Background: Hoarding disorder (HD) is a new disorder in DSM-5. While cognitive-behavioral therapy (CBT) is seen as the gold standard approach to treatment, the literature in this field is still emerging.

Methods: The aim of the present study is to synthesize the current treatment outcome literature on CBT for HD, as well as secondary depressive symptoms, using a meta-analytic approach. Due to a lack of controlled trials only within-group effect sizes were calculated.

Results: Sixteen studies were included in the meta-analysis (n =505; mean age =56 years; mean percentage female participants =72%). Large effect sizes were found from pre-treatment to post-treatment (g =1.11; 95% CI: 0.92-1.29) and from pre-treatment to follow-up (g =1.25; 95% CI: 0.94-1.56) on HD symptoms. The gender distribution of the sample moderated treatment outcome, with larger effects seen in studies that included a larger proportion of female patients. Treatment modality (individual vs group), therapist training, use of home visits, trial type (efficacy vs effectiveness), number of treatment weeks, participant age, and study quality did not moderate treatment outcome. Small effect sizes were found from pre-treatment to post-treatment (g =0.45; 95% CI: 0.28-0.61) for depressive symptoms and baseline depression severity, treatment modality, use of home visits, and assessment tool used did not moderate outcome.

Limitations: The study is limited by the small number of studies available in this field.

Conclusions: This study demonstrates that CBT for HD is an effective treatment. However, controlled trials are needed, as are trials examining the long-term efficacy of CBT for HD.

Keywords: Hoarding Disorder; Meta-Analysis; Cognitive-Behavioural Therapy; CBT; Treatment Outcome

Cognitive Behavioral Therapy for Hoarding Disorder: An Updated Meta-Analysis

1. Introduction

Hoarding disorder (HD) is characterized by an inability to discard possessions, regardless of their value, due to a perceived need to save the item, or distress associated with discarding (American Psychiatric Association, 2013). HD is a new diagnosis in the Diagnostic and Statistical Manual of Mental Disorders (5th Edition) (DSM-5) (American Psychiatric Association, 2013) and the disorder has an estimated prevalence of approximately 2.5% (Postlethwaite et al., 2019). HD often has a significant impact on psychosocial functioning (Archer et al., 2019) and can create a significant burden on families, often resulting in relationship breakdowns and isolation (Davidson et al., 2020).

Individuals with HD often present with significant co-morbidity, including both physical and psychiatric comorbidities (Frost et al., 2011; Tolin et al., 2008). Common physical comorbidities include severe joint diseases such as arthritis or rheumatism, lung problems such as emphysema or asthma and high blood pressure/hypertension (Tolin et al., 2008). In terms of psychiatric co-morbidities, major depressive disorder is noted as one of the most prevalent co-morbid conditions, with approximately half of individuals with HD presenting with clinically significant comorbid depressive symptoms (Frost et al., 2011; Tolin et al., 2019). Attention-deficit hyperactivity disorder, as well as anxiety and related disorders, are also common co-morbidities (Frost et al., 2011; Tolin et al., 2019).

Cognitive behavioural therapy (CBT) for HD is often based on the model proposed by Frost and Hartl (1996) and treatment generally includes in-session and between-session sorting and discarding, exposure tasks designed to resist acquiring behaviours, cognitive restructuring of hoarding related beliefs, and skills training to reduce executive functioning deficits, such as problem solving skills and time management skills (Steketee & Frost, 2007; Tolin, Wootton, et al., 2017; Tolin, Worden, et al., 2017). Treatments often also include a

motivational enhancement component, as motivation towards treatment tends to fluctuate in individuals with HD (Frost et al., 2010). Treatment for HD generally requires a greater number of treatment sessions than other psychiatric disorders (Wootton et al., 2019), with 20 sessions or more often delivered during active treatment (Gilliam et al., 2011; Muroff et al., 2012; O'Connor et al., 2018).

CBT for HD may include home visits to assist with sorting and discarding exercises (Ayers et al., 2011; Chandler et al., 2019; Muroff et al., 2012) and some research suggests that the use of home visits may enhance clinical outcomes (Crone & Norberg, 2018; Muroff et al., 2012; Tolin et al., 2015). For example, Muroff et al. (2012) found modestly higher improvement in hoarding symptoms for individuals receiving home assistance compared to individuals without. Additionally, Tolin et al. (2015) found that a greater number of home visits were related to higher reductions on the clutter and difficulty discarding subscales of the Saving Inventory – Revised (Frost et al., 2004), but not overall HD symptomatology. However, the literature on the usefulness of home visits is mixed, with other studies finding similar treatment outcomes without the use of home visits (e.g., Gilliam et al., 2011; Tolin et al., 2019).

