School of Psychology
Ysgol Seicoleg

Hoarding Disorder:

Beliefs about Possessions

Thesis submitted in partial fulfilment of the requirement for the degree of:

Doctorate of Clinical Psychology (DClinPsy)

South Wales Doctoral Programme in Clinical Psychology

Cardiff University

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18th September 2024

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Acknowledgements

I would like to begin by thanking my research supervisors, Dr James Gregory and Dr Falguni Nathwani. Your continuous encouragement and motivation throughout this process have been greatly appreciated and has supported both my professional development and personal wellbeing. I have learnt so much from you both and I am grateful for the time and effort you have dedicated to my Large-Scale Research Project.

I am extremely grateful for the support offered by so many others in my life. I would like to express my gratitude to my husband, who has truly believed in me and continuously inspired me. Thank you for all that you have done to help me during this time. I am also grateful for the kindness and compassion offered by my family and friends around me.

Preface

Individuals with Hoarding Disorder (HD) find it difficult and distressing to discard possessions and this can result in cluttered living spaces which are difficult to move around in (Frost & Hartl, 1996). This can significantly impact a person's wellbeing, for example, it can interfere with daily activities such as food preparation and personal hygiene (Frost et al., 2000). HD is also associated with substantial risks, such as fires, and those who experience HD are at risk of losing possessions through forced clearances, or losing their home through eviction (Frost et al., 2000). The cognitive behavioural model of hoarding, proposed by Frost and Hartl (1996) aims to explain why hoarding may develop and why it may continue. The model suggests that the beliefs people hold about their possessions play a critical role in understanding why individual's take in new items ('acquiring'), decide to keep items ('difficulty discarding') and why items accumulate in living spaces ('clutter'). Subsequently, there has been substantial interest in investigating the types of beliefs about possessions that are reported by those who experience clinically significant hoarding symptoms (Wheaton, 2016). Research studies have investigated a range of specific beliefs about possessions, and how strong their relationship is with both overall severity and the specific symptoms of hoarding (Dozier & Ayers, 2014; Steketee et al., 2003). Researchers have also investigated whether those who experience clinically significant hoarding difficulties report higher levels of these beliefs compared to individuals who do not report hoarding difficulties (Gordon et al., 2013; Steketee et al., 2003).

Despite the wealth of research data available, there has not yet been a comprehensive summary of what is known about beliefs about possessions and their association with the symptoms of hoarding (acquiring, difficulty discarding, clutter). Therefore, the first paper presented in this thesis is a comprehensive review of what is known about beliefs about possessions in the context of hoarding. Using meta-analytic techniques, we were able to statistically combine the results of many studies to more accurately estimate whether beliefs about possessions have a significant relationship with the symptoms of hoarding. In combination with narrative synthesis, our results provided

consistent, strong evidence to suggest that beliefs about possessions are highly important and relevant in better understanding hoarding. The results also highlighted that a wide range of beliefs about possessions are present. For example, beliefs may include those concerning emotional attachment with possessions (e.g., *"This possession provides me with emotional comfort"*), being responsible for looking after items (e.g., *"I am responsible for the well-being of this possession"*), needing to maintain control over possessions (e.g., *"No one has the right to touch my possessions"*) and possessions serving as memory aids (e.g., *"I must remember something about this, I can't if I throw this away"*) (Steketee et al., 2003). Whilst the majority of research studies have primarily focused on these four belief types, other types of beliefs were also implicated in relation to hoarding, including those about possessions representing parts of identity (Tinlin et al., 2022) and items being beautiful or aesthetically pleasing (Dozier & Ayers, 2014; Frost et al., 2015), among others. It is evident therefore, that a diverse range of beliefs about possessions are significant in Hoarding Disorder.

To be best able to support individuals who experience clinically significant hoarding difficulties, health professionals need a way of asking about these kinds of beliefs. This will enable health professionals to understand why individuals may be taking in objects and finding it difficult to get rid of them. Indeed, clinicians are encouraged to use questionnaire tools as part of cognitive behavioural treatment (CBT) for hoarding, to develop a better understanding of the beliefs about possessions that are held by those seeking treatment (Steketee & Frost, 2006). These beliefs can then be targeted through the use of a range of techniques in CBT (Steketee & Frost, 2006). The second paper presented here therefore describes the evaluation of a new assessment tool, the Hoarding Disorder Beliefs Inventory (HDBI; Ragan et al., unpublished results). This tool aims to comprehensively capture a range of beliefs about possessions and has been developed in collaboration with those with personal and professional experience of hoarding difficulties. The study described here investigated whether the questionnaire accurately assesses beliefs about possessions and whether it does so reliably over time. To do this, online survey data was collected. Results

provided support for the reliability and validity of the HDBI and highlighted its potential clinical and research utility.

Overall, the results described in this thesis provide strong support for the role of beliefs about possessions in Hoarding Disorder, in both its maintenance as described by the cognitive behavioural model (Frost & Hartl, 1996) and as an important target during CBT treatment (Steketee & Frost, 2006). Clinicians are encouraged to use questionnaire tools to aid with the assessment of beliefs about possessions in therapy and the HDBI may represent a tool that has been carefully developed and thoroughly evaluated.

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Beliefs associated with Acquiring, Difficulty Discarding and Clutter in Hoarding Disorder: A Systematic Review and Meta-Analysis

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To be submitted to: Journal of Obsessive-Compulsive and Related Disorders

Word count: 8818

Abstract

There is substantial evidence highlighting the importance of beliefs about possessions in understanding and treating Hoarding Disorder. Despite this, there has not yet been a comprehensive review of this topic. Therefore, the aim of the current systematic review and meta-analysis was to synthesise the evidence base concerning the association between hoarding beliefs and hoarding symptom severity. Meta-analytic techniques were used to pool effect sizes concerning the association between hoarding beliefs and symptom severity (*r*, *d*) and narrative synthesis was applied to data which could not be included in the meta-analysis. 30 studies were eligible for inclusion in the review, with 24 studies contributing data for meta-analysis. Meta-analysis results indicated a small-medium significant association between beliefs about possessions and hoarding severity. This was generally consistent when considering specific belief types (i.e., emotional attachment, responsibility, memory, control) and specific hoarding symptoms (i.e., acquiring, difficulty discarding, clutter). Narrative synthesis confirmed that a range of beliefs about possessions were associated with hoarding symptoms amongst those with clinically significant hoarding symptoms. Overall, the results provide further support for the cognitive behavioural model and treatment of Hoarding Disorder.

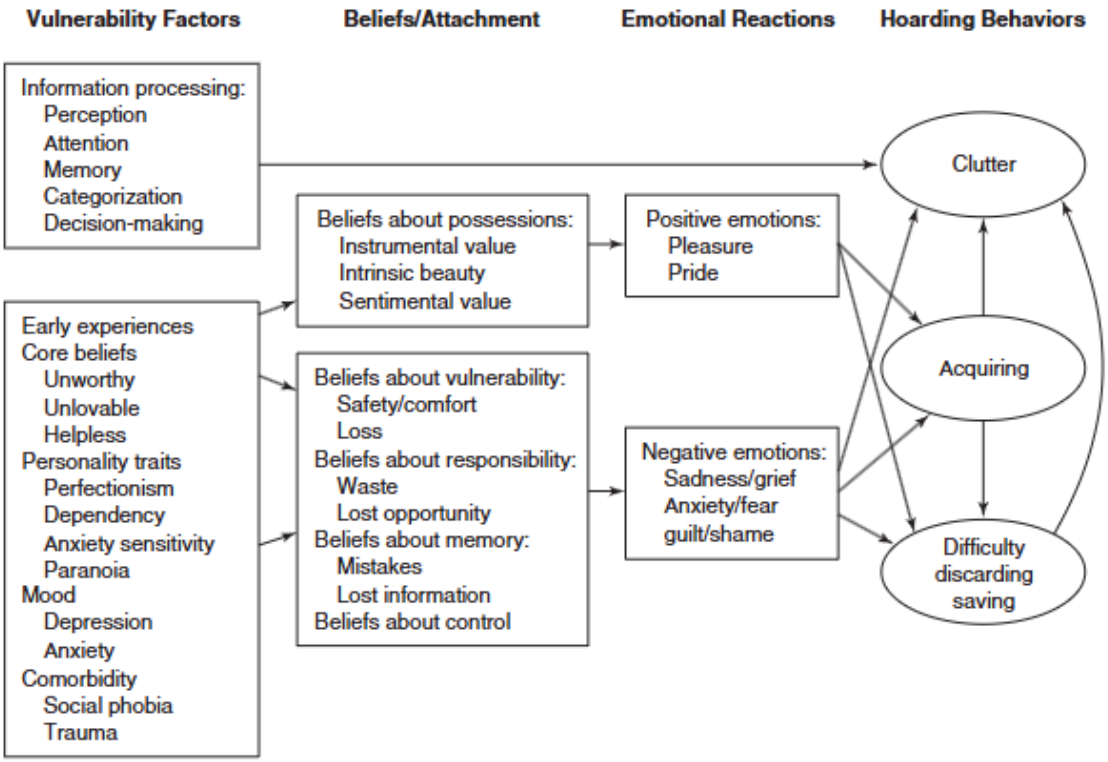
Individuals who meet criteria for Hoarding Disorder (HD) are assessed as having difficulty discarding possessions, which clutter living spaces and interfere with individuals being able to move around freely and use rooms as intended (American Psychiatric Association, 2013). HD has an estimated prevalence rate of 2.5% (Postlethwaite et al., 2019). It is important to further our understanding and treatment of HD, given the profound impact of these difficulties upon individuals; hoarding has been associated with occupational and social impairment (Archer et al., 2019; Tolin et al., 2008) and significant risks including fires, falls, poor hygiene and health, and pests (Diefenbach et al., 2013; Frost et al., 2000).

Specialised cognitive behavioural therapy (CBT) for hoarding has been developed (e.g., Steketee & Frost, 2006) which aims to target the maintenance factors implicated in the cognitive behavioural model proposed by Frost and Hartl (1996). This model was first represented diagrammatically by Steketee & Frost (2006) (Figure 1). The model suggests that the symptoms of hoarding (i.e., acquiring, difficulty discarding and clutter) result from interactions between information processing difficulties, beliefs about and attachment to possessions and emotional reactions which positively or negatively reinforce the continuation of hoarding (Frost & Hartl, 1996). Therefore, CBT treatment includes techniques which aim to target these maintaining factors, such as developing skills for organising and problem solving, cognitive strategies to reduce unhelpful beliefs about possessions and exposure methods to habituate to emotional discomfort during hoarding-related tasks (e.g., sorting possessions and attempting to discard) (Steketee & Frost, 2003; Steketee & Frost, 2006). Although CBT for hoarding is associated with symptom improvement (Gilliam et al., 2011; Steketee et al., 2010), a recent meta-analysis concluded that most individuals who engage with treatment continue to experience clinically significant symptoms (Tolin et al., 2015). Consistent with the implications of the Cognitive Behavioural model (Frost & Hartl, 1996), beliefs about possessions, as assessed by the Saving Cognitions Inventory (SCI; Steketee et al., 2003) have been found to reduce following CBT treatment (Ivanov et al.,

2018) and further, their reduction has been found to mediate changes in hoarding symptom severity during treatment (Levy et al., 2017; Tolin et al., 2019).

