes. Class 1 (42% of the sample) had a high probability of endorsing depression and was therefore defined as a *depressed hoarding* group. Class 2 (16%) demonstrated a high probability for endorsing ADHD-inattention and depression and was labeled *inattentive-depressed hoarding* group. Class 3 (42%) was represented by a low probability of endorsing any of the four disorders and was therefore labeled a *non-comorbid* group. This group was used as the reference group in the following logistic regression models.

### Predictors of Class Membership

ANOVAs were conducted to determine if the three groups differed with regard to hoarding severity or age. Age was not statistically different for the groups $F(2,359)=2.80$, $p=.06$; $\eta^2=.02$). The three groups differed with regard to overall hoarding severity $F(2,359)=14.66$, $p<.001$; $\eta^2=.08$). Least squared difference tests revealed that the depressed hoarding group and the depressed-inattentive hoarding group both reported significantly more severe symptoms than the non-comorbid group (both $p$s < .0001). The results of the multinomial logistic regressions are reported in Table 2.

Results of Model 1 (Cognitive Concerns) indicated that when compared to the non-comorbid group, greater perfectionism was associated with the depressed hoarding group (Odds Ratio [OR]=1.04, $p < .001$), and greater indecisiveness was associated with the depressed-inattentive hoarding group (OR=1.07, $p <.05$). Both of these groups were associated with greater cognitive failures (OR=1.06, $p<.00$; OR=1.05, $p<.001$).

Results of Model 2 (Impulsivity) indicated that the depressed hoarding group (OR=0.92, $p<.001$) and the depressed-inattentive hoarding group (OR=0.88, $p<.001$) were associated with greater impulsivity. Results of Model 3 (Obessionality) indicated that the depressed hoarding group (OR=1.40, $p<.001$) and the depressed-inattentive hoarding group (OR=1.46, $p<.001$) were associated with greater obsessions. Results of Model 4 (Affective Distress) indicated that the depressed hoarding group was associated with greater anxiety (OR=1.06, $p<.001$), and the depressed-inattentive hoarding group was associated with greater disgust (OR=1.42, $p<.001$). Both of these groups was predicted by greater stress (OR=1.11, $p<.001$; OR=1.08, $p<.001$) and greater emotional reactivity (OR=1.02, $p<.05$; OR=1.03, $p<.05$, respectively).

Results of Model 5 (Hoarding Severity) indicated that the depressed hoarding group was associated with greater acquisition of objects (OR=1.16, $p$<.001) and the depressed-inattentive hoarding group was associated with greater problems with activities of daily living (OR=2.03, $p$<.001).

Results of the final model, Model 6 (Hoarding Topography), indicated that the depressed hoarding group was associated with greater connectedness (OR=1.07, $p$<.001) and greater avoidance (OR=1.09, $p$<.001). The depressed-inattentive hoarding group was associated with higher levels of squalor (OR=1.07, $p$<.001).

We tested the non-comorbid group against non-psychiatric norms on a variety of clinical measures (see Table 3.). Significant mean differences were noted for all clinical measures (all $p$ values < .001) except for stress and emotional reactivity.

## Discussion

Hoarding followed three primary patterns of diagnostic comorbidity. The first exemplified a "non-comorbid" hoarding group (42% of the sample) without clinically significant levels of OCD, depression or ADHD. Given the size of this group, the prevalence of comorbidity was lower than that noted in previous studies conducted within psychiatric populations[7]. This could be a function of our not including other disorders highly comorbid with hoarding such as generalized anxiety disorder and social anxiety disorder. However, this hoarding group was not entirely free of psychiatric symptoms, as this group evidenced significantly higher levels of depression, ADHD-inattention and hyperactivity, indecisiveness, cognitive failures, and anxiety, and less self-control were found when compared with non-clinical samples, suggesting that these symptoms might be considered associated features of hoarding. Less cognitive self-consciousness, and fewer OCD symptoms were reported compared to normative groups suggesting a lack of these concerns compared to some hoarding samples[59]. This group evidenced significant impairment in daily functioning compared to norms from an elderly sample.

The second group (42% of the sample), had a high probability of co-occurring depression and was characterized by high levels of impulsivity and acquiring behaviors, consistent with models of compulsive acquisition as a mood-regulation strategy[60,61]. This group was characterized by poor emotion-regulation strategies and self-control, suggesting a high likelihood of using external, maladaptive strategies to regulate mood. High levels of perfectionism and cognitive failures were also noted, suggesting decision-making problems.