CBT for HD has been demonstrated to be successful across a number of treatment formats and while early treatments focussed on individual treatment delivery (Steketee et al., 2010; Tolin et al., 2007), more recent studies have focussed on the delivery of CBT in a group format (Mathews et al., 2018; Tolin et al., 2019). Group treatments have the advantage of improving the efficiency of treatment, and some authors have suggested that the group format also helps to improve motivation and treatment adherence due to increased peer support (Muroff et al., 2009). However, preliminary research demonstrated that individuals with HD prefer individual treatment over group based treatments (Robertson et al., 2020).

CBT for HD has been demonstrated to be an efficacious treatment, with an early meta-analysis of 10 clinical trials demonstrating large within-group effect sizes (g = 0.82) on measures of HD symptom severity (Tolin et al., 2015). In terms of specific symptom domains, difficulty discarding showed the largest effect size (g = 0.89), followed by clutter (g = 0.70) and acquiring (g = .72) (Tolin et al., 2015). The smallest effect size was found for impairment (g = 0.52) (Tolin et al., 2015). Despite these promising findings, it was found that the number of patients demonstrating clinically significant change was low, ranging from 25% – 43%, indicating that many of the patients continue to experience clinically significant symptoms of HD (Tolin et al., 2015).

The Tolin et al. (2015) meta-analysis also explored a number of potential moderators of treatment outcome. The moderators explored included whether a diagnosis was required for study entry, degree of therapist involvement, treatment modality (individual vs group), treatment duration, number of home visits, baseline depressive symptoms, gender distribution of the sample, mean age of participants, and number of participants on pharmacological treatments. Only two of these variables moderated overall HD severity. First, gender distribution of the sample at baseline moderated outcomes, with those studies with higher numbers of females performing better at post-treatment than those with higher numbers of male participants (Tolin et al., 2015). Second, mean age of participants at baseline was found to moderate treatment outcomes, with a younger mean age at baseline associated with more improved symptoms at post-treatment (Tolin et al., 2015).

While the Tolin et al. (2015) meta-analysis is an important contribution to the literature there have been a number of large CBT treatment outcome studies for HD published since the meta-analysis search was conducted (e.g., Mathews et al., 2018; Moulding et al., 2017; Tolin et al., 2019). These studies have larger samples sizes, potentially demonstrating more accurate treatment effects, and thus an updated meta-analysis is now

required. In addition, the Tolin et al. (2015) meta-analysis was limited in a number of ways. Firstly, the study did not include an examination of other outcomes, such as secondary measures of depressive symptoms. Secondly, the study did not examine some important moderators of treatment outcome, such as therapist levels of training, study quality, or type of trial (e.g., efficacy vs effectiveness). Finally, an analysis of the durability of symptom improvement was not examined (i.e., effect sizes at follow up).

Therefore, the aim of the present study is to extend the literature in a number of important ways. Firstly, by synthesizing outcomes of CBT for HD in an updated meta-analysis including the larger, more robust studies that have emerged in the past five years since the publication of the Tolin et al (2015) meta-analysis. Secondly, by investigating the effects of CBT for HD on secondary, but highly co-morbid symptoms, such as depressive symptoms. Finally, by examining important potential moderators of treatment outcome. The findings have important implications for clinicians and researchers working with patients with HD.

2. Method

2.1. Search Procedure

Articles were identified through the following electronic databases: Medline, PsycINFO, and Scopus through to 3rd February 2020 and the protocol was registered with PROSPERO (CRD42020154528). The search terms included ‘hoarding disorder’ OR ‘hoarding’ OR ‘hoarding behavio*’AND ‘cognitive behav* therapy’ OR ‘CBT’ OR ‘cognitive therap*’ OR ‘treatment’. The reference lists of previously completed meta-analyses on the efficacy of CBT for HD were also reviewed (e.g., Tolin et al., 2015).

2.2. Study Selection

In order to be included individual studies were required to 1) be an open trial or RCT; 2) use a behavioural or cognitive-behavioural intervention as a monotherapy with clinician

support; 3) focus on the treatment of adults; 4) include individuals with clinically significant hoarding symptoms; 5) hoarding was the primary condition being studied; 6) studies must be published in English in a peer-reviewed journal; and 6) the study must report original data. Both uncontrolled trials and RCT's were included due to small number of clinical trials published in this field. Intention to treat (ITT) data was used where possible and completer data was used when ITT was unavailable.