Figure 1

Cognitive behavioural model of hoarding (reproduced from Steketee & Frost, 2006)



Despite the central role of beliefs about possessions in the cognitive behavioural model (Frost & Hartl, 1996; Steketee & Frost, 2006), a comprehensive synthesis of what is known about beliefs about possessions in HD has not been conducted. Although reviews have synthesised studies exploring emotional attachment to possessions in hoarding (Kings et al., 2017; Mathes et al., 2020), they did not comprehensively examine the full range of beliefs about possessions that have been investigated using multiple measures in the HD field. Using the SCI, in addition to the role of beliefs about emotional attachment to possessions (e.g., “I could not tolerate it if I were to get rid of this”), beliefs related to control (e.g., I like to maintain sole control over my things”), responsibility (e.g., I’m ashamed when I don’t have something like this when I need it”) and memory (e.g., “I must remember

something about this, and I can't if I throw this away") have been associated with hoarding severity (Steketee et al., 2003). Although the SCI is the most popular assessment of beliefs about possessions, there are a range of self-report and interview tools that have been used to capture beliefs about possessions (Dozier & Ayers, 2014; Frost et al., 2015; Gordon et al., 2013; Hartl et al., 2005) and each of these assess different specific beliefs about possessions. These tools have additionally assessed beliefs about: (1) the aesthetic appeal of items or possessions (e.g., "How often do you save things because the object is beautiful or aesthetically pleasing regardless of its monetary or sentimental value?"; Dozier & Ayers, 2014), (2) possessions representing parts of the self or identity (e.g., "Items tell the story of my life – who I am and what I have done"; Tinlin et al., 2022), (3) fear of material deprivation (e.g., "If something is free then it would be very upsetting not to have it"; Gordon et al., 2013) and (4) possessions being predictable and stable (e.g., "My objects are predictable when nothing else is"; Tinlin et al., 2022).

The lack of a systematic review investigating the role of hoarding related beliefs about possessions is surprising given the wealth of data available. Indeed, as noted by Wheaton (2016), "Perhaps the most thoroughly researched area of the CBT model of HD concerns the cognitive factors that drive the remarkable attachment to possessions…" (p. 45). The association between hoarding and beliefs about possessions has been investigated using a range of methodologies and analyses, including group comparisons (i.e., comparing scores on belief measures between hoarders and clinical or community comparisons) (e.g., Steketee et al., 2003; Wheaton et al., 2013) and evaluations of the strength of the relationship (e.g., Dozier & Ayers, 2014; Grisham et al., 2018). In addition to investigating how overall belief strength is associated with hoarding severity (e.g., Grisham et al., 2018), including severity of specific symptoms of acquiring, difficulty discarding and clutter (e.g., Dozier et al., 2017), studies have also considered whether distinct belief types (e.g., beliefs about the emotional significance vs wasting a potentially useful object) have stronger/weaker associations with specific symptoms of hoarding (e.g., Dozier & Ayers, 2014).

Due to the central role of beliefs about possessions in both the cognitive behavioural model of hoarding (Frost & Hartl, 1996; Steketee & Frost, 2003) and the associated CBT treatment (e.g., Steketee & Frost, 2006), it is important to understand the relationship between beliefs about possessions and hoarding severity, through consideration of both correlational and group comparison data. This will enable the synthesis of both the strength of the association between beliefs and hoarding severity, and the specificity of beliefs about possessions in hoarding (i.e., are they specific to those who experience clinically significant hoarding difficulties or do non-clinical and clinical comparison groups experience them to the same degree?). By applying both meta-analysis and narrative synthesis to all available evidence, we can further our understanding of HD and develop hypotheses for how to improve treatment outcomes. For example, an understanding of the beliefs about possessions that are more specific in hoarding would support CBT treatments to become more targeted, analogous to the advancements that were made in treatments for panic disorder (e.g., Clark et al., 1997) and other anxiety disorders (e.g., LoSavio et al., 2017) as a consequence of understanding problem specific cognitions. The review aimed to answer the following questions:

1. What beliefs are associated with HD?
2. Is there evidence that particular belief domains are related to specific aspects of hoarding (i.e., acquisition, difficulty discarding or clutter)?
3. How does the strength of the association between beliefs and hoarding severity compare to that between other constructs of interest (e.g., experiential avoidance, emotion regulation) and hoarding severity?

Method

This systematic review and meta-analysis was pre-registered using Prospero (https://www.crd.york.ac.uk/prospero/display_record.php?ID=CRD42023346300). It was conducted in line with the Preferred Reporting Items for Systematic reviews and Meta-analyses (PRISMA; Page, McKenzie, et al., 2021; Page, Moher, et al., 2021).

Eligibility criteria

To be included in the review, studies had to measure and quantify the relationship between beliefs about possessions and hoarding severity. This included:

1. For a hoarding group, reporting the association between beliefs about possessions and hoarding severity (e.g., correlational, regression or mediation analysis).
2. Reporting group differences on measures of beliefs about possessions.

Studies had to include adults (18 years or older) with clinically significant hoarding, which was defined as either being assessed as meeting diagnostic criteria for HD according to DSM-5 (American Psychiatric Association, 2013) or ICD-11 (World Health Organization, 2019) or scoring above a justified threshold on a validated hoarding symptom severity measure (e.g., Hoarding Rating Scale, Tolin et al., 2010). Studies had to be written in English. Published, as well as unpublished studies (e.g., dissertations) were eligible for inclusion. To be included in the meta-analysis, studies had to report at least one of the following:

1. Sample size (*n*), hoarding severity (*M, SD*) and severity or intensity of beliefs about possessions (*M, SD*) for both a hoarding group and a comparison group (clinical or non-clinical).
2. For a hoarding group, sample size (*n*) and the association (*r*) between hoarding symptom severity (i.e., overall severity, acquiring, difficulty discarding, clutter) and beliefs about possessions (i.e., overall severity or intensity, or subscales of beliefs).

Studies were excluded if participants only hoarded animals, if they hoarded for other reasons (e.g., dementia, brain injury, neurological disorders, other mental health problems) or if they were categorised into a hoarding group using an Obsessive-Compulsive Disorder (OCD) related measure (e.g., hoarding subscale of the Obsessive-Compulsive Inventory-Revised, Foa et al., 2002). Finally, studies were excluded if they only utilised qualitative methods to describe the relationship between beliefs about possessions and hoarding.

Search strategy

Three literature databases (Embase, APA PsycInfo, PubMed) were searched in November 2023, with no filters or limits applied. The searches were re-run in May 2024 to capture any recently published relevant data prior to data analysis. The search strategies can be seen in Table 1. Prevalent authors within the HD research field were also contacted via email in March 2024 to request unpublished data that fit the eligibility criteria. The reference lists of eligible studies were also reviewed to identify further potentially relevant studies.

Table 1

Search Strategy for Bibliographic Databases

Database	Version	Search platform	Search strategy
APA PsycINFO	1806 to October Week 4 2023	OVID	Hoard*.mp AND (cognition*.mp OR belief*.mp OR meaning*.mp OR motiv*.mp OR incentive*.mp OR attitude*.mp OR thought*.mp OR view*.mp OR reason*.mp OR opinion*.mp OR value*.mp OR think*.mp)
Embase Classic +Embase	1947 to 2023 November 03	OVID	Hoard*.mp AND (cognition*.mp OR belief*.mp OR meaning*.mp OR motiv*.mp OR incentive*.mp OR attitude*.mp OR thought*.mp OR view*.mp OR reason*.mp OR opinion*.mp OR value*.mp OR think*.mp)

Database	Version	Search platform	Search strategy
PubMed	1947 to 2023	PubMed	"hoard*"[All Fields] OR "hoarding disorder"[MeSH Terms] OR "hoarding" [MeSH Terms] AND "cognition*"[All Fields] OR "belief*" [All Fields] OR "meaning*"[All Fields] OR "motiv*" [All Fields] OR "incentive*"[All Fields] OR "attitude*" [All Fields] OR "thought*"[All Fields] OR "view*"[All Fields] OR "reason*" [All Fields] OR "opinion*"[All Fields] OR "value*" [All Fields] OR "think*"[All Fields] OR "cognition"[MeSH Terms] OR "motivation"[MeSH Terms] OR "attitude"[MeSH Terms] OR "thinking"[MeSH Terms]

Note. In APA PsycINFO, .mp searches abstract, heading word, key concepts, MeSH word, original title, table of contents, tests & measures and title. In Embase, .mp searches abstract, candidate team word, device manufacturer, device trade name, drug manufacturer, drug trade name, floating subheading word, heading word, keyword heading word, original title and title.

Identification of eligible studies

Following the searches, deduplication of results was completed by first using Endnote's deduplication function (Endnote 20.6), then as recommended by Kwon et al. (2015), checked manually. The former allowed for automatic searching of duplicates using a combination of title, author and year. The primary author (AS) then sifted all titles and abstracts to identify potentially eligible articles, which were then reviewed at full text to determine inclusion or exclusion based upon the eligibility criteria. A second independent reviewer sifted through 18% of the titles and abstracts (325 records) and screened 10% of the full text articles (20 papers). Initial disagreements at both stages were resolved through discussion. Rayaan (Ouzzani et al., 2016) was used by the primary author and the independent reviewer to consider the titles and abstracts of papers. There were 27 disagreements at the title and abstract stage (8%), which were resolved through discussion. There was one disagreement at full text review (5%) which was resolved through discussion.

Data extraction

The primary author applied a pilot data extraction tool to an eligible paper before data was extracted from the remaining papers. Where available, data was extracted for the

following variables: title of publication, authors and date of publication, study setting, study design, participant groups, sample size, demographics of sample (age, gender, ethnicity), co-morbidity data, inclusion and exclusion criteria, interview or self-report measures used, study procedure (for experimental or longitudinal studies), analysis strategy, *M/SD* on interview or self-report measures, results (i.e., correlations, regression models, group differences, mediation analysis).

For the meta-analysis specifically, the following data was extracted where available: sample size (*n*), overall hoarding severity (*M, SD*) and severity (*M, SD*) of acquiring, difficulty discarding and clutter. As well as overall severity or intensity of beliefs about possessions (*M, SD*), data was extracted for specific hoarding-related beliefs about possessions, including those relating to: (1) emotional attachment, (2) control, (3) responsibility and (4) memory. Where data was not reported, but was available based on study methodology, authors were contacted with a request to provide the additional data. Authors were given at least one week to respond. Four authors responded, providing additional data that was not reported in the initial publications (Diefenbach et al., 2013; Dozier et al., 2017; Pardini et al., 2023; Wheaton et al., 2013). For severity of hoarding symptoms, the Saving Inventory-Revised (SI-R; Frost et al., 2004) was prioritised, such that if studies used more than one hoarding symptom severity measure, only data (i.e., *M, SD*) relating to the SI-R was extracted for the meta-analysis. In comparison, if studies included more than one measure of beliefs about possessions, or if they reported data related to both subscales and totals of belief measures, all data was extracted. Where possible, missing data was calculated based on that available within manuscripts. For example, if studies only reported mean and standard deviation for belief subscales, this data was used to calculate an estimated overall hoarding beliefs severity (*M, SD*).

Data synthesis

Meta-analysis

The metafor package (Viechtbauer, 2010) within R (4.4.1) (R Core Team, 2024) was used to run the meta-analysis. Many studies utilised the SCI (Steketee et al., 2003) to assess hoarding related beliefs about possessions. Therefore, in addition to investigating the relationship between hoarding and overall strength or intensity of beliefs about possessions, it was also possible to investigate the relationship between hoarding and specific belief types as assessed by the SCI (i.e., emotional attachment, responsibility, control, memory). Where possible, other belief measures or subscales used by studies included in the meta-analysis were mapped onto the subscales of the SCI for pooling of effect sizes (Table 2).

Table 2

Belief measure(s) pooled during meta-analysis

Belief type	Belief measure(s)
Emotional attachment to possessions	SCI emotional attachment subscale (Steketee et al., 2003) HDBI emotional attachment and safety subscale (Ragan et al., unpublished results) Reasons for saving/acquiring sentimental or emotionally significant subscale (Dozier & Ayers, 2014) Hoarding Interview emotional reasons subscale (Frost et al., 2015) BAH attachment disturbance subscale (Gordon et al., 2013) PCS (Hartl et al., 2005)
Responsibility	SCI responsibility subscale (Steketee et al., 2003) HDBI Items are useful and should not be wasted subscale (Ragan et al., unpublished results) Reasons for saving/acquiring wasting a potentially useful object subscale (Dozier & Ayers, 2014) Hoarding Interview avoid waste subscale (Frost et al., 2015)
Memory	SCI memory subscale (Steketee et al., 2003) Reasons for saving/acquiring losing important information (Dozier & Ayers, 2014) Hoarding Interview information subscale (Frost et al., 2015)
Control	SCI control subscale (Steketee et al., 2003)

Note. SCI = Saving Cognitions Inventory; HDBI = Hoarding Disorder Beliefs Inventory (HDBI), BAH = Beliefs about Hoarding; PCS = Possessions Comfort Scale.