The third group (16% of the sample) evidenced high rates of clinically significant depression and ADHD-inattentive symptoms. The percentage of people in this group is consistent with previously reported rates of ADHD-inattentive type in hoarders[6,62]. This group was associated with high levels of indecisiveness and cognitive failures, suggesting significant decision-making problems. These concerns comport well with current models of hoarding that emphasize decision-making impairments[63], and studies showing impaired capacity to sustain attention[29,64], problems of executive function[65] among individuals with HD, which may also be consistent with an ADHD presentation[66]. This group had greater difficulties in

activities of daily living, stress, as well as higher levels of domestic squalor, suggesting that inattention increases the severity hoarding-related impairment.

The absence of an OCD comorbidity group was noteworthy. Hoarding has been considered a subtype of OCD, and much of the extant hoarding research has been conducted within OCD clinics. However, studies of primary hoarding samples have suggested that the relation between hoarding and OCD is not as strong as previously thought[6,25]. However, it must be noted that in some cases, hoarding behaviors can be specific to OCD itself (in which case the diagnosis of HD would not apply) and therefore the relationship between OCD and hoarding remains complex.[14]

This study presents further evidence of the comorbidity involved in hoarding samples that may have implications for the cognitive behavioral model of hoarding[33], which suggests that information processing deficits such as problems with attention, categorization, and decision-making have etiological significance in hoarding. This may be especially true for the depressed-inattentive hoarding group as these tasks are difficult or aversive for people with ADHD. Similarly, the cognitive behavioral model hypothesizes that possessions provide comfort and security to people who otherwise feel vulnerable[33]. This may be especially true of the depressed hoarding group for whom excessive acquisition and saving may help to regulate dysphoria.

### Treatment considerations

Despite significant advances in treatment formulation for hoarding, hoarding remains difficult to treat[28,37]. The findings from the present study suggest several reasons why this might be the case. Of the three patterns of comorbidity we examined in this study, it appears that the non-comorbid hoarding group may be the easiest to treat. This group may respond very well to cognitive behavioral interventions targeting acquiring, and discarding possessions[28]. This group did not report the same degree of executive functioning difficulties that lead to poor treatment prognosis[37].

In contrast, the ADHD-inattentive-depressed hoarding comorbidity group may be the most difficult to treat. People with this comorbidity would likely have the most problems in terms of discarding and sorting their possessions[29,31,63]. Inattentive symptoms of ADHD have been shown to correlate with completion of homework assignments ($r$'s=-.42 and -.44)[67], and lack of homework completion has been found to predict poorer outcome[37]. In addition to CBT interventions for hoarding, adjunctive pharmacotherapy for ADHD difficulties may prove beneficial. By targeting the symptoms related to inattention, treatment compliance may improve, and problems in sorting possessions may also lesson. It should also be mentioned that the two comorbid groups had higher levels of hoarding symptoms, which could indicate that more severe hoarding could lead to these co-occurring symptoms.

The large sample size makes the application of latent class analysis possible, allowing for a unique exploration of the possibility of patterns of comorbidity with hoarding symptoms. Nevertheless, several limitations should be noted. First, the cross-sectional methodology precludes the examination of causal linkages between hoarding and the other psychiatric symptoms included in this study. The study also lacks a structured clinical interview, so

formal diagnoses were not possible. This may affect the validity of the study results. Moreover, a complete diagnostic battery was not feasible within the context of the current study and therefore other diagnostic comorbidity could not be examined (e.g., with traumatic stress). Although the internet methodology allowed recruitment of a large sample, it may have been biased toward higher functioning individuals. Another limitation is that participants in this study did not complete all study measures. Although compete case analysis was appropriate, structuring the online responses in such a way as to limit participant non-response, or following-up with respondents to complete missing questions, should be considered in future online investigations. In addition, the sample was predominately female and white, limiting the generalizability of the study results. It is noteworthy that our sample was 95% female and the prevalence of the co-occurring symptoms would likely be biased as a greater number of women report depression, and ADHD is more commonly found in men.