The initial search was conducted by the first author (REMOVED FOR BLIND REVIEW). The title and abstract search was conducted by the first author (REMOVED FOR BLIND REVIEW) with at least 10% co-reviewed by the third author (REMOVED FOR BLIND REVIEW). A similar process was followed at the full text review stage. All final included articles were reviewed by the first and third authors to ensure they met inclusion criteria and all outcome and moderator data were extracted independently by the first and third authors to ensure accuracy. Where there were discrepancies in extracted data these were discussed and resolved between the first and third authors.

2.3. Data Analysis

Due to the small number of controlled trials in the HD treatment outcome literature, only active treatment arms were examined in the current meta-analysis and thus between-group effect sizes could not be calculated in the present study. Effect sizes were calculated using Comprehensive Meta-Analysis (Version 3) (Borenstein et al., 2013) for both HD outcomes, as well depressive symptoms. Within-group analyses were conducted using random effects models. The following formula was used for calculating effect sizes using Cohen's *d*: $\frac{X_1 - X_2}{SD_{diff}}$. X_1 was the pre-treatment mean, X_2 was the post-treatment mean and SD_{diff} was the SD of the difference between scores. The following formula was used to calculate SD_{diff} $\frac{\sqrt{{SD_1}^2 + {SD_2}^2 - 2r \times SD_1 \times SD_2}}{\sqrt{2(1-r)}}$. SD_1 was the pre-treatment standard deviation, SD_2

was the post-treatment (or follow up) standard deviation and *r* was the correlation between pre-treatment and post-treatment scores. A conservative estimate of .70 was used when correlations between pre-treatment and post-treatment outcomes were not available. This estimate is consistent with previous meta-analyses (Glombiewski et al., 2010; Winkler et al., 2013; Wootton, 2016). The scores were then transformed into Hedges's *g* by multiplying it by correction J through the following formula $J(df) = 1 - \frac{3}{4_{df}-1}$ (Borenstein et al., 2011). Hedges's *g* was interpreted as follows: 0.2 a small effect, 0.5 a medium effect, and 0.8 or greater a large effect. A positive *g* value indicated a decrease of symptoms in HD and larger values indicate larger effect sizes.

Apriori moderators included treatment modality (group vs individual treatment), therapist training (trainee vs licensed clinician), use of home visits (yes vs no) and number of home visits, trial type (efficacy, where the treatment was conducted as part of a clinical trial vs effectiveness, where the treatment was provided as part of routine care), number of treatment weeks, mean age of sample, gender distribution of sample, and study quality. Categorical moderators were examined by comparing effect sizes between the groups. When moderators were continuous meta-regression was used. Moderators were only examined from pre-treatment to post-treatment. Due to the small number of studies available, moderators of pre-treatment to follow-up outcomes were not examined.

Homogeneity of effect sizes was calculated via the I^2 statistic. The I^2 statistic was interpreted as follows: 25% indicated low heterogeneity amongst studies, 50% as moderate heterogeneity, and 75% as high heterogeneity (Higgins et al., 2003). The 'one study removed' method was used in order to investigate the impact of each study on the combined effect via sensitivity analyses. Additionally, the 'trim and fill method' was used to assess publication bias (Duval & Tweedie, 2000).

Quality analysis was conducted using the Psychotherapy Outcome Study Methodology Rating Form (Öst, 2008). The Psychotherapy Outcome Study Methodology Rating Form is a 22-item measure of study quality and assesses, for example, the use of blind evaluators, the study design, the reliability of the diagnosis, how attrition was handled, etc. (Öst, 2008). Each item is rated on a three-point scale with total scores ranging from 0-44. Higher scores indicate higher study quality. The quality analysis was conducted by the first author (REMOVED FOR BLIND REVIEW) and third author (REMOVED FOR BLIND REVIEW) independently and to confirm satisfactory interrater reliability the intraclass correlation coefficient (ICC) was calculated (along with 95% confident intervals) using SPSS Version 26. The interrater reliability was excellent (ICC = .95; 95% CI: .79-.99) and thus the quality ratings of the first author were retained and are outlined in Table 1.