Due to some studies contributing more than one effect size per analysis, multi-level meta-analytic models (i.e., three-level meta-analysis) were applied. Multi-level models allow all information (i.e., effect sizes) to be included, whilst acknowledging that effect sizes from the same study may have shared dependencies (Assink & Wibbelink, 2016). Cochran's Q-test and Higgin's and Thompson's I^2 statistic were used to assess heterogeneity of effect sizes. Potential publication bias was investigated by visual inspection of funnel plots, the Egger's test and where appropriate, Kendall's tau was also calculated.

To investigate the association between hoarding severity (i.e., overall severity and severity of acquiring, difficulty discarding and clutter specifically) and overall strength of beliefs about possessions, Pearson product-moment correlations were first standardised by transforming them into Fisher's z, before they were pooled using a three-level meta-analysis model. This process was repeated but considering only those correlations that reported on the association between the sub-indices of the SCI and hoarding severity (i.e., overall severity and severity of acquiring, difficulty discarding and clutter specifically). This enabled us to investigate whether the relationship between beliefs and hoarding severity depended on type of belief (i.e., emotional attachment, control, responsibility or memory) using three-level mixed-effects models.

Finally, three-level meta-regression models were used to investigate whether group differences (i.e., hoarders vs clinical or non-clinical comparison groups) in hoarding beliefs were associated with group differences in hoarding severity. Group differences were standardised using Cohen's *d* before they were pooled. A three-level meta-regression mixed effect model was used to investigate whether the association differed depending on type of belief.

Narrative synthesis

Narrative synthesis was used to summarise and interpret study results which could not be incorporated into the meta-analysis. This included studies which only reported results

related to the role of beliefs as mediators, or only reported on the predictive ability of beliefs about possessions within multiple regression analysis. Narrative synthesis also applied to studies which compared distinct hoarding groups to one another and did not compare them to a non-clinical or clinical comparison group. Studies were also included in the narrative synthesis, but not the meta-analysis, if they had pooled results from multiple studies to complete their analysis or if the sample was already included in the meta-analysis separately (i.e., separate publications had used the same sample of participants). Finally, narrative synthesis was applied to studies which were included in the meta-analysis, if they had additionally reported results that could not be incorporated into the meta-analysis.

Quality assessment

The assessment tool for observational cohort and cross-sectional studies was used to rate study quality in the current review (National Heart Lung and Blood Institute, 2013). Six additional questions were also extracted and applied from the assessment tool for case control studies (National Heart Lung and Blood Institute, 2013), due to their relevance for group comparison methodology (see Appendix A). All questions were answered 'Yes', 'No', 'Cannot determine' (CD), 'Not Reported' (NR) or 'Not Applicable' (N/A). When applying the quality assessment tool, *exposure/risk* was defined as beliefs about possessions, *outcome* was defined as hoarding severity, *cases* were defined as those meeting criteria for clinically significant hoarding and *controls* were defined as referring to community and/or clinical comparison groups. In line with the recommended use of each tool, after applying all relevant questions each study was given an overall rating of 'poor', 'fair' or 'good'. Due to the number of questions dedicated to whether studies were cross-sectional or longitudinal (25%), studies which only provided cross-sectional data could not be rated above 'fair'. This ultimately applied to all studies included in the review and therefore no studies were given a quality rating of 'good'. Considering all other question items, studies were given a quality rating of 'poor' if they scored 'No', 'CD' or 'NR' on over 50% of the remaining applicable items. A second independent reviewer completed the quality assessment tool for six papers

(20%). There were initially disagreements on 12 individual question items (11%) which were resolved through discussion.

Results

Search results

The process of identifying eligible studies via database searching and other methods is shown in Figure 2. The database search strategy resulted in 2833 total records. Following deduplication, 1822 titles and abstracts were screened to identify potentially suitable studies. Eligibility criteria was subsequently applied to 201 full text articles, with 28 studies retained for inclusion in the review. Two further studies were identified via alternative methods: one via citation searching, and one provided by the primary author (unpublished data).

Study characteristics

Characteristics of the studies which were included in the review can be seen in Table 3. Most studies (N = 15) were based in the USA (1, 3-7, 9-10, 15-16, 20-21, 23, 27, 30), followed by the UK (12, 14, 22, 24-26, 28-29), Australia (2, 8, 11, 13), Italy (19) and Singapore (17). One study was based in several countries (18), with Nordsletten et al. (2018) comparing hoarding groups across London and Rio de Janeiro.

Figure 2
Process to identify eligible studies for the review

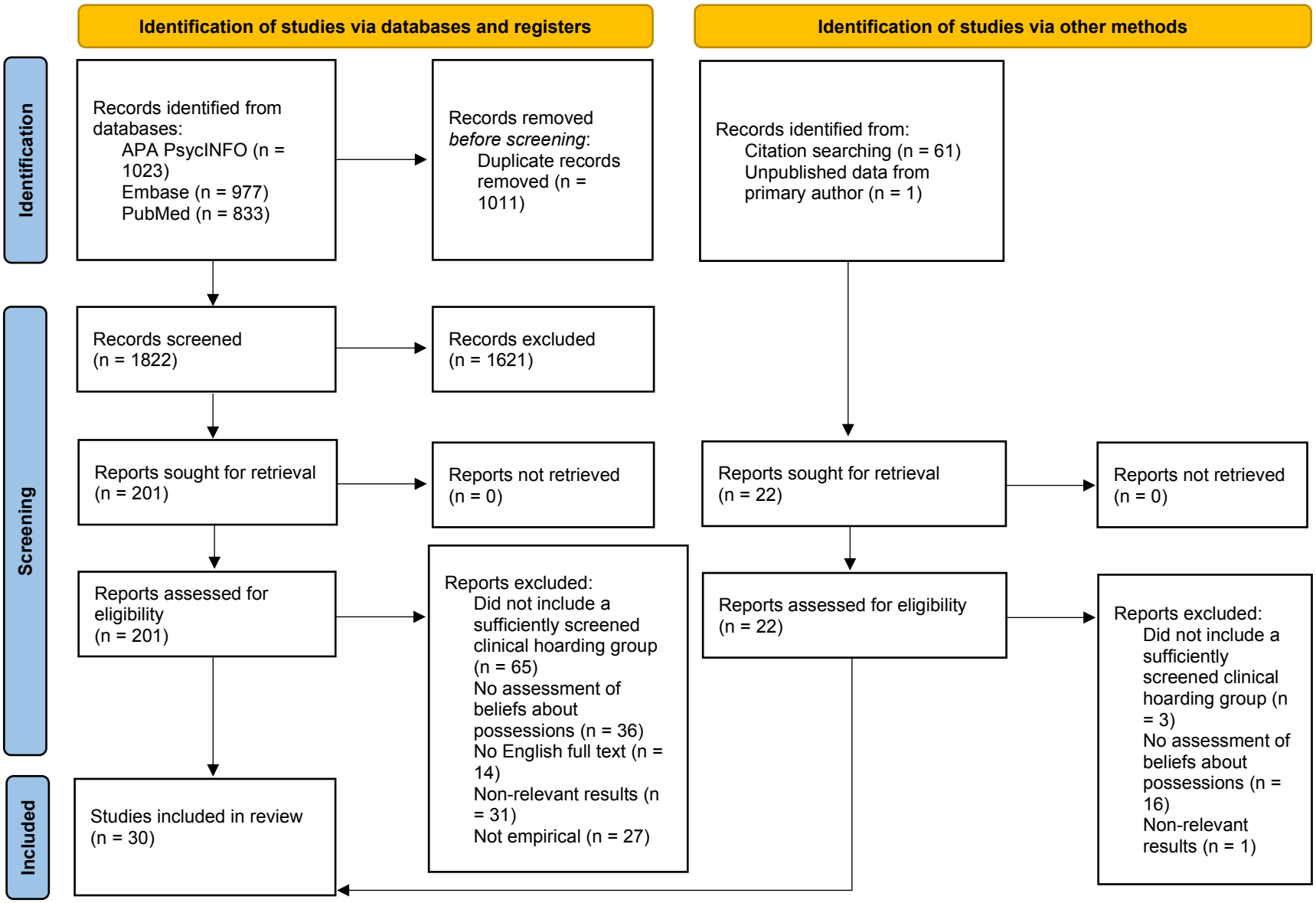


Table 3

Study Characteristics

ID	Study	Setting	Study design	Analysis	Hoarding criteria	Sample (*n* =)	Gender %	Age (M, *SD*)	Ethnicity (% White)
1	(Dozier & Ayers, 2014)	USA	Cross-sectional correlational within-groups	Zero-order correlations, paired sample t-tests, multiple regressions	Proposed DSM-5 criteria	Hoarding (*n* = 84)	75% female 25% male	(63.8, *8.1*)	No data
2	(Grisham et al., 2018)	AUS	Cross-sectional correlational	Zero-order correlations, mediation	DSM-5 HD	Hoarding (*n* = 73)	75% female 25% male	(64.17, *9.3*)	No data
3	(Frost et al., 2015)	USA	Cross-sectional correlational mixed methods	Mixed model ANOVAs, zero-order correlations, linear multiple regressions	DSM-5 HD	Hoarding (*n* = 217)	Hoarding: 77% female, 23% male	Hoarding (52.6, *10.3*)	Hoarding (88%)
						OCD (*n* = 96)	OCD: 48% female, 52% male	OCD (34.5, *13.7*)	OCD (86%)
						CC (*n* = 130)	CC: 70% female, 20% male	CC (52.6, *13.5*)	CC (88%)

ID	Study	Setting	Study design	Analysis	Hoarding criteria	Sample (*n* =)	Gender %	Age (M, *SD*)	Ethnicity (% White)
4	(Wheaton et al., 2013)	USA	Cross-sectional correlational between-groups	t-tests, ANCOVAs, zero-order correlations, multiple regression	Proposed DSM-5 criteria	Hoarding (*n* = 33) HC (*n* = 30)	Hoarding: 70% female, 30% male HC: 63% female, 37% male	Hoarding (48.8, *15.6*) HC (42.2, *14.0*)	Hoarding (73%) HC (80%)
5	(Hallion et al., 2015)	USA	Cross-sectional between-groups	t-test	DSM-5 HD	Hoarding (*n* = 32) HC (*n* = 26)	69% female	Hoarding (54.2, *7.4*) HC (52.5, *7.8*)	91%
6	(Chou, Tsoh, et al., 2018)	USA	Cross-sectional correlational	Mediation	DSM-5 HD	Hoarding (*n* = 104)	23% male	(59.9, *9.0*)	No data
7	(Dozier et al., 2017)	USA	Cross-sectional correlational	Zero-order correlations	DSM-5 HD	Hoarding (*n* = 20)	40% female 60% male	(59.4, *13.3*)	50%
8	(Fontenelle et al., 2021b)	AUS	Cross-sectional correlational	Spearman's correlations	SI-R > or = 39	Hoarding (*n* = 117)	91% female, 7% male, 2% non-binary, 1% gender not listed	(48.4, *12.7*)	No data