## Conclusion

Despite these limitations, this study provides evidence of a unique group of people who have difficulty with hoarding but who are less distressed relative to other groups with significant co-occurring symptoms. It also supports previous research demonstrating the link between ADHD-inattention and depression to the disorder. It would be useful for future research to continue to focus on community samples, rather than specific psychiatric disorder populations, to enable a naturalistic investigation into the patterns of comorbidity. However, future research could be improved by involving structured diagnostic interviewing to better define the boundaries of the disorders under study. In addition, the validity of our hoarding diagnosis could be augmented by informant interviews or independent evaluation of the living space through photographs taken by study respondents of their homes. Furthermore, oversampling in order to account for the prevalence of psychiatric conditions, especially with regard to potential gender differences, should be considered. Continued investigations into potential genetic[59,68] and neurological relationships to the disorder could help to further tease apart the risk factors and potential treatments for hoarding.

## Acknowledgments

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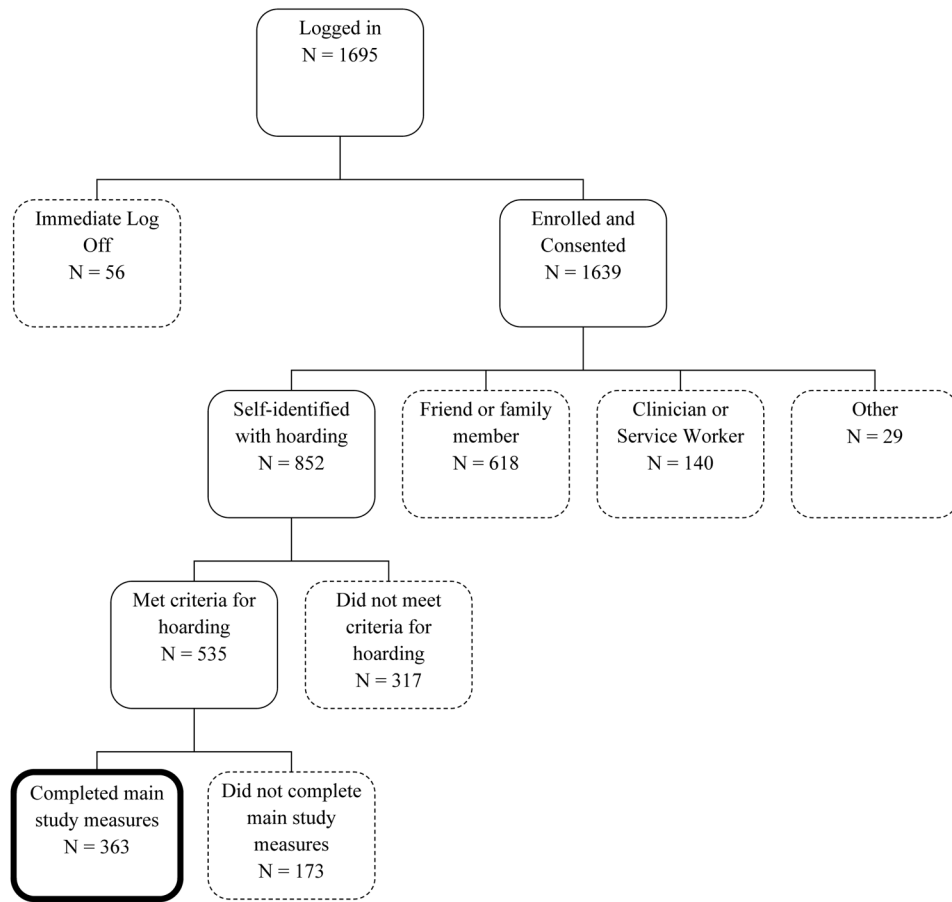
**Figure 1. Flow Chart of Participation**
Note: exclusions are indicated by dashed lines. Final sample is indicated by bold lines.
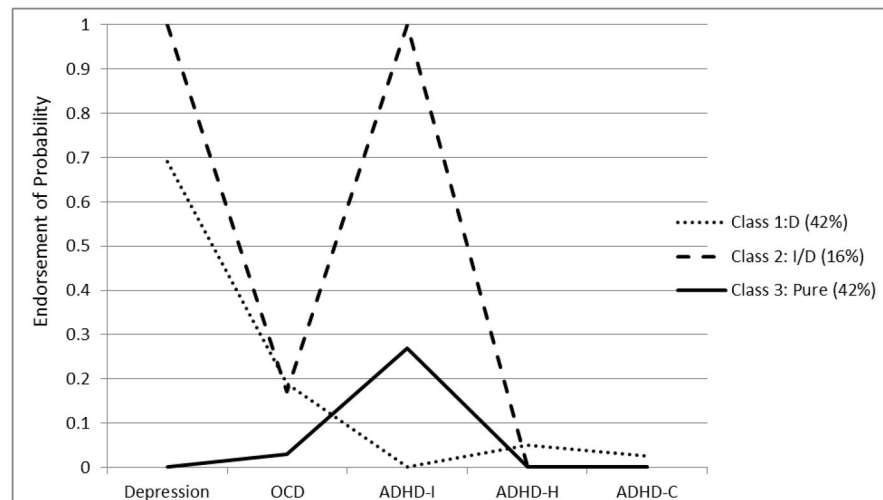
**Figure 2.**
Profile plot for the three-class model. Endorsement probabilities indicate the proportion of individuals in each class with each disorder.

Note. OCD = Obessive compulsive disorder; ADHD-I = Attention Deficit Hyperactivity Disorder, Inattentive type; ADHD-H = Attention Deficit Hyperactivity Disorder, Hyperactive type; ADHD-C = Attention Deficit Hyperactivity Disorder, Combined type; D =depressed hoarding group; I/D = Innatentive-depressed hoarding group.

**Table 1**

Fit statistics for a one-class to 4-class model.

| Latent class models | Fit statistics | | | |
|---|---|---|---|---|
| | BIC | Entropy | LMR-LRT value | *p* value |
| 1-class | 1538.24 | - | - | - |
| 2-class | 1530.79 | 1.00 | 41.63 | .0001 |
| 3-class | 1533.74 | .81 | 31.50 | .0001 |
| 4-class | 1562.22 | .80 | 6.68 | .16 |

*Note.* BIC=Bayesian Information Criterion. LMR-LRT=Lo–Mendel–Rubin Likelihood Ratio Test.

**Table 2**

Results of multinomial logistic regression analyses predicting latent class membership

| Variable | −2 log likelihood | χ²(2) | Class 1: Depressed | | | Class 2: Inattentive-depressed | | | Class 3: Non-comorbid |
|---|---|---|---|---|---|---|---|---|---|
| | | | M | Exp(B) | 95% confidence interval for Exp(B) | M | Exp(B) | 95% confidence interval for Exp(B) | Reference Category M |
| *Model 1: Cognitive Concerns* | 694.02 | 87.73** | B: −6.32 | | | B: −7.33 | | | |
| Frost indecisiveness scale | 611.13 | 4.84 | 28.61 | 1.01 | 0.97, 1.06 | 29.63 | 1.07* | 1.01, 1.13 | 24.03 |
| Cognitive self-consciousness scale | 606.48 | 0.19 | 36.02 | 0.99 | 0.96, 1.03 | 35.64 | 1.00 | 0.96, 1.05 | 33.06 |
| Cognitive failures | 628.59 | 22.29** | 60.57 | 1.06** | 1.03, 1.09 | 61.34 | 1.05** | 1.02, 1.08 | 47.57 |
| Confidence in memory | 609.95 | 3.65 | 44.19 | 1.00 | 0.98, 1.03 | 47.03 | 1.03 | 1.00, 1.06 | 34.35 |
| OBQ perfectionism | 633.88 | 27.58** | 80.12 | 1.04** | 1.02, 1.05 | 73.36 | 1.01 | 0.99, 1.03 | 59.00 |
| *Model 2: Impulsivity* | 236.84 | 34.22** | B: 2.89 | | | B: 3.27 | | | |
| Brief Self Control Scale | 256.60 | 53.99** | 33.09 | 0.92** | 0.89, 0.94 | 31.02 | 0.88** | 0.84, 0.92 | 38.49 |
| *Model 3: Obsessionality* | 641.36 | 83.31** | B: −1.39 | | | B: −2.04 | | | |
| OCI-R-washing | 559.72 | 1.67 | 1.49 | 1.09 | 0.90, 1.32 | 1.24 | 1.14 | 0.93, 1.41 | 0.49 |
| OCI-R-checking | 561.23 | 3.18 | 3.06 | 1.09 | 0.96, 1.23 | 2.12 | 0.96 | 0.81, 1.13 | 1.47 |
| OCI-R-obsessing | 597.56 | 39.51** | 3.61 | 1.40** | 1.23, 1.59 | 3.38 | 1.46** | 1.26, 1.69 | 1.25 |
| OCI-R-neutralizing | 561.40 | 3.35 | 1.98 | 1.11 | 0.92, 1.32 | 1.19 | 0.94 | 0.75, 1.17 | 0.72 |
| OCI-R-ordering | 558.78 | 0.73 | 4.02 | 1.00 | 0.90, 1.11 | 3.76 | 1.05 | 0.93, 1.19 | 2.68 |
| *Model 4: Distress* | 707.56 | 125.07** | B: −3.62 | | | B: −4.67 | | | |
| DASS − Anxiety | 587.61 | 5.12 | 14.20 | 1.06* | 1.01, 1.11 | 13.55 | 1.05 | 0.99, 1.11 | 6.02 |
| DASS − Stress | 600.54 | 18.05** | 20.68 | 1.11** | 1.06, 1.17 | 19.90 | 1.08** | 1.02, 1.15 | 10.45 |
| M-DES: Sad | 585.84 | 3.35 | 3.31 | 1.26 | 0.96, 1.65 | 3.57 | 1.28 | 0.91, 1.78 | 2.63 |
| M-DES: Fearful | 584.87 | 2.37 | 2.59 | 0.87 | 0.70, 1.09 | 2.83 | 0.83 | 0.64, 1.07 | 1.85 |
| M-DES: Disgusted | 586.69 | 4.20 | 1.66 | 1.11 | 0.84, 1.48 | 1.97 | 1.42* | 1.01, 2.00 | 0.95 |
| M-DES: Angry | 585.87 | 3.38 | 2.44 | 0.96 | 0.75, 1.21 | 2.45 | 0.77 | 0.57, 1.04 | 1.74 |
| M-DES: NJRE | 583.79 | 1.30 | 3.25 | 0.94 | 0.76, 1.16 | 3.68 | 1.10 | 0.84, 1.43 | 1.37 |
| Emotional Reactivity Scale | 591.99 | 9.50** | 52.79 | 1.02* | 1.01, 1.04 | 54.00 | 1.03** | 1.01, 1.06 | 34.33 |
| *Model 5: Hoarding Severity* | 711.45 | 30.36** | B: −2.44 | | | B: −4.33 | | | |

| Variable | −2 log likelihood | $\chi^2(2)$ | Class 1: Depressed | | | Class 2: Inattentive-depressed | | | Class 3: Non-comorbid |
|---|---|---|---|---|---|---|---|---|---|
| | | | M | Exp(B) | 95% confidence interval for Exp(B) | M | Exp(B) | 95% confidence interval for Exp(B) | Reference Category M |
| SI-R Clutter | 682.46 | 1.37 | 27.43 | 1.03 | 0.98, 1.09 | 28.48 | 1.02 | 0.95, 1.10 | 25.46 |
| SI-R Difficulty Discarding | 683.66 | 2.57 | 20.04 | 0.95 | 0.88, 1.02 | 20.67 | 1.01 | 0.92, 1.10 | 18.92 |
| SI-R Acquiring | 706.38 | 25.30** | 17.67 | 1.16** | 1.09, 1.23 | 17.16 | 1.07 | 0.99, 1.15 | 14.27 |
| Activities of Daily Living | 689.38 | 8.29* | 1.90 | 0.98 | 0.62, 1.54 | 2.21 | 2.03* | 1.18, 3.48 | 1.76 |
| *Model 6: Hoarding Topography* | 727.54 | 38.42** | B: −2.11 | | | B: −4.87 | | | |
| Home Environment Inventory | 700.16 | 12.04** | 32.99 | 1.02 | 0.99, 1.05 | 36.47 | 1.07** | 1.03, 1.11 | 31.59 |
| Hoarding behavior – connectedness | 700.65 | 12.53** | 13.73 | 1.07** | 1.03, 1.12 | 12.67 | 1.04 | 0.98, 1.09 | 9.81 |
| Hoarding behavior – distractibility | 690.29 | 2.17 | 19.52 | 0.99 | 0.94, 1.05 | 20.28 | 1.05 | 0.97, 1.13 | 17.73 |
| Hoarding behavior – avoidance | 692.66 | 4.54 | 5.81 | 1.09* | 1.01, 1.19 | 5.55 | 1.04 | 0.94, 1.15 | 4.61 |

*Note.* The $\chi^2$ indicates the difference between the −2 log likelihoods of the full model and the model is this independent variable was omitted. Exp(B) indicates that the odds ratio of being in the class as opposed to the reference category as a function of a one-unit increase of the independent variable. Means are reported for all variables. Higher values for the brief control scale indicates less impulsivity.

*
$p < .05$.

**
$p < .001$.

**Table 3**

Evaluating the impairment of the non-comorbid hoarding group by comparing them to norms

| Scale | Study | Population norms | Non-comorbid Hoarding | | Norms | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| | | | M | SD | M | SD | t | df |
| DASS – Depression | Lovibond & Lovibond, 1995 | n = 1771 nonclinical | 9.51 | 5.2 | 5.55 | 7.48 | 6.84 | 1944** |
| ADHD – Inattention | Ratchford et al., 2009 | n = 75 nonclinical | 10.75 | 5.2 | 3.1 | 4.2 | 11.26 | 248** |
| ADHD – Hyperactivity | Ratchford et al., 2009 | n = 75 nonclinical | 6.89 | 4.07 | 2.8 | 3.0 | 7.83 | 248** |
| *Cognitive Concerns* | | | | | | | | |
| Frost Indecisiveness Scale | Kyrios, Frost, & Steketee, 2004 | n = 85 nonclinical | 24.03 | 7.25 | 18.67 | 6.04 | 5.80 | 239** |
| Cognitive Self-Consciousness Scale | Cohen & Calamari, 2004 | n = 323 nonclinical | 33.06 | 8.2 | 36.94 | 7.4 | −5.38 | 496** |
| Cognitive Failures | Wallace, Kass, & Stanny, 2002 | n = 335 nonclinical | 47.57 | 12.57 | 43.46 | 17.02 | 2.82 | 508** |
| *Impulsivity* | | | | | | | | |
| Brief Self Control Scale | Tangney, et al., 2004 | n = 351 nonclinical | 36.77 | 4.77 | 39.22 | 8.58 | −3.52 | 524** |
| *Obsessionality* | | | | | | | | |
| OCI-R-washing | Foa et al., 2002 | n = 477 nonclinical | 0.49 | 1.24 | 2.41 | 2.5 | −9.73 | 650** |
| OCI-R-checking | Foa et al., 2002 | n = 477 nonclinical | 1.47 | 1.85 | 2.91 | 2.56 | −6.82 | 650** |
| OCI-R-obsessing | Foa et al., 2002 | n = 477 nonclinical | 1.25 | 1.85 | 2.86 | 2.72 | −7.24 | 650** |
| OCI-R-neutralizing | Foa et al., 2002 | n = 477 nonclinical | 0.72 | 1.25 | 1.82 | 2.2 | −6.25 | 650** |
| OCI-R-ordering | Foa et al., 2002 | n = 477 nonclinical | 2.68 | 2.51 | 4.40 | 3.03 | −6.71 | 650** |
| *Affective Distress* | | | | | | | | |
| DASS – Anxiety | Crawford & Henry, 2003 | n = 1771 nonclinical | 6.02 | 5.65 | 3.56 | 5.39 | 5.73 | 1944** |
| DASS – Stress | Crawford & Henry, 2003 | n = 1771 nonclinical | 10.45 | 6.5 | 9.27 | 8.04 | 1.88 | 1944 |
| Emotional Reactivity Scale | Nock et al., 2008 | n = 87 Psychiatric | 34.33 | 16.84 | 36.66 | 17.52 | −1.04 | 260 |
| *Hoarding Severity* | | | | | | | | |
| SI-R Clutter | Frost et al., 2004 | n = 23 nonclinical | 25.46 | 5.5 | 8.2 | 7.1 | 13.65 | 196** |
| SI-R Difficulty Discarding | Frost et al., 2004 | n = 23 nonclinical | 18.92 | 4.1 | 9.2 | 5 | 10.41 | 196** |
| SI-R Acquiring | Frost et al., 2004 | n = 23 nonclinical | 14.27 | 4.68 | 6.4 | 3.6 | 7.76 | 196** |
| Activities of Daily Living | Steketee et al, 2010 | n = 25 nonclinical | 1.76 | 0.58 | 1.01 | 0.03 | 6.45 | 198** |

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*
$p < .05.$

**
$p < .01.$

***
$p < .001.$