3. Results

The initial search yielded 309 articles. Abstracts were reviewed and 268 were excluded, resulting in 41 studies. These 41 studies were reviewed in full against the inclusion and exclusion criteria using a comprehensive coding sheet, and 25 were excluded, resulting in 16 included studies. The study selection process is outlined in Figure 1.

3.1. Study Characteristics

The characteristics of each study are outlined in Table 1. In total 505 individuals [mean age-range: 49 -74 (average 56 years); percentage female participants' range 29% - 100% (average 72%)] across 16 studies (18 active treatment comparisons) were included in the analysis. Studies were conducted in the following countries; United States of America (12/16; 75%), United Kingdom (1/16; 6.3%), Sweden (1/16; 6.3%), Australia (1/16; 6.3%) and Canada (1/16; 6.3%). The majority of the studies were open trials (12/16; 75%) and the remaining were controlled trials (4/16; 25%). Twelve of the 16 studies (75%) were efficacy trials and 4/16 (25%) were effectiveness trials. The majority of studies used the Saving

Inventory – Revised (14/16; 87.5%) (Frost et al., 2004) as the primary outcome measure to assess the severity of HD symptoms. Measures of depressive symptoms were included in ten of the sixteen studies. Seven of the ten studies (70%) used the Beck Depression Inventory (Beck et al., 1996) to measure depressive symptoms, while 3 out of 10 (30%) used the depression subscale of the Depression Anxiety Stress Scales (Lovibond & Lovibond, 1995). Study quality ranged from 12-31 (M = 21.19; SD = 4.79). Four out of the 16 studies (25%) included a follow up assessment and the follow up time period ranged from 3 to 6 months.

3.2. Hoarding Symptoms

3.2.1. Overall within-group effect size for CBT treatment. Table 2 outlines the pre-treatment to post-treatment and pre-treatment to follow-up pooled within-group effect sizes for each of the included studies. The pooled within-group mean effect size was large from pre-treatment to post-treatment (k = 18; g = 1.11; 95% CI: 0.92-1.29). Moderate to high levels of heterogeneity across studies was indicated (I^2 = 73.48) suggesting significant variability between studies. The Trim and Fill method indicated some evidence of publication bias with one study trimmed (adjusted g = 1.08; 95% CI: 0.89-1.26). From pre-treatment to follow-up large pooled within-group effect sizes were found (k = 4; g = 1.25; 95% CI: 0.94-1.56) with moderate levels of heterogeneity (I^2= 59.32) suggesting some variability within results. The Trim and Fill method indicated there was some publication bias with one study trimmed (adjusted g = 1.14; 95% CI: 0.83 - 1.47). Using the one study removed method effect sizes remained unchanged for both pre-treatment to post-treatment and pre-treatment to follow-up results.

3.2.2. Moderator Analyses

3.2.2.1. Treatment modality. Type of treatment did not significantly moderate the treatment outcome from pre-treatment to post-treatment (Q_1 = 0.31, p >.05). Large effect sizes were found from pre-treatment to post-treatment for both group treatment approaches (k

= 14; *g* = 1.14; 95% CI: 0.92 - 1.35; I^2 = 78.13) and individual treatment approaches (*k* = 4; *g* = 1.00; 95% CI: 0.59 – 1.42; I^2 = 0.00).

3.2.2.2. Therapist training. Therapist type did not significantly moderate treatment from pre-treatment to post-treatment (Q_1 = 3.66, *p* > .05), although larger effect sizes were found from pre-treatment to post-treatment when the treatment was provided by a licensed therapist (*k* = 11; *g* = 1.27; 95% CI: 1.02 - 1.52; I^2 = 64.28) rather than a trainee therapist (*k* = 7; *g* = 0.89; 95% CI: 0.60 – 1.19; I^2 = 82.43).

3.2.2.3. Home visits. From pre-treatment to post-treatment the use of home visits did not moderate treatment outcome when analysed as a dichotomous (Q_1 = 0.26, *p* > .05) or continuous variable (Q_1 = 3.68, *p* > .05). Large effect sizes were found from pre-treatment to post-treatment for treatments that included home visits (*k* = 9; *g* = 1.16; 95% CI: 0.89 – 1.43; I^2 = 61.93), as well as those that did not (*k* = 9; *g* = 1.06; 95% CI: 0.80 – 1.32; I^2 = 82.50).

3.2.2.4. Trial type. The trial type did not significantly moderate treatment outcome from pre-treatment to post-treatment (Q_1 = 0.12, *p* > .05). Large effect sizes were seen in effectiveness studies (*k* = 4; *g* = 1.05; 95% CI: 0.64 – 1.45; I^2 = 64.88) as well as efficacy studies (*k* = 14; *g* = 1.13; 95% CI: 0.91 – 1.34; I^2 = 75.66).

3.2.2.5. Number of treatment weeks. The number of treatment weeks did not moderate treatment effects from pre-treatment to post-treatment (Q_1 = 1.95, *p* > .05).

3.2.2.6. Mean age of participants. The mean age of participants did not moderate treatment effects from pre-treatment to post-treatment (Q_1 = 0.04, *p* >.05).

3.2.2.7. Gender distribution. The gender distribution of participants moderated treatment effects from pre-treatment to post-treatment ($Q_1 = 4.40$, $p = .04$) with studies that had a higher percentage of female participants having higher effect sizes than those with lower levels of female participants. Approximately 15% of the pre-treatment to post-treatment variance was explained by the percentage of female participants in the sample.

3.2.2.8. Study quality. The study quality did not moderate treatment effects from pre-treatment to post-treatment ($Q_1 = 3.27$, $p > .05$).

3.3. Depressive Symptoms

3.3.1. Overall within-group effect size for co-morbid depression symptoms. Table 3 outlines the within-group effect sizes for each of the included studies. The pooled within-group mean effect size was small for depression outcomes from pre-treatment to post-treatment ($k = 11$; $g = 0.45$; 95% CI: 0.28 - 0.61). A moderate level of heterogeneity across studies was found ($I^2 = 73.32$). The Trim and Fill method indicated there was evidence of publication bias with four studies trimmed (adjusted $g = 0.28$; 95% CI: 0.10-0.46). Using the one study removed method effect sizes remained unchanged. Pre-treatment to follow-up effects could not be calculated due to small sample size.

3.3.2. Moderator Analyses

3.3.2.1. Baseline depression severity. Baseline depression severity did not significantly moderate treatment effects on depression outcome measures from pre-treatment to post-treatment ($Q_1 = 3.82$, $p > .05$), however larger effect sizes were seen on depression outcome measures when the baseline level of depression was in the *'moderate'* ($k = 6$; $g = 0.49$; 95% CI: 0.27 - 0.71) or *'severe'* ($k = 3$; $g = 0.59$; 95% CI: 0.27 - 0.90) range, rather than the *'normal/mild'* range ($k = 2$; $g = 0.12$; 95% CI: -0.26 - 0.49).

3.3.2.2. Treatment modality. Treatment modality did not moderate treatment effects on depression measures from pre-treatment to post-treatment ($Q_1 = 0.22$, $p > .05$), with studies using a group treatment approach resulting in a small effect size ($k = 9$; $g = 0.47$; 95% CI: 0.28 - 0.66), as did studies utilising an individual treatment approach ($k = 2$; $g = 0.36$; 95% CI: -0.06 - 0.78).

3.3.2.3. Home visits. Treatment presence of home visits did not moderate treatment effects on depression measures from pre-treatment to post-treatment ($Q_1 = 0.16$, $p > .05$), with studies utilising home visits resulting in a small effect size ($k = 6$; $g = 0.49$; 95% CI: 0.24 - 0.73), as did studies that omitted home visits ($k = 5$; $g = 0.41$; 95% CI: 0.16 - 0.67).

3.3.2.4. Depression measure. The depression assessment tool used did not moderate treatment effects on depression measures from pre-treatment to post-treatment ($Q_1 = 0.01$, $p > .05$), with studies utilising the BDI resulting in a small effect sizes ($k = 8$; $g = 0.45$; 95% CI: 0.25 - 0.66), as did studies that used the depression subscale of the DASS ($k = 3$; $g = 0.44$; 95% CI: 0.12 - 0.76).

4. Discussion

The aim of the present study was to extend the literature by conducting an updated meta-analysis to synthesize treatment effects of CBT for HD and secondary depressive symptoms. The results indicated that CBT for HD results in large effect sizes from pre-treatment to post-treatment ($g = 1.11$). The pre-treatment to post-treatment within-group effect size found in the present study is slightly larger than that found in a previous meta-analyses examining CBT for HD (e.g., Tolin et al., 2015) which found a pooled within-group effect size of $g = 0.82$. From pre-treatment to follow-up, the effect size remained in the large range ($g = 1.25$). This is the first study to examine the long-term effects of CBT for HD using a meta-analytic approach. The results indicate that improvements in HD symptoms after CBT

may be maintained in the long term, however, these results should be interpreted as preliminary given that only four studies included a follow-up assessment and the longest follow up assessment was six months, which is problematic given the chronic nature of HD (Tolin et al., 2010). As the field progresses it will be important for more studies to assess the long-term effects of CBT for HD including studies with follow up assessments of 12-months or longer.

Moderator analyses in the present study indicated that studies that included a higher proportion of female participants performed better than studies with lower levels of female participants. This finding is consistent with Tolin et al. (2015) who found that that a higher proportion of female participants moderated not just overall HD symptoms, but also outcomes on measures of clutter, difficulty discarding, and acquiring. Given the gender distribution was skewed towards women in most studies, as well as the small number of studies included in the meta-analysis overall, it is important that these results are considered preliminary. As the field progresses it will be important for researchers to assess whether demographic factors such as gender and age affect treatment outcomes in both the short and long-term.

Treatment modality (i.e., individual vs group treatment), level of therapist training, the use of home visits (as well as the number of home visits), the number of treatment weeks, the trial type (i.e., efficacy vs effectiveness), the mean age of the sample, and study quality did not moderate treatment outcome from pre-treatment to post-treatment. Our finding regarding treatment modality is consistent with previous meta-analyses of CBT for HD (Tolin et al., 2015) and it indicates that patients can be provided with either treatment approach informed by preference and service provider availability. It is noteworthy that there is preliminary evidence to suggest that individuals with HD may demonstrate a preference for

individually delivered treatment over group based treatment (Robertson et al., 2020) and providing such options may enhance treatment uptake for those with HD.

While the level of training of the therapist was not a significant moderator there was some evidence to suggest that treatments provided by licensed therapists produced larger effect sizes (g = 1.27) than those delivered by trainees (g = 0.89). Research on therapist training on treatment outcomes has been mixed in the literature with some suggesting it is important (Kobak et al., 2017), while others suggesting it does not make meaningful a difference (Van Oppen et al., 2010). Thus, this is an important variable to examine in future research, as this will help inform the appropriate level of training required to provide treatment for individuals with HD.

The presence of home visits as part of the intervention was not found to moderate treatment outcomes. This finding is inconsistent with previous meta-analyses of CBT for HD (e.g., Tolin et al., 2015) which found that discarding in the home improves treatment effects. While it is important that the role of home visits be assessed in future research in HD, as this can be a difficult and costly service to provide to patients, there may also be scope to deliver such home visits virtually, reducing any associated costs. For instance, some researchers have used remote treatment methodologies, such as internet-videoconferencing to provide treatment in the home, with promising results (e.g., Muroff & Steketee, 2018). As a result, future research may wish to examine not only the usefulness of home visits, but also whether there are differences between *in-vivo* home visits and virtual home visits.

The number of treatment weeks associated with the treatment protocol did not moderate treatment outcomes. This finding is partially consistent with Tolin et al. (2015) who found that the number of sessions moderated treatment outcome for clutter severity, but not overall HD symptoms. While existing treatment guidelines have suggested that CBT for HD typically requires longer treatment than other psychological conditions (Wootton et al., 2019)

it is important for this to be examined empirically where different treatment durations are compared in order to inform a best practice service delivery model for HD.

The current study demonstrated that effectiveness studies produced similar outcomes to efficacy studies. Notably, this highlights that when CBT is delivered as part of standard treatment for HD results are generally equivalent to those found in tightly controlled research trials. This finding is consistent with those found for other anxiety and related disorders which have shown that CBT can be effectively disseminated in real-world clinical settings (Hans & Hiller, 2013; Stewart & Chambless, 2009) with durable outcomes over at least a three year period (Wootton et al., 2015).

A secondary aim of the present study was to examine the effectiveness of CBT for HD in reducing depressive symptoms. The present study demonstrated small treatment effects from pre-treatment to post-treatment on depressive symptoms (g = 0.45). Baseline depression severity, treatment modality, use of home visits, and the assessment tool used (i.e., BDI or DASS) did not moderate treatment outcomes in the present study. While the results from the current study indicate some evidence to suggest that larger effect sizes on depression measures are seen in groups of patients who had a higher level of depressive symptoms at baseline, it is possible that this finding reflects a potential floor effect in those studies that included individuals with lower depressive symptoms at baseline. However, given approximately half of individuals with HD will have a co-morbid depressive disorder (Frost et al., 2011; Tolin et al., 2019) future research may wish to examine the efficacy of transdiagnostic approaches to the HD treatment, where multiple disorders are treated simultaneously. Transdiagnostic treatments have been demonstrated to be effective across a number of internalising disorders (Andersen et al., 2016; Barlow et al., 2017; Farchione et al., 2012) and have also been found to improve emotion regulation difficulties across multiple disorders (Sloan et al., 2017), which is also seen as a difficulty in individuals with HD

(Taylor et al., 2018). Future research may also wish to examine other potential moderators of depressive symptom outcome in patients being treated with CBT for HD.

While the current study demonstrates the efficacy of CBT for HD there are a number of methodological limitations that must be acknowledged. Firstly, there were only two controlled trials available comparing an active treatment to a non-active CBT treatment, and as such between-group analyses were not able to be conducted. Secondly, most of the included studies were of low quality and did not include long term follow up assessments. As the field progresses it is important that more controlled trials with high study quality are used to examine the efficacy of CBT for HD. Finally, the present study included only published papers and the inclusion of 'grey' literature may alter the results found in the current study. Notwithstanding these limitations, the present study provides some updated insights into efficacy of CBT for HD and some moderators for further consideration.

HD is a new diagnostic category in DSM-5 and the literature supporting the efficacy of CBT as a treatment for this condition is still emerging. The current study demonstrates the short term and long term efficacy of CBT for HD and demonstrated that the gender distribution of the sample at baseline may moderate treatment outcome. The study also highlighted that treatment modality (individual vs group), therapist training, presence of home visits, as well as number of home visits, trial type (efficacy vs effectiveness), number of treatment weeks, mean age of participants, and study quality did not moderate treatment outcome. While most individuals with HD will have a comorbid depressive disorder, CBT for HD results in only small to moderate changes in depressive symptoms. It is important for future research to continue to evaluate the efficacy of CBT for HD using well designed controlled trials in order to ascertain a best-practice approach to treatment for this disabling condition.

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Table 1.

Characteristics of Included Studies

Study	Country	Trial type	Treatment	*n*	Treatment length (weeks)	Hoarding outcome measure	Depression outcome measure	Mean age (years)	% female	Longest follow-up (months)	Quality rating	Therapists	Use of home visits (number of home visits)
Ayers et al. (2011)	USA	Efficacy	I	12	16	SI-R#	BDI	73.7	58	6	27	Licensed	Y (6.5)
Chandler et al. (2019)	UK	Effectiveness	G	24	24	SI-R#	BDI	57.8	75	None	23	Licensed	Y (2)
Gilliam et al. (2011)	USA	Efficacy	G	35	16	SI-R	DASS-D	55.1	86	None	19	Trainee	N
Ivanov et al. (2018)	SN	Efficacy	G	20	16	SI-R#	--	53.7	90	3	23	Licensed	N
Mathews et al. (2018)	USA	Efficacy	G	160	20	SI-R#	BDI	59.0	73	$\geq$ 3	22	Trainee	Y (2)
Moulding et al. (2017)	AU	Effectiveness	G	41	12	SI-R	DASS-D	53.5	85	None	19	Licensed	N
Muroff et al. (2009)	USA	Efficacy	G	32	16	SI-R	BDI	53.0	66	None	19	Trainee	N
Muroff et al. (2012)	USA	Efficacy	G	14	20	SI-R	BDI	54.7	64	None	26	Licensed	Y (4)
Muroff et al. (2012)	USA	Efficacy	G	11	20	SI-R	BDI	55.0	91	None	26	Licensed	Y (8)
O'Connor et al. (2018)	CA	Efficacy	G	16	20	HRS	BDI	53.1	65	6	21	Licensed	N

Steketee et al. (2000)	USA	Efficacy	G	6	15	H-YBOCS	--	50.4	29	None	12	Trainee	Y (NS)
Steketee et al. (2010)	USA	Efficacy	I	41	26	SI-R#	BDI	54.0	75	None	24	Trainee	Y (6.5)*
Tolin et al. (2007)	USA	Efficacy	I	10	26	SI-R	--	49.2	100	None	23	Licensed	Y (6.5)*
Tolin et al. (2012)	USA	Efficacy	G	6	16	SI-R	--	52.8	33	None	19	Trainee	N
Tolin et al. (2019)	USA	Efficacy	G	46	16	SI-R	DASS-D	53.9	80	None	31	Licensed	N
Turner et al. (2010)	USA	Effectiveness	I	6	28-41	CIR	--	72.3	83	None	14	Trainee	Y (NS)
Worden et al. (2017)	USA	Effectiveness	G	11	16	SI-R	--	NS	NS	None	17	Licensed	N
Worden et al. (2017)	USA	Efficacy	G	14	16	SI-R#	--	51.5	64	None	17	Licensed	N

Note. Country: USA = United States of America, UK = United Kingdom, AU = Australia, CA = Canada, SN = Sweden; G = Group Cognitive Behavior Therapy, I = Individual Cognitive Behaviour Therapy; Outcome measure: SI-R= Savings Inventory- Revised, HRS = Hoarding Rating Scale, H-YBOCS = Hoarding Yale-Brown Obsessive Compulsive Scale, CIR = Clutter Image Rating scale; BDI = Beck Depression Inventory; DASS-D = Depression Subscale of the Depression Anxiety Stress Scales; # indicates intention-to-treat analysis used; NS = Not stated. * indicates values obtained from Tolin et al (2015).

Table 2.

Within-group Effect Sizes from Pre-treatment to Post-treatment and Pre-treatment to Follow-up on Hoarding Outcome Measures

Study	Pre-treatment to post-treatment			Pre-treatment to follow up		
	g	95% CI	Weight of included study	*g*	95% CI	Weight of included study
Ayers et al. (2011)	0.81	0.33 – 1.29	5.45	0.79	0.32 – 1.27	21.71
Chandler et al. (2019)	1.56	1.11 – 2.02	5.65	--	--	--
Gilliam et al. (2011)	1.27	0.93 – 1.61	6.65	--	--	--
Ivanov et al. (2018)	1.57	1.08 – 2.07	5.28	1.45	0.97 – 1.93	21.68
Mathews et al. (2018)	1.33	1.17 – 1.49	8.04	1.17	1.02 – 1.33	39.68
Moulding et al. (2017)	0.78	0.51 – 1.05	7.28	--	--	--
Muroff et al. (2009)	0.53	0.25 – 0.81	7.17	--	--	--
Muroff et al. (2012)	2.05	1.26 – 2.83	3.37	--	--	--
Muroff et al. (2012)	1.00	0.53 – 1.48	5.45	--	--	--
O'Connor et al. (2018)	1.07	0.61 – 1.53	5.60	1.76	1.16 – 2.35	16.94
Steketee et al. (2000)	0.61	0.02 – 1.19	4.61	--	--	--

Steketee et al. (2010)	0.95	0.67 – 1.23	7.16	--	--	--
Tolin et al. (2007)	1.48	0.82 – 2.15	4.05	--	--	--
Tolin et al. (2012)	0.41	-0.15 – 0.96	4.87	--	--	--
Tolin et al. (2019)	1.46	1.14 – 1.78	6.84	--	--	--
Turner et al. (2010)	0.87	0.23 – 1.52	4.18	--	--	--
Worden et al. (2017)	0.99	0.46 – 1.52	5.03	--	--	--
Worden et al. (2017)	1.81	1.02 – 2.60	3.33	--	--	--
Overall	**1.11**	**0.92 – 1.29**	**--**	**1.25**	**0.94 – 1.56**	**--**

Table 3.

Within-group Effect Sizes from Pre-treatment to Post-treatment on Depression Outcome Measures

Study	Pre-treatment to post-treatment		
	g	95% CI	Weight of included study
Ayers et al. (2011)	0.73	0.27 – 1.20	6.53
Chandler et al. (2019)	0.94	0.58 – 1.30	8.21
Gilliam et al. (2011)	0.74	0.46 – 1.03	9.70
Mathews et al. (2018)	0.20	0.08 – 0.33	12.70
Moulding et al. (2017)	0.36	0.11 – 0.61	10.47
Muroff et al. (2009)	0.59	0.31 – 0.88	9.70
Muroff et al. (2012)	0.51	0.10 – 0.92	7.42
Muroff et al. (2012)	0.73	0.24 – 1.21	6.29
O'Connor et al. (2018)	0.11	-0.25 – 0.47	8.25
Steketee et al. (2010)	0.12	-0.11 – 0.36	10.71
Tolin et al. (2019)	0.23	-0.04 – 0.50	10.01
Overall	**0.45**	**0.28 – 0.61**	

Figure 1.

Study flow chart