ID	Study	Setting	Study design	Analysis	Hoarding criteria	Sample (*n* =)	Gender %	Age (M, *SD*)	Ethnicity (% White)
9	(DeJong, 2016)	USA	Cross-sectional correlational between-groups	Zero-order correlations, independent t-tests	DSM-5 HD	Hoarding (*n* = 18) Non-hoarding (*n* = 20)	Hoarding: 83% female Non-hoarding: 75% female	Hoarding (47.5, *13.5*) Non-hoarding (42.4, *12.6*)	No data
10	(Frisse, 2014) **Post hoc HRS = or > 14 analysis only**	USA	Cross-sectional correlational between-groups	Zero-order correlations, independent t-tests	HRS-SR > or = 14	Hoarding (*n* = 23) NC (*n* = 78)	Hoarding: 52% female, 43% male NC: 63% female, 31% male	Hoarding (21.4, *3.4*) NC (22.5, *7.2*)	Hoarding (57%), NC (55%)
11	(Fontenelle et al., 2021a)	AUS	Cross-sectional correlational	Linear regression	SI-R > or = 39	Hoarding (*n* = 117)	91% female, 6% male, 2% non-binary, 1% gender not listed	(48.4, *12.7*)	No data

ID	Study	Setting	Study design	Analysis	Hoarding criteria	Sample (*n* =)	Gender %	Age (M, *SD*)	Ethnicity (% White)
12	(Walji & Salkovskis, 2024)	UK	Cross-sectional correlational mixed methods	Mixed model ANOVAs, zero-order correlations	DSM-5 HD	HWD (*n* = 24)	HWD: 87% female, 8% male, 4% other	HWD (60.5, *10.2*)	HWD (88%)
						HND (*n* = 24)	HND: 71% female, 25% male, 4% other	HND (54.4, *12.2*)	HND (88%)
						CC (*n* = 26)	CC: 85% female, 12% male	CC (51.4, *19.0*)	CC (81%)
13	(Phung et al., 2015)	AUS	Cross-sectional between-groups	t-tests	SI-R > or = 42	High hoarding (*n* = 43)	72% female	(29.1, *9.2*)	No data
						Low hoarding (*n* = 116)			

ID	Study	Setting	Study design	Analysis	Hoarding criteria	Sample (*n* =)	Gender %	Age (M, *SD*)	Ethnicity (% White)
14	(Drury et al., 2014)	UK	Cross-sectional between-groups	ANOVA or student's t-tests	DSM-5 HD	Hoarding (*n* = 37)	Hoarding: 16% male	Hoarding (54.1,?)	No data
						Collectors (*n* = 51)	Collectors: 67% male	Collectors (52.4,?)	
						Hoarding relatives (*n* = 55)	Hoarders relatives: 22% male	Hoarders relatives (40.3,?)	
						Collectors relatives (*n* = 25)	Collectors relatives: 24%	Collectors relatives (45.4, *?*)	
15	(Chou, Mackin, et al., 2018)	USA	Cross-sectional between-groups	t-tests	DSM-5 HD	Hoarding (*n* = 24)	Hoarding: 17% male	Hoarding (49.3, *15.4*)	No data
						HC (*n* = 40)	HC: 40% male	HC (46.4, *16.7*)	
16	(Diefenbach et al., 2013)	USA	Cross-sectional between-groups	t-tests	Proposed DSM-5 criteria	Hoarding (*n* = 55)		Hoarding (64.1, *4.1*)	Hoarding (96%)
						HC (*n* = 39)		HC (68.5, *6.4*)	HC (92%)

ID	Study	Setting	Study design	Analysis	Hoarding criteria	Sample (*n* =)	Gender %	Age (M, *SD*)	Ethnicity (% White)
17	(Ong et al., 2016)	SGP	Cross-sectional between-groups	Independent t-tests	SI-R > or = 41	Hoarding (*n* = 102) Non-hoarding (*n* = 240)	56% male	(35.3, *10.1*)	No data
18	(Nordsletten et al., 2018)	LDN RIO	Cross-sectional between-groups	Kruskal-Wallis tests	DSM-5 HD	London (*n* = 29) Rio de Janeiro (*n* = 15)	London: 55% female Rio de Janeiro: 40% female	London (56.6, *13.6*) Rio de Janeiro (55.0, *11.1*)	No data
19	(Pardini et al., 2023)	ITA	Cross-sectional between-groups	ANOVAs	SI-R > or = 37	High hoarding (*n* = 53) Low hoarding (*n* = 55)	High hoarding: 56% female Low hoarding: 42% female	High hoarding (28.3, *9.3*) Low hoarding (26.9, *9.8*)	No data
20	(Steketee et al., 2003)	USA	Cross-sectional between-groups	ANOVAs/ ANCOVAs	SI > One SD above mean	Hoarding (*n* = 61) OCD (*n* = 21) CC (*n* = 40)	Hoarding: 31% male OCD: 19% male CC: 28% male	Hoarding (52.0, *11.0*) OCD (36.7, *10.9*) CC (42.0, *13.8*)	Hoarding (97%) OCD (91%) CC (90%)

ID	Study	Setting	Study design	Analysis	Hoarding criteria	Sample (*n* =)	Gender %	Age (M, *SD*)	Ethnicity (% White)
21	(Steketee et al., 2012)	USA	Cross-sectional between-groups	ANOVAs	Hoarding Interview & SI-R > or = 30	Hoarding (*n* = 25)	Hoarding: 72% female	Hoarding (71.7,?)	No data
						Non-hoarding (*n* = 28)	Non-hoarding: 79% female	Non-hoarding (77.2,?)	
22	(Tinlin et al., 2022)	UK	Cross-sectional correlational	By-person factor analysis	HRS-SR > or = 14	Hoarding (*n* = 32)	91% female 9% male	(45.0, *14.6*)	No data
23	(Frost et al., 2016)	USA	Cross-sectional between-groups	t-tests	DSM-5 HD	Hoarding (*n* = 103)	Hoarding-CR: 67% female	Hoarding-CR (52.7, *8.0*)	90%
							Hoarding-TL: 74% female	Hoarding-TL (51.4, *10.8*)	
						CC (*n* = 66)	CC: 77% female	CC (53.9, *13.5*)	
24	(Gordon et al., 2013)	UK	Cross-sectional between-groups	t-tests, ANOVAs	Frost & Hartl (1996) hoarding definition	Hoarding (*n* = 24)	Hoarding: 71% female	Hoarding (59.0, *13.8*)	Hoarding (88%)
						OCD (*n* = 22)	OCD: 68% female	OCD (32.5, *8.1*)	OCD (91%)
					SI-R > or = 31	Hoarding + OCD (*n* = 21)	Hoarding+ OCD: 92% female	Hoarding+OCD (50.6, *11.7*)	Hoarding+OCD (86%)
						CC (*n* = 21)	CC: 92% female	CC (51.4, *9.4*)	CC (95%)

ID	Study	Setting	Study design	Analysis	Hoarding criteria	Sample (*n* =)	Gender %	Age (M, *SD*)	Ethnicity (% White)
25	(Nordsletten et al., 2013)	UK	Cross-sectional between-groups	Wilcoxon rank-sum tests, ANOVAs	Proposed DSM-5 criteria	Hoarding (*n* = 29) Collectors (*n* = 20)	Hoarding: 45% male Collectors: 75% male	Hoarding (56.6, *13.6*) Collectors (55.5, *10.8*)	No data
26	(Mataix-Cols et al., 2013)	UK	Cross-sectional between-groups	Student's t-tests	Proposed DSM-5 criteria	Hoarding (*n* = 29) Subclinical hoarding (*n* = 16)	Hoarding: 55% female Subclinical hoarding: 75% female	Hoarding (56.6, *13.6*) Subclinical hoarding (56.6, *10.3*)	No data
27	(Hartl et al., 2005)	USA	Cross-sectional between-groups	Independent samples t-tests, MANOVAs	Frost & Hartl (1996) hoarding definition SI-R > or = 37	Hoarding (*n* = 26) Non-hoarding (*n* = 36)	Hoarding: 85% female Non-hoarding: 88% female	Hoarding (54.3, *10.3*) Non-hoarding (50.2, *8.7*)	Hoarding (96%) Non-hoarding (100%)

ID	Study	Setting	Study design	Analysis	Hoarding criteria	Sample (*n* =)	Gender %	Age (M, *SD*)	Ethnicity (% White)
28	(Pertusa et al., 2008)	UK	Cross-sectional between-groups	Descriptive statistics only	Clinical interview SI-R > or = 40	Hoarding (*n* = 27)	Hoarding: 59% female	Hoarding (53.7, *9.7*)	Hoarding (95%)
						OCD (*n* = 71)	OCD: 44% female	OCD (37.0, *11.1*)	OCD (96%)
						Hoarding+ OCD (*n* = 25)	Hoarding+ OCD: 68% female	Hoarding+ OCD (45.0, *12.2*)	Hoarding+ OCD (83%)
						AD (*n* = 19)	AD: 68% female	AD (37.8, *9.5*)	AD (95%)
						CC (*n* = 21)	CC: 57% female	CC (49.4, *17.1*)	CC (100%)
29	Smith et al. (unpublished results)	UK	Longitudinal correlational between-groups	Zero-order correlations, ANOVAs	HRS-SR > or = 14	Hoarding (*n* = 45)	Hoarding: 91% female, 4% male, 2% gender non-conforming	Hoarding (49.3, *18.9*)	Hoarding (89%)
						OCD (*n* = 63)	OCD: 79% female, 21% male	OCD (24.5, *10.7*)	OCD (67%)
						HC (*n* = 54)	HC: 93% female, 7% male	HC (33.4, *17.4*)	HC (89%)

ID	Study	Setting	Study design	Analysis	Hoarding criteria	Sample (*n* =)	Gender %	Age (M, *SD*)	Ethnicity (% White)
30	(Timpano et al., 2020)	USA	Cross-sectional between-groups	t-tests	DSM-5 HD	Hoarding (*n* = 217) CC (*n* = 130)	Hoarding: 77% female CC: 70% female	Hoarding (52.6, *13.5*) CC (52.6, *10.3*)	Hoarding (88%) CC (88%)

Note. AUS = Australia, SGP = Singapore, LDN = London, RIO = Rio De Janeiro, ITA = Italy.
SI-R = Saving Inventory-Revised (Frost et al., 2004), HRS-SR = Hoarding Rating Scale - Self Report (Tolin et al., 2010), SI = Saving Inventory (Steketee et al. 2003)
OCD = Obsessive Compulsive Disorder, CC = Community controls, HC = Healthy controls, NC = Non-clinical, HWD = Hoarding with early material deprivation, HND = Hoarding without early material deprivation, Hoarding-CR = Hoarding Cognitive Restructuring condition, Hoarding-TL = Hoarding Thought Listing Condition, AD = Anxiety Disorder.

Although publication dates ranged from 2005 to 2024, the majority were published from 2013, with only four studies being published prior to 2013 (20-21, 27-28). This likely reflects the fact that HD did not become a distinct mental health condition in DSM-5 until 2013 (APA, 2013). With the exception of three doctoral theses (9, 10, 29), all studies were published in peer-reviewed journals. Although a few studies had longitudinal designs (e.g., 19), all data included in this review was cross-sectional in nature.

Hoarding group sample sizes varied from 15 to 217. The average age of hoarding participants was 52.8 (*11.5*) and the majority were female (72%) and white (85%). Regarding the criteria used to assign hoarding group status, twelve of the studies assessed participants using DSM-5 HD criteria (2-3, 5-7, 9, 12, 14-15, 18, 23, 30). Five studies had also applied the proposed HD criteria (1, 4, 16, 25-26), prior to its publication in the DSM-5 (APA, 2013). In addition to these interview methods, cut off scores on self-report measures were used to assign hoarding group status. Three studies (10, 22, 29) applied a cut-off score of 14 on the Hoarding Rating Scale - Self Report (Tolin et al., 2010). The Saving Inventory-Revised (SI-R; Frost et al., 2004) was also frequently used to identify those who experienced clinically significant hoarding (8, 11, 13, 17, 19, 21, 24, 27-28). A score of 39 has been suggested as the optimal cut-off score for the SI-R (Kellman-McFarlane et al., 2019). Two studies used this cut-off score (8, 11) and three applied more conservative cut-offs (13, 17, 28). Lower cut-off scores on the SI-R (i.e., <39) were used by four studies to identify hoarding participants (19, 21, 24, 27) and one study used an earlier version of the Saving Inventory to identify hoarding participants (20). These papers were included due to the cut off scores being justified and/or additional methods being used to confirm hoarding symptomatology.

Regarding group comparisons, most studies compared a hoarding group to a community comparison group (3-5, 9-10, 12-17, 19-21, 23-30). Community comparison groups were diverse and alongside those considered to be healthy, non-clinical or community controls, also included those who were collectors (14, 15) and those who had subclinical levels of hoarding (26). Six studies included clinical group comparisons, five of

which compared hoarders to an OCD group (3, 19-20, 24, 28) and one which compared hoarders to an anxiety disorder group (28). Additionally, two studies included both a hoarding only and a hoarding with OCD group (24, 28). Both studies compared these groups to an OCD only and community control group. One also compared these groups to an anxiety disorder comparison group (28). Overall, comparison group size varied from 16 to 240. The average age of comparison participants was 52.77 (*12.2*) and the majority were female (70%) and white (87%).

Assessments of quality

Appendix B presents the results of the quality assessments. Ten papers were given an overall quality assessment of 'Poor' (5, 10, 13, 15, 20-24, 30), with all others being assessed as 'Fair'. In relation to the individual elements of the quality assessment tool, the studies generally scored positively ('Yes') on questions relating to: (1) Studies having clearly stated objectives, (2) Using appropriate methods to assess exposure (i.e., Beliefs about possessions) and outcome (i.e. Hoarding symptom severity) and (3) Case vs control criteria clearly differentiating groups that were compared to one another. There were mixed results when it came to assessing whether studies had clearly described the study population, often because manuscripts did not state the time frame of recruitment, which can impact upon the reproducibility of the methodology (NHBLI, 2013). As already stated, no papers were assessed as 'Good' quality overall, due to the lack of longitudinal data. Therefore, a general weakness of included studies was that it was not possible to establish a potential causal link between hoarding beliefs (exposure) and hoarding symptom severity (outcome). Additionally, studies generally scored negatively ('No') on the items concerning pre-registration of study methodology and whether the study had discussed the rationale or justification for the sample size.

Review questions

What beliefs are associated with the experience of HD?

Meta-analysis. Nine studies (1-4, 7, 9-10, 12, 29) contributed 10 effect sizes (*r*) to the association between overall strength of hoarding severity and beliefs about possessions (Figure 3). After pooling the effect sizes, a medium significant association was found between overall hoarding severity and beliefs about possessions (r = .43, 95% CI [0.31, 0.53], $t(9) = 7.80$, p < .001), with evidence of low heterogeneity (I^2 = 25.4%, $Q(9) = 12.04$, $p = 0.21$). Visual inspection of the funnel plot (Figure 4) did not indicate publication bias. This was supported by a non-significant Egger's test ($Z = 1.74$, $p = 0.08$) and Kendall's Tau ($\tau_b = .270$, $p = 0.281$).

Seven studies (1, 3-4, 7, 9, 12, 29) also reported on the association (*r*) between specific belief types (emotional attachment, control, responsibility and/or memory) and overall hoarding severity, contributing twenty-five effect sizes in total. Pooling these effect sizes, a significant association was once again found between hoarding severity and hoarding beliefs (r = .36, 95% CI [0.29, 0.44], $t(24) = 9.08$, p < .001). Although results indicated relatively low levels of heterogeneity (I^2 = 22.7%, $Q(24) = 35.13$, $p = 0.07$), because we had a priori intentions to explore whether belief types had differential relationships with overall hoarding severity (H_0 = emotional attachment = control = responsibility = memory = 0) we also conducted sub-group analyses on particular belief types. Consistent with the low levels of heterogeneity, there was a significant association between each type of belief and overall hoarding severity, with small associations found for beliefs related to control (r = .27, 95% CI [0.06, 0.46], $t(21) = 2.60$, $p = 0.02$) and memory (r = .27, 95% CI [0.14, 0.40], $t(21) = 4.19$, p < .001), and medium associations found for beliefs related to emotional attachment (r = .41, 95% CI [0.30, 0.51], $t(21) = 7.32$, p < .001) and responsibility (r = .41, 95% CI [0.30, 0.51], $t(21) = 6.86$, p < .001).

Figure 3

Association between overall hoarding severity and hoarding beliefs

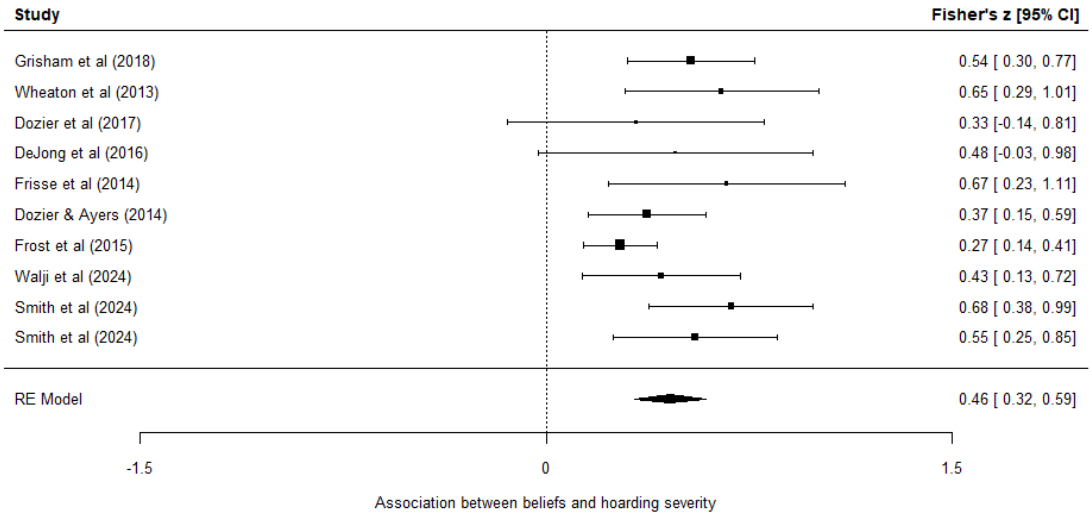
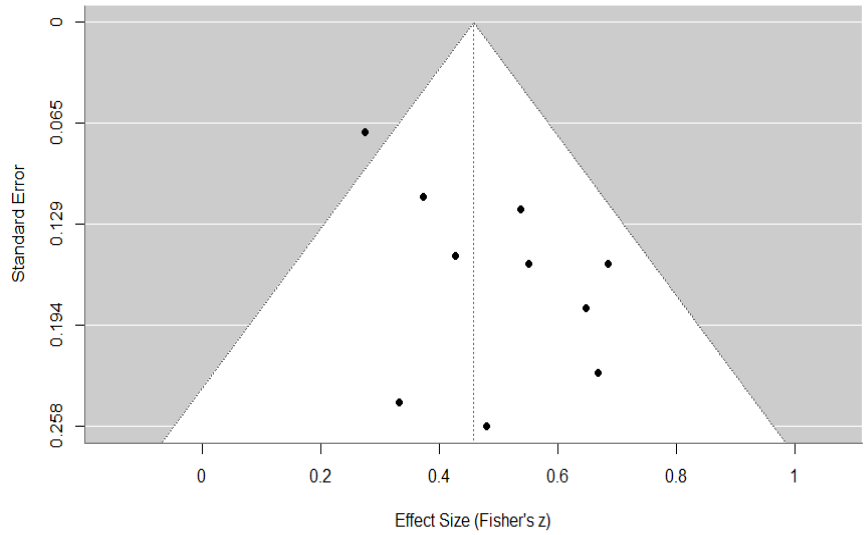


Figure 4

Funnel plot for the association between overall hoarding severity and hoarding beliefs

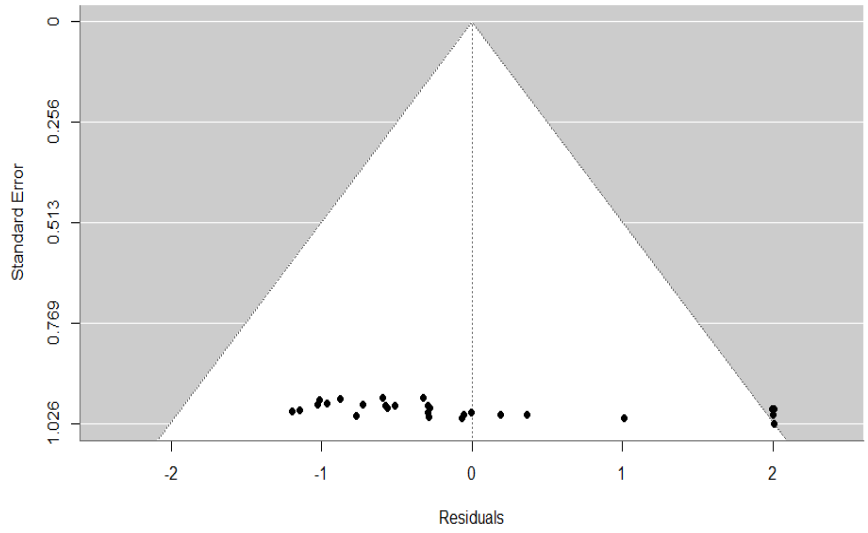


Pooling between-group differences in hoarding severity highlighted a large effect size (d = 3.58, 95% CI [3.02, 4.14], $t(26)$ = 13.22, p < .001), with substantial heterogeneity (I^2 = 89.03%, $Q(26)$ = 209.94, p < .001). Therefore, between-group differences in beliefs about possessions was entered as a predictor variable through meta-regression, with 18 studies

providing 27 effect sizes (4-5, 9-10, 12, 14-17, 19-21, 23-25, 27, 29-30). Between-group differences in hoarding beliefs were found to be positively associated with between-group differences in hoarding severity ($F(1, 25) = 15.40$, $p < .001$), such that as between-group differences in hoarding beliefs increased, so did between-group differences in hoarding severity. The funnel plot (Figure 5) highlights clustering of studies towards the bottom of the y-axis, with some bias of studies towards the left. However, the Egger's test did not indicate publication bias ($Z = 0.97$, $p = .33$).

Figure 5

Funnel plot for the association of between-group differences in hoarding severity with between-group differences in hoarding beliefs



For papers which had additionally provided between-group differences on belief subscales (i.e., emotional attachment, control, responsibility, memory), it was possible to run a similar meta-regression model, with the addition of belief type as a subgroup (moderator) variable; 16 studies (4-5, 12, 14-17, 19-21, 23-25, 27, 29-30) contributed 72 effect sizes. Results indicated that between-group differences in beliefs relating to control ($d = 3.09$, 95% CI [2.43, 3.75], $t(67) = 9.37$, $p < .001$), emotional attachment ($d = 2.97$, 95% CI [2.30, 3.65], $t(67) = 8.81$, $p < .001$), memory ($d = 2.87$, 95% CI [2.16, 3.58], $t(67) = 8.12$, $p < .001$) and

responsibility (d = 2.85, 95% CI [2.13, 3.56], $t(67) = 7.98$, $p < .001$) were significantly associated with between-group differences in hoarding severity ($F(5, 67) = 37.08$, $p < .001$).

Narrative synthesis. Mataix-Cols et al. (2013) was not included in the meta-analysis results above, due to data overlap with Nordsletten et al. (2013). Their results are of interest, however, as they compared those who met proposed DSM-5 HD criteria to those with subclinical symptoms of hoarding. Despite the comparison group experiencing some level of hoarding symptoms, the hoarding group were found to score significantly higher on the SCI overall, and on three of its subscales (responsibility, memory, emotional attachment). There were additional belief types which could not be included in the meta-analysis due to the number of studies investigating these being too low to pool (1, 3, 12, 24-25, 29-30) (Table 4). Saving or acquiring due to an item being beautiful or aesthetically pleasing had a medium association with overall hoarding severity (r = .37-43, $p < .001$) (1) and hoarding groups were found to score significantly higher on this belief type compared to OCD (3) and community controls (3, 30). Using regression analysis, Dozier and Ayers (2014) (1) found four reasons for acquiring and saving (lost information, sentimental or emotional significance, potential usefulness and aesthetic appeal) to be significantly associated with overall hoarding severity. Additionally, when controlling for gender and all other reasons to save, waste avoidance and emotional/sentimental significance were significant predictors of additional variance. For reasons to acquire, avoiding wasting a potentially useful object was the only reason found to predict significant additional variance in hoarding severity after controlling for all other reasons and gender.

Using a novel measure (Hoarding Disorder Beliefs Inventory, HDBI; Ragan et al., unpublished results) that is currently being psychometrically evaluated (29), beliefs relating to ‘Items represent parts of me and my life’ (e.g., *“I keep items because they tell the story of my life”*) were found to have a medium association with hoarding severity (r = .32, $p < .05$). Hoarders were also found to score significantly higher on this belief type compared to a community and clinical comparison group (29). Using the Beliefs about Hoarding

questionnaire (BAH; Gordon et al., 2013), beliefs concerning harm avoidance and fear of material deprivation distinguished hoarders from community control groups, with hoarders scoring significantly higher on these belief types (12, 24). However, when comparing a hoarding only group to an OCD only group, Gordon et al. (2013) found that hoarders scored higher on the fear of material deprivation scale, but did not score significantly differently on the harm avoidance subscale (24), suggesting this belief type may not be specific to HD.

In relation to reasons for hoarding, Pertusa et al. (2008) (28) reported differences between a hoarding only and hoarding with OCD group. However, they did not report inferential statistics on either between-group differences or associations, and so no further information was extracted from this study. Using a similar semi-structured interview, Nordsletten et al. (2013) reported group differences on the endorsement of a range of reasons for hoarding. They found that hoarders reported difficulty discarding due to avoiding waste more often than collectors ($p < .001$). Hoarders also reported 'Useful in future' with more frequency ($p < .001$) in relation to acquiring. As can be seen in Table 4, there were several reasons for saving and acquiring that hoarders and collectors did not differ on.

Table 4

Narrative Synthesis Data: What beliefs are associated with the experience of HD?

ID - Study	Results
1 - Dozier and Ayers (2014)	**Correlations** Beautiful or aesthetically pleasing (reason for saving) & SI-R total: $r = .37$, $p < .001$. Beautiful or aesthetically pleasing (reason for acquiring) & SI-R total: $r = .43$, $p < .001$. **Regressions** Four reasons for saving and acquiring (losing important information, sentimental or emotionally significant, wasting a potentially useful object, beautiful or aesthetically pleasing) were significant predictors of SI-R total, after gender was controlled for ($p < .001$) Two reasons for saving (wasting a potentially useful object, sentimental or emotionally significant) were significant predictors of additional variance, once gender and all other reasons for saving were controlled for ($p < .05$) One reason for acquiring (wasting a potentially useful object) was a significant predictor of additional variance, once gender and all other reasons for acquiring were controlled for ($p < .05$)

ID - Study	Results
3 - Frost et al. (2015)	**Between-groups** Hoarding Interview Acquire for aesthetics: HD>OCD=CC, p < .001. Hoarding Interview Saving for aesthetics: HD>OCD=CC, p < .001.
12 - Walji and Salkovskis (2024)	**Between-groups** BAH Harm Avoidance: HWD=HND>CC, *p* < .01 BAH Fear of Material Deprivation: HWD=HND>CC, *p* < .001
24 - Gordon et al. (2013)	**Between-groups** BAH Harm Avoidance: CHOCD>CH=OCD>CC, *p* < .001 BAH Fear of Material Deprivation: CH=CHOCD>OCD=CC, *p* < .001
25 - (Nordsletten et al., 2013)	**Between-groups** Reasons for difficulty discarding: Useful in future: C=HD, *p* > .05 Sentimental attachment: C=HD, *p* > .05 Monetary value: C=HD, *p* > .05 Avoid waste: HD>C, *p* = .001 Object is unique: C=HD, *p* > .05 Misuse of personal information: HD>C, *p* < .01 Taught to save: C=HD, *p* > .05 Item part of personal identity: C=HD, *p* > .05 Fear bad consequence: C=HD, *p* > .05 Reasons for acquiring items: Useful in future: HD>C, *p* < .001 Compelled to acquire it: C=HD, *p* > .05 Compulsive shopper: C=HD, *p* = .05
29 - Smith et al. (unpublished results)	**Correlations** HDBI Identity & SI-R Total: *r* = . 32, *p* < .05 **Between-groups** HDBI Identity: HD>OCD>CC, *p* < .001.
30 - Timpano et al. (2020)	**Between-groups** Hoarding Interview aesthetics: HD > HC, *p* < .001.

Note. SI-R = Saving Inventory Revised (Frost et al., 2004), BAH = Beliefs about Hoarding (Gordon et al. 2013), HDBI = Hoarding Disorder Beliefs Inventory (Ragan et al., unpublished results)
OCD = Obsessive Compulsive Disorder, CC = Non-clinical/Community Controls, HWD = Hoarding with early material deprivation, HND = Hoarding without deprivation, CH = Compulsive Hoarding, CHOCD = Compulsive Hoarding with co-existing OCD, C = Collectors.

Using the Hoarding Interview, Frost et al. (2015) investigated whether men and women scored differently on four reasons for saving and acquiring (losing important information, sentimental or emotionally significant, wasting a potentially useful object,

beautiful or aesthetically pleasing). They found that men reported acquiring to avoid waste more often than women, but that there were no other significant differences. However, there is inconsistency in exploring gender-based differences for these belief types. Using a self-report format to assess the same reasons for saving and acquiring, Dozier and Ayers (2014) found that women scored higher on saving or acquiring due to 'beautiful or aesthetically pleasing', and women also scored higher on 'losing important information' as a reason for acquiring.

Only one study has explored potential cultural differences amongst hoarding groups to understand the relationship between beliefs and hoarding severity (18), and this was limited to a between-groups comparison of those diagnosed with HD in London and Rio De Janeiro, with small sample sizes (London *n* = 29; Rio De Janeiro *n* = 15). Nordsletten et al. (2018) found that these groups did not differ to one another on three of the SCI subscales (control, responsibility, memory), but that the London group scored significantly higher on SCI total and the SCI emotional attachment subscale. They also used a semi-structured interview to explore reasons for difficulty discarding and acquiring (as 25 and 28 did). They found that 'object is unique' was the only reason that distinguished those based in London to those based in Rio De Janerio, with the former scoring significantly higher on this item.

Tinlin et al. (2022) used a Q-methodology approach and by-person factor analysis to extensively assess beliefs about possessions among those meeting criteria for clinically significant hoarding. Using this approach, they found four distinct factors of beliefs about possessions. Factor one captured beliefs about the role of possessions in representing aspects of the self, including that related to the past, present or future (Expressions of Identity factor). Factor two reflected beliefs around being responsible for the proper use and care of objects, and the avoidance of waste (Morality and Responsibility factor). Factor three included beliefs about objects being reliable and predictable, and so providing a sense of security and safety (Stability and Predictability factor). Finally, factor four represented anthropomorphism type beliefs and beliefs about possessions storing emotions (Objects as

emotional and meaningful beings factor). Using the SI-R (Frost et al., 2004), hoarding symptom severity was not found to differ between the factors.

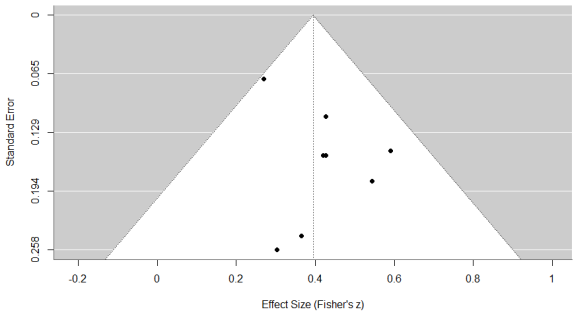
Is there evidence that particular belief domains are related to specific aspects of hoarding (i.e., acquisition, difficulty discarding or clutter)?

Meta-analysis. Seven studies (1, 3-4, 7, 9, 12, 29) contributed eight effect sizes (*r*) for the association between excessive acquiring and overall strength of beliefs about possessions (e.g., SCI total), and difficulty discarding and overall strength of beliefs about possessions. After pooling effect sizes, a medium association was found between beliefs and acquiring (r = .38, 95% CI [0.26, 0.48], $t(7) = 7.05$, $p < .001$) and between beliefs and difficulty discarding (r = .40, 95% CI [0.27, 0.51], $t(7) = 6.85$, $p < .001$). For both acquiring (I^2 = 12.9%, $Q(7) = 5.73$, $p = 0.57$) and difficulty discarding (I^2 = 20.4%, $Q(7) = 7.62$, $p = 0.37$), statistics indicated low heterogeneity. Six studies (1, 4, 7, 9, 12, 29) contributed seven effect sizes (*r*) for the association between clutter and beliefs about possessions, with a small association being found (r = .23, 95% CI [0.02, 0.41], $t(6) = 2.68$, $p < .05$) and indication of moderate heterogeneity (I^2 = 37.0%, $Q(6) = 8.71$, $p = 0.19$). Visual inspection of the funnel plots (Figure 6) and Egger's tests indicated potential publication bias for acquiring ($Z = 2.04$, $p = 0.042$) and difficulty discarding ($Z = 2.02$, $p = 0.044$) results. However, this was not supported by Kendall's Tau for either acquiring (τ_b = -.182, $p = 0.533$) or difficulty discarding (τ_b = -.036, $p = 0.901$). For clutter results, visual inspection of the funnel plot (Figure 6) did not indicate publication bias. This was supported by a non-significant Egger's test (Z = -0.07, $p = 0.947$) and Kendall's Tau (τ_b = .098, $p = 0.761$).

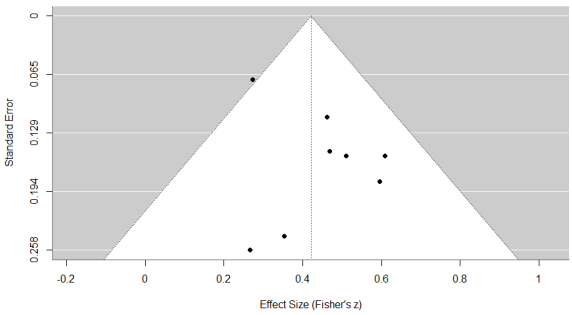
Figure 6

Funnel plots for the association between hoarding beliefs and hoarding symptom severity (acquiring, difficulty discarding and clutter)

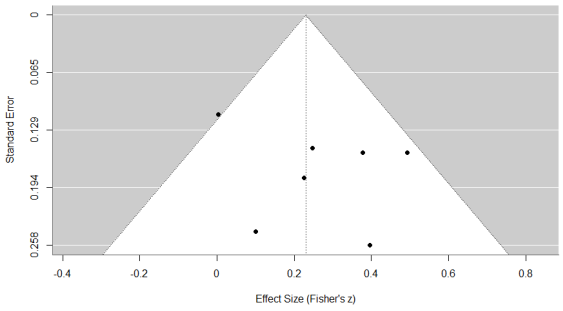
A



B



C



Note. Funnel plots of Effect Size (Fisher's z) against Standard Errors for the association between beliefs about possessions and (A) Acquiring, (B) Difficulty Discarding and (C) Clutter.

Studies also reported on the association between belief types (i.e., emotional attachment, control, responsibility, memory) and the specific symptoms of hoarding (i.e., acquiring, difficulty discarding, clutter). Pooling 25 effect sizes from seven studies (1, 3-4, 7, 9, 12, 29) indicated a medium association between pooled SCI sub-indices (i.e., emotional attachment, control, responsibility memory) and both acquiring (r = .32, 95% CI [0.25, 0.39], $t(24) = 8.93$, $p < .001$) and difficulty discarding (r = .36; 95% CI [0.30, 0.41], $t(24) = 12.25$, p

< .001). Pooling 22 effect sizes from six studies (1, 4, 7, 9, 12, 29) indicated a small association (r = .16, 95% CI [0.03, 0.28], $t(21) = 2.56$, p = .018) between combined belief types and clutter. Heterogeneity was very low for difficulty discarding (I^2 = 2.5%), suggesting that the association does not depend on the type of belief being assessed. Heterogeneity was low for acquiring (I^2 = 14.1%) and moderate for clutter (I^2 = 26.0%). Through subgroup analysis, each belief type was found to be related significantly to acquiring, with beliefs related to emotional attachment and responsibility having a medium association (r = .37-.38) and beliefs about control and memory having a small association (r = .21-.22). For clutter, only responsibility beliefs were significantly related, with a small association being found (r = .21). These results are presented in table 5.

Table 5
Association between beliefs and hoarding symptoms (acquiring and clutter), with belief type as a moderator

Symptom type	Belief type	Moderating effect of belief type
Acquiring	Control	r = .21, 95% CI [0.00, 0.40], $t(21) = 2.09$, p = 0.049
	Emotional attachment	r = .38, 95% CI [0.28, 0.47], $t(21) = 7.58$, p < .001
	Memory	r = .22, 95% CI [0.10, 0.33], $t(21) = 3.83$, p = .001
	Responsibility	r = .37, 95% CI [0.27, 0.47], $t(21) = 6.98$, p < .001
Clutter	Control	r = .10, 95% CI -[0.13, 0.33], $t(18) = 0.93$, p = .36
	Emotional attachment	r = .16, 95% CI [-0.01, 0.32], $t(18) = 2.03$, p = .06
	Memory	r = .13, 95% CI [-0.06, 0.31], $t(18) = 1.39$, p = .18
	Responsibility	r = .21, 95% CI [0.03, 0.38], $t(18) = 2.49$, p = .02

Narrative synthesis. Studies reported additional information regarding specific belief types and their association with acquiring, difficulty discarding and clutter, which could not be pooled in the meta-analysis (Table 6). Acquiring or saving because an item is beautiful/aesthetically pleasing was found to have medium-large associations with both acquiring (r = .35-54, p < .01), and difficulty discarding (r = .46-47, p < .001), but non-significant associations with clutter (r = 0-.11) (1). Whilst Frost et al. (2015) (3) also found a significant medium association between SI-R acquisition and acquiring for aesthetic reasons

(r = .32, p < .01), they did not find a significant association between saving for aesthetic reasons and SI-R difficulty discarding. Using the BAH (Gordon et al., 2013), difficulty discarding was associated with beliefs related to fear of material deprivation (r = .54, p < .001) but not those concerning harm avoidance (r = .38, p < .01; Bonferroni correction applied) (12). Acquiring was associated with both fear of material deprivation (r = .59, p < .001) and harm avoidance beliefs (r = .48, p < .001), whereas clutter had a non-significant association with both types of belief (r = .20-24) (12). One unpublished study (29) contributed data concerning the relationship between beliefs about items representing identity and acquiring/difficulty discarding/clutter. These beliefs had a medium association with both difficulty discarding (r = .37, p < .05) and clutter (r = .32, p < .05), but not acquiring (r = .11).

Two used multiple regression to evaluate the role of specific belief types as predictors of acquiring, difficulty discarding and clutter (1, 3). In both studies, reasons for saving and acquiring, assessed through self-report (1) and interview (3) format, were not found to significantly predict clutter. In comparison, reasons for saving and acquiring related to aesthetic appeal, wasting a potentially useful object, sentimental or emotional attachment and losing important information were significant predictors of difficulty discarding and acquisition.

Table 6

Narrative Synthesis Data: Is there evidence that particular belief domains are related to the specific aspects of hoarding (i.e., acquisition, difficulty discarding of clutter)?

ID – Study	Results
1 – Dozier and Ayers (2014)	**Correlations** Beautiful or aesthetically pleasing (reason for saving) & SI-R acquisition: $r = .35$, $p < .01$. Beautiful or aesthetically pleasing (reason for saving) & SI-R difficulty discarding: $r = .46$, $p < .001$. Beautiful or aesthetically pleasing (reason for saving) & SI-R clutter: $r = .05$, $p > .05$. Beautiful or aesthetically pleasing (reason for saving) & CIR: $r = .08$, $p > .05$. Beautiful or aesthetically pleasing (reason for acquiring) & SI-R acquisition: r = .54, p < .001. Beautiful or aesthetically pleasing (reason for acquiring) & SI-R difficulty discarding: r = .47, p < .001. Beautiful or aesthetically pleasing (reason for acquiring) & SI-R clutter: r = -.00, p > .05. Beautiful or aesthetically pleasing (reason for acquiring) & CIR: r = .11, p > .05. **Regressions** For SI-R difficulty discarding and SI-R acquisition, and with gender controlled for, all reasons for saving and acquiring (losing important information, sentimental or emotionally significant, wasting a potentially useful object, beautiful or aesthetically pleasing) were significant predictors ($p < .001$). When considering SI-R clutter, gender and all reasons for saving and acquiring were not significant predictors ($p > .05$).
3 - Frost et al. (2015)	**Correlations** Acquire for aesthetics & SI-R acquisition: $r = .32$, $p < .01$. Save for aesthetics & SI-R difficulty discarding: $r = .13$, $p = .13$. **Regressions** Acquiring to avoid waste and for aesthetic reasons were significant predictors of SI-R acquisition ($p < .01$) when all four reasons for acquiring were entered together (i.e., acquiring for information, for emotion, to avoid waste and for aesthetics). With the exception of saving for aesthetic reasons, all other reasons for saving (save for emotion, information, to avoid waste) were significant predictors of SI-R difficulty discarding ($p < .05$) when these were entered simultaneously.

ID – Study	Results
12 - Walji and Salkovskis (2024)	**Correlations*** BAH Harm avoidance & SI-R clutter: *r* = .29, *p* <.05 BAH Harm avoidance & SI-R difficulty discarding: *r* = .38, *p* < .01 BAH Harm avoidance & SI-R acquisition: *r* = .51, *p* < .001 BAH Fear of material deprivation & SI-R clutter: *r* = .24, *p* > .05 BAH Fear of material deprivation & SI-R difficulty discarding: *r* = .54, *p* < .001 BAH Fear of material deprivation & SI-R acquisition: *r* = .59, *p* < .001 *Bonferroni correction applied, therefore significance level set at p < .0056.
29 - Smith et al. (unpublished data)	**Correlations** HDBI Identity & SI-R Acquisition: *r* = . 11, *p* > .05 HDBI Identity & SI-R Difficulty discarding: r = . 37, p < .05 HDBI Identity & SI-R Clutter: r = . 32, p < .05

Note. SI-R = Saving Inventory Revised (Frost et al., 2004), BAH = Beliefs about Hoarding (Gordon et al. 2013), HDBI = Hoarding Disorder Beliefs Inventory (Ragan et al., unpublished results)

How does the strength of the association between beliefs and hoarding severity compare to that between other constructs of interest and hoarding severity?

Narrative synthesis. Hoarding beliefs have been investigated in relation to several other psychological constructs and outcomes (2). Hoarding beliefs have generally been found to have a stronger association with hoarding severity (through larger effect sizes or significant associations with a greater number of specific symptoms) when compared to measures of intolerance of uncertainty (2), anxiety sensitivity (2), traumatic experiences (8), perceived social support (8) and experiential avoidance (4). Whilst distress tolerance has been found to have a large association with hoarding severity, mediational analysis suggests that the relationship between distress tolerance and hoarding symptoms is partially mediated by beliefs about possessions (and specifically emotional attachment beliefs) (2). This adds to the evidence base of hoarding beliefs as mediating the relationship between psychological constructs and outcomes in HD. For example, Chou, Tsoh, et al. (2018) found that hoarding beliefs, and specifically beliefs about responsibility, fully mediated the association between

both self-criticism and shame, and hoarding severity. Linear regression results based on only two studies have provided mixed results regarding the predictive role of beliefs about possessions in comparison to other psychological constructs of interest (4, 11). Both studies assessed beliefs using the SCI (Steketee et al., 2003) and hoarding severity using the SI-R (Frost et al., 2004). However, the study which founds beliefs to be predictive of SI-R scores entered SCI total as the predictor (4), whereas the study which did not find them to be predictive entered the subscales of the SCI separately (11).

In addition to higher scores on measures of beliefs about possessions, scores on measures assessing traumatic experiences (15, 27) and emotional vulnerabilities (13, 16, 19) have also been found to differentiate hoarders from controls. In support of the specificity of beliefs about possessions in HD, hoarders have reported higher levels of these compared to OCD groups, whereas OCD groups have reported higher levels of beliefs more theoretically associated with OCD (20, 24). When confounders have been controlled for, between-group differences in hoarding severity have remained, whereas between-group differences in experiential avoidance have become non-significant (4).

Discussion

This review has provided robust evidence for the significant association between beliefs about possessions and hoarding severity. Meta-analysis models demonstrated generally consistent significant associations when pooling both between-group comparison (*d*) and association (*r*) data. With few exceptions, this was the case when considering the association between (a) overall hoarding severity, acquiring, clutter or difficulty discarding and (b) overall hoarding severity or specific belief types. These results were also supported by narrative synthesis of data not eligible for inclusion in meta-analysis.

Question 1: What beliefs are specifically associated with HD?

Through meta-analysis, four types of beliefs about possessions were found to be significantly associated with hoarding symptom severity. These include emotional attachment to possessions (e.g., *"I could not tolerate it if I were to get rid of this"*) and beliefs related to control (e.g., *"I like to maintain sole control over my things"*), memory (e.g., *"I must remember something about this, and I can't if I throw this away"*) and responsibility (e.g., *"I'm ashamed when I don't have something like this when I need it"*) (Steketee et al., 2003). There was evidence to suggest that beliefs about responsibility and emotional attachment had a marginally stronger association with hoarding severity, compared to beliefs concerning control or memory. Support for this came from moderator analysis of belief type during meta-analysis but also narrative synthesis of regression and mediation results.

In addition to these four belief types, narrative synthesis highlighted additional specific beliefs that have been associated with hoarding severity. These include beliefs about: (a) objects being beautiful or aesthetically pleasing (Dozier & Ayers, 2014; Frost et al., 2015; Timpano et al., 2020), (b) possessions representing parts of identity (Tinlin et al., 2022; Smith et al., unpublished results), (c) fear of material deprivation (Gordon et al., 2013; Walji & Salkovskis, 2024) and (d) objects being safe and comforting due to their stability/predictability (Tinlin et al., 2022). These results require further investigation and replication, due to the minimal number of studies that have investigated these specific belief types, and the lack of formal psychometric evaluation of measures used to assess beliefs in many of these studies.

Question 2: Is there evidence that particular belief domains are related to specific aspects of hoarding (i.e., acquisition, difficulty discarding or clutter)?

Through meta-analysis, results indicated that clutter had a weaker (albeit still significant) association with beliefs about possessions, whereas both difficulty discarding and acquiring had medium significant associations with these beliefs. Due to low

heterogeneity of effect sizes when pooling associations, results suggested that each belief type (i.e., emotional attachment, control, responsibility, memory) was significantly associated with difficulty discarding. Although all belief types were significantly associated with acquiring, consistent with the findings for overall hoarding severity, a stronger relationship was found for beliefs relating to emotional attachment and responsibility, compared to control and memory. A different picture emerged for clutter, with beliefs about responsibility being the only belief type to be significantly associated.

Narrative synthesis was consistent with this pattern of generally weaker associations between specific belief types and clutter, compared to that with acquiring or difficulty discarding. Narrative synthesis again implicated a range of additional beliefs about possessions not captured in the meta-analysis.

Question 3: How does the strength of the association between beliefs and hoarding severity compare to that between other constructs of interest and hoarding severity?

In addition to exploring the association between beliefs about possessions and hoarding severity, we extracted data that allowed us to compare the strength of the association between beliefs about possessions and hoarding severity to that between hoarding severity and other constructs of interest. Most of the comparison constructs included here were factors that are implicated in the cognitive model of hoarding (Frost & Hartl, 1996). We observed that compared to other psychological constructs of interest (e.g., emotional vulnerabilities, trauma experiences, experiential avoidance), beliefs about possessions generally had more consistent and stronger associations with hoarding severity. Additionally, for constructs which were found to relate significantly to hoarding and to a large degree (e.g., distress tolerance), mediation analysis suggested that beliefs about possessions were still highly relevant, in that they were found to partially mediate the relationship between distress tolerance and hoarding severity.

Several systematic reviews have investigated constructs implicated in the cognitive behavioural model (Frost & Hartl, 1996), including information processing difficulties (Gledhill et al., 2021; Stumpf et al., 2023; Woody et al., 2014) and emotional experiences, such as emotion regulation (Barton et al., 2021). There are also reviews which have investigated more distal vulnerability factors implicated in the model, including prior life experiences such as trauma (Chia et al., 2021). Compared to the strong, consistent association between beliefs about possessions and hoarding severity found in the current review, the results of these reviews looking at the association between hoarding severity and other constructs of interest have been more mixed. For example, considering evidence relating to HD patients only, Gledhill et al. (2021) reports that impairments in information processing may not be as diverse as those suggested in Frost and Hartl's (1996) model.

We are only aware of one review which has utilised meta-analytic techniques to estimate the association between hoarding severity and another potential maintenance factor and this focused on emotion dysregulation (Akbari et al., 2022). Although they found a significant medium association between emotion dysregulation and hoarding severity (r = .43) which is the same as the pooled association we found between beliefs about possessions and hoarding (r = .43), they had included both clinical and non-clinical samples, and through moderation analysis they noted this association was smaller for clinical samples compared to non-clinical samples. Therefore, on balance, beliefs about possessions would seem to have a stronger estimated association with hoarding severity for clinical samples compared to that between emotion dysregulation and hoarding severity.

Due to the interactional nature of the CBT model (Frost & Hartl, 1996; Steketee & Frost, 2003), it is valuable to consider data concerning beliefs about possessions alongside other psychological constructs of interest as it could highlight the best target for intervention. As we have discussed, there is consistent evidence for the relationship between beliefs about possessions and hoarding symptoms. In comparison, other constructs that we have reviewed here have smaller or more mixed associations. Therefore when thinking about CBT

treatment, which aims to target the maintaining factors of hoarding (Steketee & Frost, 2006), a pragmatic approach to these maintaining factors would be to target beliefs about possessions, which may impact numerous other factors at once.

Limitations

During meta-analysis, data availability meant that moderator analysis of belief type was limited to the beliefs captured in the SCI (Steketee et al., 2003), specifically, beliefs relating to emotional attachment, control, memory and responsibility. However, to combat this, belief types that could not be incorporated into moderator analyses were narratively synthesised and therefore still included in the review.

All the data captured within this review was cross-sectional in nature. Therefore, whilst a strong association between beliefs about possessions and hoarding is evident, it is not possible to make causal links. Another limitation of the current review is the fact that hoarding groups included in the studies reported being primarily female (72%) and white (85%). It is therefore not possible to confidently generalise our findings to other sociodemographic factors. We included studies which compared hoarding groups to one another, which enabled consideration of potential cultural differences between London and Rio De Janeiro (Nordsletten et al., 2018) and potential gender differences (Dozier & Ayers, 2014; Frost et al., 2015). However, due to the fact the former was restricted to two countries, there is little generalisation that can be made. The restriction of papers to English language likely hindered inclusion of papers with more diverse populations.

Theoretical implications

Our results provide strong, consistent evidence for the relevance of beliefs about possessions in understanding HD. They also implicate a diverse range of beliefs about possessions and make preliminary suggestions that beliefs about possessions interact with other vulnerability factors (e.g., shame, self-criticism, distress tolerance). All of this is consistent with the cognitive model of hoarding proposed by Frost and Hartl (1996). As well

as supporting the range of beliefs discussed in the cognitive model, we summarised evidence of belief types not currently captured. For example, beliefs about possessions communicating parts of identity (past, current, future) (Smith et al., unpublished results; Tinlin et al., 2022).

Clinical implications

The current findings confirm that clinicians should pay close attention to the presence of beliefs about possessions in HD. They also further encourage advice that formal assessments of beliefs about possessions are an important part of CBT assessment and formulation (Steketee & Frost, 2006). Due to findings that a diverse range of beliefs are associated with hoarding severity and it seems unlikely based on the data synthesised that specific beliefs are more important to target (except perhaps responsibility and emotional attachment type beliefs), it would be preferable for clinicians to use tools that assess a wide range of beliefs about possessions, so that these can all be accurately captured in formulation and treatment planning. Clinicians should also assess which beliefs are associated with acquiring, difficulty discarding or clutter and should not assume that they are the same.

Clinicians' ability to effectively assess, formulate, intervene and evaluate, are evidently impacted by the availability of appropriate tools to assess the diverse range of beliefs about possessions that are relevant in understanding HD. Concerns have been raised that currently available tools (e.g., SCI, Steketee et al., 2003), are missing relevant beliefs themes and that this will impact upon their clinical utility (Tinlin et al., 2022). The current review results strengthen these concerns, due to finding that beliefs not currently captured in the widely used SCI (e.g., those concerning the role of possessions as representing parts of the self or identity) are associated with hoarding severity. Therefore, we recommend that clinicians are mindful about the potential limitations of currently available assessment tools and that they use their clinical skills to assess for additional belief themes

which may be relevant to building an idiosyncratic formulation of an individual's hoarding difficulties.

Based upon the strong association between beliefs about possessions and hoarding severity, the results encourage clinicians to pay close attention to belief change during therapy and to reformulate and adjust treatment if strongly endorsed beliefs are not reducing in strength following intervention techniques. Although our results suggest that intervention may need to focus on a diverse range of belief themes, the results also highlight that emotional attachment and responsibility-related beliefs about possessions are more closely associated with HD. Due to this, it may be prudent for clinicians to first focus treatment interventions on these belief types where these are present at assessment.

Research implications

Whilst these results tell us that beliefs about possessions are important in HD and that there are a range of relevant belief types, they do not tell us how they are best targeted in treatment. Indeed both Levy et al. (2017) and Tolin et al. (2019) found that beliefs about possessions, as assessed by the SCI (Steketee et al., 2003) mediated treatment improvement, but the treatments evaluated differed from one another in terms of how much they prioritised cognitive restructuring of beliefs. Therefore, due to their evident relevance in HD and in its treatment (Levy et al., 2017; Tolin et al., 2019), it would be of benefit for research to focus on the evaluation of specific techniques to intervene with beliefs about possessions. Further, it is possible that the most impactful therapeutic technique or approach depends on the belief type being targeted. For example, focusing on the development of alternative emotional regulation skills may reduce beliefs about emotional attachment to possessions, whereas cognitive restructuring and behavioural experiments may be more suited to disproving memory-related beliefs about possessions (for example, "I must remember something about this, and I can't if I throw this away"; Steketee et al., 2003).

These future research endeavours are ultimately supported or hindered by the tools used to assess beliefs about possessions. In addition to highlighting how existing belief measures (e.g., SCI, Steketee et al., 2003; BAH, Gordon et al., 2013) may be limiting clinicians in treatment settings, Tinlin et al. (2022) highlighted how research may be hindered by reliance on these existing measures, due to concerns that they are missing relevant belief themes. Indeed, neither of these assessment tools include beliefs about possessions representing parts of the self or identity, and this was found to be a relevant belief type within the current review. Therefore, our results encourage researchers to consider whether widely used belief assessment tools are appropriate and psychometrically sound when attempting to investigate future research questions. These concerns have motivated the development of a new self-report tool to assess beliefs about possessions, the HDBI (Ragan et al., unpublished results). It was developed with an intention for it to be a comprehensive assessment of beliefs about possessions in HD and therefore, the HDBI is a novel measure that may represent an alternative assessment of beliefs about possessions that could further our understanding of the role of beliefs about possessions in HD, and how best to target them in treatment.

Although this review implicates a diverse range of beliefs about possessions in the continuation of HD, what contributes to the development of these beliefs remains an empirical question. The cognitive behavioural model highlights several potential vulnerability factors in HD, including information processing deficits, early experiences, core beliefs, personality factors, mood (depression, anxiety) and comorbidity (Steketee & Frost, 2006). Whilst there have been some preliminary cross-sectional investigations into how experiences of trauma may contribute to the development of beliefs about emotional attachment to possessions (Fontenelle et al., 2021), there is further research to be done to understand what contributes to belief development in HD. For example, qualitative studies could be used to explore what has contributed to the development of beliefs for those with HD. This research might lead to novel treatment techniques not currently suggested in CBT

manuals for HD (Steketee & Frost, 2006), such as imagery rescripting or trauma reprocessing.

Conclusion

This review represents a comprehensive summary of the wealth of data available concerning the relationship between beliefs about possessions and hoarding severity. Applying both meta-analytic techniques and narrative synthesis, we have demonstrated a consistent relationship between beliefs about possessions and hoarding severity. Through the inclusion of group comparison data, we have also observed that beliefs about possessions are specific to those experiencing clinically significant hoarding symptoms. The results provide support for both the cognitive model of hoarding and CBT treatment of hoarding, with the latter including techniques to target beliefs about possessions.

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Investigating the Psychometric Properties of the Hoarding Disorder Beliefs Inventory (HDBI): Specificity and Validity

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To be submitted to the Journal of Obsessive-Compulsive and Related Disorders

Word count: 9247

Abstract

This study aimed to evaluate the psychometric properties of a novel measure of beliefs associated with hoarding, the Hoarding Disorder Beliefs Inventory (HDBI). These properties were evaluated using online survey data provided by 45 individuals who reported clinically significant hoarding difficulties, 63 individuals who reported clinically significant obsessive-compulsive disorder (OCD) symptoms and 54 non-clinical control participants. Participants completed a range of self-report measures to determine convergent, divergent and known-groups validity. To assess test-retest reliability, participants were invited to complete a second survey two weeks later. There was evidence in support of the convergent and divergent validity of the HDBI, due to generally stronger associations with self-report measures of hoarding severity and beliefs, compared to self-report measures assessing symptoms or beliefs associated with low mood, anxiety and OCD. Known-groups validity was demonstrated with the HDBI almost exclusively differentiating hoarding participants from both clinical and non-clinical control groups. A large proportion of participants opted to and completed the second survey, supporting confidence in evidence of good test-retest reliability. Overall, these results found that the HDBI has strong psychometric properties. The potential utility for using the HDBI to understand hoarding beliefs about possessions in clinical and research contexts is discussed.

Hoarding Disorder (HD) is recognised as a distinct mental health condition in the 5th edition of the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-5; American Psychiatric Association, 2013). It is defined as finding it difficult and distressing to discard possessions, resulting in cluttered living spaces that cannot be used for their normal purpose. Hoarding is associated with numerous negative consequences, including significant health and safety concerns (Frost et al., 2000) and impairment in personal functioning (Frost et al., 2000; Tolin et al., 2008). Evidence suggests that hoarding difficulties can have widespread effects, including putting pressure on public services (e.g., social care, fire brigades and health services; Kim et al., 2001) and negatively affecting those in the support network around the person with HD (Drury et al., 2014).

The importance of beliefs about possessions in HD

Beliefs about possessions have been implicated as a maintenance factor in the cognitive-behavioral model of hoarding (Frost & Hartl, 1996). For example, higher ratings of beliefs about possessions differentiate those who experience clinically significant hoarding difficulties compared to both non-clinical (Steketee et al., 2003; Wheaton et al., 2013) and clinical comparison groups (Grisham et al., 2008; Steketee et al., 2003). