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# Hoarding among outpatients seeking treatment at a psychiatric hospital in Singapore

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ABSTRACT

Hoarding symptoms commonly co-occur with other psychiatric disorders, such as major depressive disorder, and have been observed across cultures. Yet, few studies have examined hoarding in other disorders or in an Asian context. The present study aimed to determine: (1) the prevalence of clinically significant hoarding, (2) differences between participants with and without significant hoarding, and (3) predictors of hoarding severity in a Singaporean clinical sample. Five hundred outpatients with anxiety disorders, depressive disorders, schizophrenia, and pathological gambling completed a battery of questionnaires on hoarding, anxiety, depression, functional impairment due to clutter, and quality of life. Thirty percent of our sample reported significant hoarding. However, clutter levels in the hoarding group were low, and hoarding severity was not significantly linked to quality of life, after adjusting for anxiety and depression. In addition, depression – but not anxiety – predicted hoarding severity. Our results provide a cross-cultural perspective on hoarding symptoms, and replicate findings that support a link between depression and hoarding. The differential presentation of hoarding in our sample could be due to true cultural differences in hoarding pathology or to variant psychometric properties of the measures used. Further research evaluating hoarding in Asian contexts with different methodology is needed.



## 1. Introduction

Hoarding disorder (HD) is characterized by persistent difficulty discarding or parting with possessions, resulting in clutter that precludes the use of active living spaces for their intended purposes. It is included in the *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition* (DSM-5) as an independent disorder, and is accompanied by an excessive acquisition specifier (American Psychiatric Association [APA], 2013). Hoarding symptoms and their associated clutter cause significant distress and/or impairment in functioning, compromising individuals' ability to maintain a safe environment for themselves and those around them (APA, 2013). Beyond its impact on family members and neighbors, hoarding poses a substantial public health burden in terms of occupational impairment and social service intervention (Tolin, Frost, Steketee, & Fitch, 2008; Tolin, Frost, Steketee, Gray, & Fitch, 2008).

Prevalence estimates of hoarding in the general population range from 2% to 6% (Mueller, Mitchell, Crosby, Glaesmer, & de Zwaan, 2009; Nordsletten et al., 2013; Timpano et al., 2011), though figures may be higher among clinical samples due to the significant psychiatric comorbidity associated with HD (Frost, Steketee, & Tolin, 2011). For example, Tolin, Meunier, Frost, and Steketee (2011) found that 12–25% of their sample of patients with anxiety disorders had significant hoarding symptoms, while Frost, Meagher, and Riskind (2001) reported that pathological gamblers had more hoarding symptoms than light gamblers. In addition, more than 75% of patients with HD were found to have a co-occurring anxiety and/or mood disorder, with the most common diagnoses being major depressive disorder (MDD; 50.7%), generalized anxiety disorder (GAD; 24.4%), and social phobia (23.5%; Frost et al., 2011). Chiu, Chong, and Lau (2003) also found that 46.7% of their hoarding sample had received a formal diagnosis of schizophrenia.

The presence of hoarding in other disorders warrants clinical concern, given the unique impairment associated with such symptoms. Research has found that obsessive–compulsive disorder (OCD) patients who hoard experience higher levels of

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psychopathology (e.g., anxiety symptoms, lifetime suicidal attempts), worse functioning, and greater disability than patients with only OCD symptoms (Chakraborty et al., 2012; Frost, Steketee, Williams, & Warren, 2000; Samuels et al., 2002; Wheaton, Timpano, Lasalle-Ricci, & Murphy, 2008). Furthermore, among patients with anxiety disorders, hoarding symptoms were significantly correlated with family impairment, above and beyond the effects of depression (Tolin et al., 2011). Hoarding/collecting compulsions also predicted worse psychotic symptoms (e.g., bizarre delusions, disorganization) in patients with schizophrenia (Guillem, Satterthwaite, Pampoulova, & Stip, 2009).

Despite evidence that hoarding symptoms occur across cultures (Chakraborty et al., 2012; Matsunaga et al., 2008; Timpano et al., 2015), research on hoarding in Asian contexts – independent of OCD – is lacking. Chiu et al. (2003) conducted a qualitative study on 30 community-dwelling individuals in Hong Kong with severe hoarding, and found that their presentation was similar to that observed in Western samples. For example, the types of items hoarded (clothing, paper items, containers), amount of clutter in the home, and difficulties associated with hoarding (interpersonal conflict, poor sanitary conditions, embarrassment over clutter) were consistent with those reported by researchers in the U.S. (Frost & Hristova, 2011; Frost, Steketee, & Williams, 2000). However, the median age of onset in the Hong Kong sample was 41 years, compared to 11–15 years reported by Tolin, Meunier, Frost, and Steketee (2010). In addition, Timpano et al. (2015) found greater endorsement of hoarding symptoms in their Chinese student sample versus their U.S. university sample. Thus, despite similar presentations, the developmental course and base rate of hoarding may differ across cultures, underscoring the importance of cross-cultural investigations of hoarding.

The present exploratory study aimed to add to the nascent body of research on hoarding in non-Western samples by examining hoarding behaviors, hoarding-related beliefs, and related constructs among treatment-seeking psychiatric outpatients in Singapore. The current study had 3 main objectives: (1) to determine the prevalence of clinically significant hoarding among a heterogeneous sample of outpatients with anxiety disorders, depressive disorders, schizophrenia, and pathological gambling; (2) to examine group differences between patients with and without clinically significant hoarding on measures of hoarding, anxiety, depression, functional impairment due to clutter, and quality of life; and (3) to investigate the specific contributions of anxiety and depression to hoarding. Based on the extant literature, we hypothesized that (1) participants with clinically significant hoarding would report greater psychopathology, worse functioning, and worse quality of life than those without clinically significant hoarding; and (2) anxiety and depressive symptoms would be significantly and independently linked to hoarding severity.

## 2. Methods

### 2.1. Participants

Five hundred treatment-seeking outpatients were recruited from the Institute of Mental Health in Singapore, a tertiary hospital specializing in psychiatric care, and its satellite clinics between May 2014 and April 2015. To be included in the study, participants had to (1) be at least 21 years old (age of majority in Singapore); (2) receive a primary DSM-IV diagnosis of any anxiety disorder (including OCD), any depressive disorder, schizophrenia, or pathological gambling; (3) be able to complete the questionnaires in English; and (4) be cognitively capable of providing informed consent and completing the study measures. Patients with co-occurring diagnoses were allowed in the present study to improve generalizability of our findings. Secondary diagnoses were assigned by clinicians and classified into their respective DSM-IV categories. Patients with cognitive deficits (e.g., intellectual disability) as indicated in their medical records were excluded from the study due to potential difficulty completing the study measures.

### 2.2. Measures

*DSM-IV diagnoses* were established during standard psychiatric intake assessments conducted by licensed clinicians and subsequently extracted from patients' medical records by the study team. DSM-IV diagnoses were used as the hospital had not converted to the DSM-5 diagnostic system at the start of the study.

The *Saving Inventory-Revised* (SI-R; Frost, Steketee, & Grisham, 2004) is a 23-item self-report measure comprising three subscales: difficulty discarding, clutter, and excessive acquisition. Items on the SI-R are scored between 0 and 4, with higher scores indicating greater hoarding severity. Internal consistency, test-retest reliability, and convergent and divergent validity have been established (Coles, Frost, Heimberg, & Steketee, 2003; Frost et al., 2004). The SI-R has also been used in Chinese (Timpano et al., 2015) and Indian (Chakraborty et al., 2012) samples; the former study supported the internal consistency as well as convergent and divergent validity of the SI-R. Internal reliabilities for the full scale and three subscales were good to excellent in the current sample (Cronbach's α values ranged from .80 to .93).

The *Saving Cognitions Inventory* (SCI; Steketee, Frost, & Kyrios, 2003) is a 24-item self-report measure that evaluates maladaptive beliefs about and emotional attachment to possessions. It is made up of four subscales: emotional attachment, control, responsibility, and memory. Each item on the SCI represents a thought associated with one of the subscales. Participants are asked to rate the extent to which they had each thought when deciding whether or not to discard something in the past week, from 1 (not at all) to 7 (very much). The scale has demonstrated good internal consistency, as well as convergent and discriminant validity (Steketee et al., 2003). The full scale and four subscales showed at least satisfactory internal consistency in the present study ($\alpha$ values ranged from .78 to .96).

The *Clutter Image Rating* scale (CIR; Frost, Steketee, Tolin, & Renaud, 2008) consists of three sets of 9 color photographs. Each set depicts a room in the home (living room, bedroom, and kitchen) with varying amounts of clutter (1=least cluttered, 9=most cluttered). Participants were instructed to rate the level of clutter in the corresponding room in their homes using these photographs. A score of 4 and above indicates clutter significant enough to warrant clinical attention. The CIR has demonstrated good internal consistency, test–retest reliability, and convergent validity, as well as excellent inter-rater reliability (Frost et al., 2008). Internal consistency for the current sample was good ($\alpha$=.84).

The *Beck Anxiety Inventory* (BAI; Beck, Epstein, Brown, & Steer, 1988) is a 21-item self-report measure that evaluates distress associated with common symptoms of anxiety. Items are rated from 0 (not bothered at all) to 3 (severely bothered). The BAI has been found to have high internal consistency and test–retest reliability as well as good concurrent and discriminant validity (Beck et al., 1988). Internal consistency for the current sample was excellent ($\alpha$=.95).

The *Beck Depression Inventory-II* (BDI-II; Beck, Steer, & Brown, 1996) is a 21-item self-report measure that assesses depressive symptoms. Items are rated from 0 to 3, with higher scores indicating greater depression severity. The BDI-II has demonstrated high internal reliability and convergent validity (Dozois, Dobson, &

Ahnberg, 1998). Internal consistency for the current sample was excellent ($\alpha$=.94).

The *Activities of Daily Living Scale for Hoarding* (ADL-H; Frost, Hristova, Steketee, & Tolin, 2013) is a 15-item self-report questionnaire that measures degree of functional impairment in daily living activities due to clutter. Participants are asked about the level of difficulty they experience carrying out daily activities due to clutter or a hoarding problem. Responses are scored from 1 (can do it easily) to 5 (unable to do), and are averaged across applicable items, with higher scores indicating greater impairment. The ADL-H has shown very good internal consistency, good inter-rater reliability, and good convergent and discriminant validity (Frost et al., 2013). Internal consistency for the current sample was excellent ($\alpha$=.96).

The *Quality of Life Enjoyment and Satisfaction Questionnaire – Short Form* (Q-LES-Q-SF; Endicott, Nee, Harrison, & Blumenthal, 1993) is a 16-item self-administered scale that assesses enjoyment and satisfaction across various life domains, including mood, social relationships, and economic status. Higher scores indicate higher self-rated quality of life. The Q-LES-Q-SF has been found to have high internal consistency, acceptable construct validity, and criterion validity (Pitkanen et al., 2012; Stevanovic, 2011). Internal consistency for the current sample was excellent ($\alpha$=.93).

### 2.3. Procedure

The present study was approved by the institutional ethics committee (National Healthcare Group, Domain Specific Review Board). All participants signed an informed consent form prior to filling in the study questionnaire packet, which comprised a demographic questionnaire and the self-report measures listed above. Measures were completed in English, in pen-and-paper format. Participants received a compensation fee of 30 SGD (~21 USD) upon completion of the study measures.

### 2.4. Data analyses

Preliminary analyses revealed satisfactory skewness and kurtosis values (between −1 and 1) for all main study variables (i.e., SI-R, SCI, BAI, BDI, Q-LES-Q), except the CIR and ADL-H, both of which were positively skewed.

Cutoff scores for clinically significant hoarding symptoms on the SI-R were established by Frost, Steketee, and Tolin (unpublished data, cited in Tolin et al. (2011)). Values that maximized sensitivity and specificity for the full scale and its three subscales were selected. They are as follows: total score 41 (sensitivity .959, specificity .931), difficulty discarding 14 (sensitivity .919, specificity .862), clutter 17 (sensitivity .932, specificity .931), and excessive acquisition 9 (sensitivity .892, specificity .759). These cutoff scores have been used to estimate the prevalence of hoarding symptoms among patients with anxiety disorders, including OCD (Chakraborty et al., 2012; Tolin et al., 2011). Prevalence of significant hoarding symptoms in the present study was calculated using these cutoff scores. Chi square analyses followed by post-hoc examination of adjusted standardized residuals and the Marascuilo procedure were used to compare the prevalence of hoarding across diagnostic groups (Beasley & Schumacker, 1995).

Based on SI-R total score, participants were divided into hoarding ($\geq$41) and non-hoarding ($<$41) groups. Independent samples *t*-tests with Bonferroni correction were conducted to examine group differences on the study measures. Effect sizes (Cohen's *d*) were calculated for these comparisons given the large sample size.

Spearman's rank correlation coefficients were used to determine the strength of associations among the main study variables, as CIR and ADL-H scores were non-normally distributed. Due to the large number of correlations (21), *p*-values below .002 (.05/21) were considered significant. To test the specific associations between hoarding and other variables, we used partial rank correlation coefficients to control for anxiety (BAI) and depression (BDI-II).

Linear regression analysis was used to examine the unique contribution of anxiety and depression to hoarding. We focused on these two types of psychopathology based on prior findings that indicated hoarding was linked to anxiety and depression (Frost et al., 2011; Reid et al., 2011; Tolin et al., 2011). BAI total score and BDI-II total score were entered into the regression model, with SI-R total score as the dependent variable. Variance inflation factors for the predictors did not exceed 2, suggesting a lack of multicollinearity (Stevens, 2002). Although all 500 participants completed study procedures (i.e., none terminated participation halfway), 31.6% ($n$=158) missed at least one item on the study measures. Because missing data were addressed with listwise deletion, the number of participants varied across analyses depending on which variables were considered.

## 3. Results

### 3.1. Sample description

The mean age among participants was 35.3 years (SD=10.1, range=21–69). The majority of the sample was male (56.4%) and Chinese (70.2%). Ten percent of the sample was Malay, 13.4% were Indian, and 6.4% belonged to other ethnicities (e.g., Eurasian). Participants were classified into one of four diagnostic groups based on their primary diagnosis: anxiety disorders (AD; $n$=144; 28.8%), depressive disorders (DD; $n$=153; 30.6%), schizophrenia (SZ; $n$=150; 30.0%), and pathological gambling (PG; $n$=53; 10.6%). Within the AD group, 20 (4.0%) had GAD, 25 (5.0%) had panic disorder, 1 (0.2%) had specific phobia, 11 (2.2%) had social phobia, 49 (9.8%) had OCD, and 38 (7.6%) had anxiety disorder not otherwise specified (NOS). In the DD group, 124 (24.8%) had major depressive disorder, 17 (3.4%) had dysthymia, and 12 (2.4%) had depressive disorder NOS. Thirty-three participants (6.6%) had a comorbid anxiety disorder, 47 (9.4%) had a comorbid depressive disorder, and 9 (1.8%) had comorbid anxiety and depressive disorders. Descriptive figures for each of the study measures are presented in Table 1.

### 3.2. Hoarding symptoms by diagnostic group

Using cutoffs previously established by Frost, Steketee, and Tolin (unpublished data, cited in Tolin et al. (2011)), we found that 26.5% of our sample demonstrated significant difficulty discarding,

**Table 1**
Descriptive information for study measures[a].

| | Mean | Standard deviation | Actual range | Possible range | Mean inter-item correlation |
|---|---|---|---|---|---|
| SI-R total | 30.80 | 15.97 | 0–77 | 0–92 | .37 |
| SCI total | 69.17 | 31.61 | 24–168 | 24–168 | .48 |
| CIR composite | 1.65 | .85 | 1–9 | 1–9 | .65 |
| BAI | 16.94 | 13.35 | 0–61 | 0–63 | .46 |
| BDI-II | 19.64 | 13.77 | 0–62 | 0–63 | .43 |
| ADL-H | 1.40 | .63 | 1–5 | 1–5 | .62 |
| Q-LES-Q-SF | 54.48 | 18.06 | 0–100 | 0–100 | .50 |

*Note.* SI-R=Saving Inventory-Revised; SCI=Saving Cognitions Inventory; CIR=Clutter Image Rating; BAI=Beck Anxiety Inventory; BDI-II=Beck Depression Inventory; ADL-H=Activities of Daily Living Scale for Hoarding; Q-LES-Q-SF=Quality of Life Enjoyment and Satisfaction Questionnaire – Short Form.

[a] *n*'s (per row) ranged from 434 to 487.

**Table 2**
Prevalence of significant hoarding symptoms based on SI-R scores by diagnostic group[a].

| | Anxiety disorders | Depressive disorders | Schizophrenia | Pathological gambling | Overall sample | $\chi^2(3)$ |
|---|---|---|---|---|---|---|
| Difficulty discarding | 25 (17.5%) | 59 (38.8%) | 39 (26.0%) | 9 (17.0%) | 132 (26.5%) | 20.29*** |
| Clutter | 21 (14.7%) | 40 (26.8%) | 48 (32.4%) | 6 (11.3%) | 115 (23.3%) | 18.14*** |
| Acquisition | 73 (51.0%) | 89 (58.6%) | 92 (62.2%) | 34 (64.2%) | 288 (58.1%) | 4.73 |
| Total score | 31 (22.0%) | 55 (37.4%) | 53 (36.3%) | 8 (15.1%) | 147 (30.2%) | 16.46** |
| ≥ 1 subscale | 75 (52.4%) | 102 (67.1%) | 97 (65.5%) | 34 (64.2%) | 308 (62.1%) | 8.12* |
| ≥ 2 subscales | 31 (21.8%) | 60 (40.0%) | 62 (41.6%) | 10 (18.9%) | 163 (33.0%) | 21.12*** |
| All subscales | 13 (9.0%) | 26 (17.2%) | 20 (13.4%) | 5 (9.4%) | 64 (12.9%) | 5.04 |

*Note.* SI-R = Saving Inventory-Revised.

[a] *n*'s (per row) ranged from 487 to 498.

* $p < .05$.

** $p < .01$.

*** $p < .001$.

23.3% had significant clutter, 58.1% had excessive acquisition, and 30.2% had a total SI-R score meeting clinical significance. In addition, in line with the DSM-5 symptom criteria that exclude excessive acquisition as a symptom of HD, 13.8% of participants had significant difficulty discarding and clutter, with 95.5% of this subgroup reporting excessive acquisition. That is, 12.9% showed significant levels of all 3 symptoms.

The proportion of participants whose SI-R scores exceeded their respective cutoffs by diagnostic group is reported in Table 2. DD participants (38.8%) had a higher rate of significant difficulty discarding than AD (17.5%) and PG (17.0%) participants. The SZ group (32.4%) showed greater frequency of clutter than the AD (14.7%) and PG (11.3%) groups. DD participants (37.4%) were more likely to have significant hoarding based on SI-R total score than AD (22.0%) and PG (15.1%) participants, whereas SZ participants (36.3%) were more likely to report significant hoarding than PG participants. AD participants showed a lower than expected rate of meeting criteria for at least 1 SI-R subscale (52.4%); there were no significant pairwise differences. Finally, the DD (40.0%) and SZ (41.6%) groups were more likely to score above cutoffs for 2 or more SI-R subscales than the AD (21.8%) and PG (18.9%) groups. There was no significant group difference in the prevalence of excessive acquisition or significant hoarding based on all 3 SI-R subscales.

### 3.3. Hoarding vs. non-hoarding groups

Hoarding participants had significantly higher scores on the SI-R (total and subscales), SCI (total and subscales), CIR, BAI, and BDI-II, indicating higher levels of hoarding severity, hoarding cognitions, clutter, anxiety, and depression than non-hoarding participants (*ps* < .001; see Table 3). In addition, the hoarding group reported significantly worse functioning and quality of life (*ps* < .001).

### 3.4. Relationship between hoarding and other variables

Hoarding severity was significantly and positively correlated with hoarding cognitions, clutter, anxiety, depression, and functional impairment due to clutter, as well as negatively correlated with quality of life (all *ps* < .001; see Table 4 for a full correlation matrix). Given the moderate correlations hoarding severity had with anxiety and depression, partial correlations were calculated controlling for the latter 2 variables. Associations among hoarding variables (i.e., SI-R, SCI, CIR, and ADL-H) remained significant, however, the relationship between hoarding severity and quality of life was no longer significant (see Table 5).

**Table 3**
Means and standard deviations on study measures for hoarding (SI-R total score ≥ 41) and non-hoarding (SI-R total score < 41) groups.

| | Hoarding (*n* = 102) | Non-hoarding (*n* = 240) | *t* | *p*[a] | *d* |
|---|---|---|---|---|---|
| SI-R | | | | | |
| Difficulty discarding | 16.03 (3.66) | 7.78 (3.89) | 18.24 | < .001 | 2.18 |
| Clutter | 18.78 (5.15) | 7.44 (5.01) | 18.99 | < .001 | 2.23 |
| Acquisition | 15.60 (3.95) | 7.64 (4.07) | 16.70 | < .001 | 1.99 |
| Total score | 50.41 (8.30) | 22.86 (10.39) | 23.75 | < .001 | 2.93 |
| SCI | | | | | |
| Emotional attachment | 38.73 (14.13) | 22.29 (11.82) | 11.08 | < .001 | 1.26 |
| Control | 14.36 (4.75) | 10.53 (5.16) | 6.43 | < .001 | 0.77 |
| Responsibility | 24.37 (7.38) | 14.64 (7.24) | 11.31 | < .001 | 1.33 |
| Memory | 18.46 (6.92) | 11.06 (5.66) | 10.34 | < .001 | 1.17 |
| Total score | 95.92 (29.54) | 58.53 (26.45) | 11.55 | < .001 | 1.33 |
| CIR composite | 2.26 (1.17) | 1.44 (0.57) | 8.73 | < .001 | 0.89 |
| BAI | 21.98 (13.92) | 14.05 (12.31) | 5.24 | < .001 | 0.60 |
| BDI-II | 25.93 (15.62) | 15.93 (12.10) | 6.39 | < .001 | 0.72 |
| ADL-H | 1.72 (0.60) | 1.28 (0.61) | 6.17 | < .001 | 0.73 |
| Q-LES-Q-SF | 46.73 (18.03) | 57.86 (17.26) | −5.38 | < .001 | −0.63 |

*Note.* SI-R = Saving Inventory-Revised; SCI = Saving Cognitions Inventory; CIR = Clutter Image Rating; BAI = Beck Anxiety Inventory; BDI-II = Beck Depression Inventory; ADL-H = Activities of Daily Living Scale for Hoarding; Q-LES-Q-SF = Quality of Life Enjoyment and Satisfaction Questionnaire – Short Form.

[a] Bonferroni-corrected *p*-value = .004.

**Table 4**
Zero-order rank correlations among measures of hoarding, psychopathology, functional impairment due to clutter, and quality of life[a,b,c].

| | SI-R total | SCI total | CIR composite | BAI | BDI-II | ADL-H |
|---|---|---|---|---|---|---|
| SCI total | .65 | | | | | |
| CIR composite | .53 | .41 | | | | |
| BAI | .32 | .33 | .28 | | | |
| BDI-II | .33 | .32 | .25 | .70 | | |
| ADL-H | .58 | .38 | .53 | .33 | .32 | |
| Q-LES-Q | −.28 | −.25 | −.25 | −.61 | −.67 | −.29 |

*Note.* SI-R = Saving Inventory-Revised; SCI = Saving Cognitions Inventory; CIR = Clutter Image Rating; BAI = Beck Anxiety Inventory; BDI-II = Beck Depression Inventory; ADL-H = Activities of Daily Living Scale for Hoarding; Q-LES-Q-SF = Quality of Life Enjoyment and Satisfaction Questionnaire – Short Form.

[a] *n* = 342.

[b] Bonferroni-corrected *p*-value = .002.

[c] All correlations had *p*-values < .001.

### 3.5. Predictors of hoarding severity

Preliminary analyses found no significant relationship between hoarding severity and age or sex (all *ps* > .2). Hence, regression analyses did not control for these demographic variables.

**Table 5**
Partial rank correlations among measures of hoarding, functional impairment due to clutter, and quality of life, controlling for anxiety and depression[a].

| | SI-R total | SCI total | CIR composite | ADL-H |
|---|---|---|---|---|
| SCI total | .61*** | | | |
| CIR composite | .48*** | .34*** | | |
| ADL-H | .53*** | .29*** | .48*** | |
| Q-LES-Q | −.05 | .00 | −.08 | −.06 |

*Note.* SI-R=Saving Inventory-Revised; SCI=Saving Cognitions Inventory; CIR-=Clutter Image Rating; ADL-H=Activities of Daily Living Scale for Hoarding; Q-LES-Q-SF=Quality of Life Enjoyment and Satisfaction Questionnaire – Short Form.

[a] $n=342$.

*** $p<.001$.

**Table 6**
Linear regression model with hoarding severity (SI-R total score) as dependent variable[a].

| | $R^2$ | $p$ (for $R^2$) | $B$ (SE)[a] | $\beta$[a] | $p$ | VIF |
|---|---|---|---|---|---|---|
| Overall model | .11 | <.001 | | | | |
| BAI total | | | .14 (.08) | .12 | .054 | 1.89 |
| BDI-II total | | | .27 (.07) | .23 | <.001 | 1.90 |

*Note.* SI-R=Saving Inventory-Revised; SE=standard error; VIF=variance inflation factor; SCI=Saving Cognitions Inventory; BAI=Beck Anxiety Inventory; BDI-II=Beck Depression Inventory-II.

[a] $n=421$.

Depressive symptoms significantly predicted hoarding severity ($p<.001$), independent of anxiety, whereas anxiety symptoms did not contribute significantly to the model ($p=.05$). Table 6 provides a summary of the regression results.

## 4. Discussion

### 4.1. General

In our Singaporean sample of psychiatric outpatients, we found 30.2% with clinically significant hoarding based on SI-R total score. The percentage of participants who met the DSM-5 symptom criteria for HD (i.e., difficulty discarding and clutter only) was 13.8%. It should be noted that other DSM-5 criteria, such as functional impairment, distress, and differential diagnoses, were not examined in the present study. Thus, the actual prevalence of HD in our sample is likely much lower than 13.8%. Among patients who reported significant difficulty discarding and clutter, 95.5% reported excessive acquisition, in line with previous studies that indicate excessive acquisition frequently occurs in hoarding (Frost, Tolin, Steketee, Fitch, & Selbo-Bruns, 2009; Mataix-Cols, Billotti, Fernandez de la Cruz, & Nordsletten, 2013; Meyer, Frost, Brown, Steketee, & Tolin, 2013). Notably, none of the participants recruited received a formal diagnosis of HD. That is, patients in our sample were not seeking treatment for HD nor were they evaluated for it by their treating clinician, which may indicate that hoarding symptoms often go undetected by healthcare providers, even among individuals in contact with psychiatric treatment services. In addition, the high prevalence figures suggest cultural differences in the base rate of hoarding, as only 12.3% of the U.S. anxiety disorder group in Tolin et al.'s (2011) study showed clinically significant hoarding, compared to the 22.0% in our analogous subgroup.

However, it is also possible that the significant hoarding symptoms reported in our sample were not as severe as those reported in previous studies, due to differential item functioning on the SI-R (Timpano et al., 2015). Timpano et al. (2015) found that their Chinese student sample reported greater hoarding symptoms than a U.S. university sample (Timpano et al., 2015), suggesting that certain cultures may endorse items on the SI-R more readily. Thus, the cutoff scores used in previous studies might have overestimated clinically significant hoarding in our sample. Modification – either of items or the scoring method – may be needed before the SI-R and other hoarding measures can be used in non-Western populations such as Singapore. Nonetheless, given that our hoarding group reported more severe psychopathology and worse quality of life than the non-hoarding group, the high rates of hoarding symptoms warrant some concern, and efforts should be made to address comorbid hoarding in outpatients.

Patients with depressive disorders and schizophrenia showed elevated levels of hoarding, consistent with prior research showing that hoarding commonly co-occurs with other psychiatric disorders, particularly MDD (Frost et al., 2011), as well as findings suggesting a link between hoarding and psychotic symptoms (Chiu et al., 2003; Guillem et al., 2009). Incorporating screening items for hoarding into standard clinical assessment, particularly for patients with depressive disorders and schizophrenia, could be useful in identifying potential comorbid hoarding problems, as patients may not spontaneously report their hoarding symptoms. Furthermore, given that the onset of clinically significant hoarding behavior appears to be more common later in life (ages 41 to 70; Tolin et al., 2010), the potential for early detection and intervention is high, making screening for hoarding during routine assessment particularly important.

Because we did not assess motivation for hoarding or differential diagnoses in the present study, the nature of the relationship between hoarding and depressive/psychotic symptoms is unclear. For example, it is possible that hoarding led to depressive symptoms (e.g., via social alienation due to clutter) or that depressive symptoms, such as decreased energy, resulted in difficulty discarding. The latter explanation renders such a clinical presentation qualitatively different from difficulty discarding in HD, which involves distress associated with losing possessions. Given the high level of comorbidity observed between HD and MDD (Frost et al., 2011), more research needs to be done to clarify the link between these two diagnostic constructs. The relationship between schizophrenia and hoarding also requires elaboration, as specific hypotheses about the mechanisms underlying their association have yet to be empirically tested. As such, it is unclear if psychotic symptoms were directly related to hoarding severity or if the high prevalence of hoarding in the schizophrenia group could be attributed to an intermediary mechanism. Guillem et al. (2009) postulated that hoarding behaviors served to regulate anxiety associated with positive symptoms in patients with schizophrenia. That is, psychotic symptoms may not in and of themselves lead to hoarding, but result in hoarding behaviors indirectly via the induction of anxiety – a presentation that is again different from HD.

As hypothesized, the hoarding group showed higher levels of hoarding cognitions, anxiety, and depression, as well as worse quality of life than the non-hoarding group. However, the difference between the two groups in degree of clutter was small and not practically meaningful (2.26 in hoarding group vs. 1.44 in non-hoarding group). Furthermore, the mean composite CIR score reported by the hoarding group in our study was lower than those reported by hoarding groups in previous studies (e.g., 4.01 in Frost et al. (2008), 3.67 in Nordsletten et al. (2013)), and did not meet the clinical cutoff of 4, indicating low levels of clutter despite prominent hoarding symptoms. In other words, hoarding participants in our sample were differentiated by greater difficulty discarding and excessive acquisition (behavioral dispositions associated with HD) rather than by amount of clutter (consequence of

hoarding behaviors). The low levels of clutter in the hoarding group support the interpretation that the clinically significant hoarding observed in our sample was not as severe as that reported in other samples. Indeed, the incongruence between self-reported hoarding behaviors on the SI-R and clutter on the CIR could be due to greater endorsement of hoarding symptoms on the SI-R by our majority Chinese sample (Timpano et al., 2015), relative to the pictorial CIR, as participants may have reported inflated scores on the SI-R due to subjective interpretation of its items, an effect that did not translate to the more objectively rated CIR.

It is also worth considering an alternative interpretation, given that clutter is the feature of hoarding most amenable to external influence, as in cases of pediatric hoarding (Storch et al., 2011). As 86.3% of our hoarding participants were living with their family members and/or spouse at the time of the study, it is possible that third party intervention prevented the accumulation of clutter in this group, despite strong individual inclinations to save or acquire items. The combination of high property prices and collectivistic tendencies in Singapore (Singapore Centre for Applied and Policy Economics, 2015; Soh & Leong, 2002) increases the likelihood that many Singaporeans continue to live with their relatives well into adulthood, limiting personal autonomy over living spaces. Numerous local cases of hoarding by elderly whose partners have given up intervening or who are living alone lend support to the hypothesis that familial intervention checks the build-up of clutter (Baker & Tai, 2012; Dhanaraj, 2014; Tai & Toh, 2014; Yeo, 2015). Moreover, Singapore has the third highest population density in the world, with more than 80% of residents living in densely packed public housing (Housing & Development Board, 2014; The World Bank Group, 2015). Such a living situation makes it additionally difficult for individuals to hoard as possessions that spill out of the apartment unit easily infringe on the personal space of neighbors whose potential complaints further limit the accretion of clutter. More information on the susceptibility of accumulation of clutter to environmental factors is needed to verify this explanation.

Hoarding symptoms were not significantly linked to quality of life, once anxiety and depression were controlled for. In other words, the poorer quality of life associated with hoarding symptoms was better accounted for by more general forms of psychopathology, such as anxiety and depression, than by hoarding specifically. This finding appears counterintuitive, however, the link between hoarding and quality of life is underexplored and the evidence available suggests little difference in quality of life between hoarding and non-hoarding individuals, except in the domains of victimization and safety (Saxena et al., 2011). Furthermore, the quality of life measure used (Q-LES-Q) in the present study assessed subjective quality of life and was based on self-report. Given the poor insight associated with hoarding (Dimauro, Tolin, Frost, & Steketee, 2013; Frost, Tolin, & Maltby, 2010), Q-LES-Q scores might not have reflected hoarding participants' actual standard of living. Future research using more objective methods of assessment that incorporate ratings from clinicians or independent observers would illuminate the link between hoarding and quality of life.

Both anxiety and depression showed significant associations with hoarding severity. However, when both variables were included in a regression model, only depressive symptoms uniquely contributed to hoarding severity. This suggests a more robust relationship between hoarding and depression than between hoarding and anxiety, in line with past research. For example, Frost et al. (2011) observed that MDD was more frequently diagnosed among HD participants than anxiety disorders such as GAD and social phobia. Furthermore, Tolin et al. (2011) found that anxiety as measured by the BAI was not significantly related with hoarding severity (SI-R), though depression (BDI-II) and trait anxiety (State-Trait Anxiety Inventory-Trait Version) were. This pattern is also reflected in the higher rates of hoarding in our DD group, underscoring the need to screen for hoarding among patients with prominent depressive symptoms. Nonetheless, given that other studies have reported a link between hoarding and anxiety using various measures (Ayers, Castriotta, Dozier, Espejo, & Porter, 2014; Reid et al., 2011; Timpano, Buckner, Richey, Murphy, & Schmidt, 2009), the relationship between hoarding and anxiety requires clarification. Certain facets of anxiety (e.g., trait anxiety) may be more closely related to hoarding symptoms than the physical symptoms of anxiety evaluated in the BAI.Overall, our results were consistent with the extant research on comorbidity and hoarding, though the unexpectedly high rates of hoarding demand replication in similar study samples. On one hand, present findings suggested cultural variance with respect to the presentation of hoarding symptoms, as levels of clutter in our hoarding group were uncharacteristically low. Based on results from a U.S. sample, Meyer et al. (2013) posited that hoarding psychopathology is best understood as a unidimensional construct comprising difficulty discarding, accumulation of clutter, and excessive acquisition. While this conceptualization was accurate for the 13.8% of our sample who demonstrated significant difficulty discarding and clutter – 95.5% of these participants also reported excessive acquisition – many who met the cutoff for clinically significant hoarding did not show levels of clutter high enough to warrant professional attention. Hence, it appeared that much of the significant hoarding observed in our sample was driven by difficulty discarding and/or excessive acquisition more so than by the accumulation of clutter. On the other hand, measurement variance works as a competing explanation to our findings, as the SI-R has not been validated in Singapore. Although reliability metrics (i.e., Cronbach's α, mean inter-item correlations) were acceptable in the current study and the SI-R has been used in other Asian samples (Chakraborty et al., 2012; Timpano et al., 2015), more rigorous psychometric assessment of the SI-R is needed before conclusions can be drawn regarding the differential presentation of hoarding in Singapore.

### 4.2. Limitations

As mentioned above, our results indicated an association between hoarding and schizophrenia. However, the lack of a measure of psychotic symptoms (e.g., Positive and Negative Syndrome Scale) precluded elucidation of this relationship. Including a compulsive gambling scale, such as the South Oaks Gambling Screen, would have similarly provided greater detail on the relationship between hoarding and pathological gambling. Moderating effects, which could have been parsed out with more specific measures, might have obscured links between hoarding and the other psychiatric conditions in our sample.

The present study also used an English-literate sample, which may not be representative of the general outpatient population, given that only 80% of Singaporeans are literate in English (Department of Statistics, 2010). Furthermore, English literacy tends to be more common among younger age groups (Department of Statistics, 2010), which means that our sample might be biased toward younger participants. Although we did not find a significant correlation between age and hoarding severity, given the substantial risks associated with geriatric hoarding (Ayers, Saxena, Golshan, & Wetherell, 2010; Ayers, Schiehser, Liu, & Wetherell, 2012), research using non-English hoarding measures would allow greater inclusion of older participants and provide a more accurate picture of the status of hoarding in Singapore.

Another limitation is the exclusive use of self-report measures to examine complex psychological constructs, such as hoarding,

anxiety, and depression. In particular, total reliance on the SI-R to operationalize "clinically significant hoarding" requires several caveats. Though the SI-R has strong psychometric properties (Frost et al., 2004) and has been used to identify individuals with significant hoarding (Chakraborty et al., 2012; Tolin et al., 2011), the factor structure of the SI-R in a Chinese sample has been found to vary from that in a U.S. sample (Timpano et al., 2015). Thus, further cross-cultural validation of the SI-R is needed to evaluate its psychometric properties, including factor structure stability, in non-Western samples. In addition, the SI-R cannot replace a clinical interview in establishing a hoarding diagnosis for two main reasons. First, the SI-R does not assess distress or functional impairment, at least one of which is necessary for a HD diagnosis (APA, 2013). Second, the SI-R is unable to determine the nature or motivation of hoarding behaviors. For example, difficulty discarding could be associated with psychotic symptoms rather than intense feelings of attachment, representing a phenomenologically different form of hoarding. Hence, future studies should endeavor to ensure that hoarding symptoms are measured as accurately as possible, perhaps by supplementing self-report hoarding measures with clinical interviews to verify that: (1) hoarding symptoms are significant by clinicians' standards, and (2) the symptoms identified are in fact qualitatively similar to DSM-5 HD.

## 5. Conclusions

Our results contribute to the literature on hoarding in non-Western countries, using a sample of treatment-seeking adult outpatients at a tertiary psychiatric hospital in Singapore. Supporting previous findings, depression was uniquely linked to hoarding symptoms. However, the presentation of hoarding in the current study differed from that reported in previous research, as our hoarding group showed surprisingly low levels of clutter. Therefore, there may be important cultural differences in the phenomenology of hoarding, possibly due to limited autonomy over living spaces. Findings may alternatively indicate a less severe form of hoarding in our sample, despite scores meeting previously established cutoffs, suggesting the need for modification of hoarding measures before use in non-Western samples such as Singapore. More research using different methodology (e.g., qualitative methods) is needed to better interpret present findings.

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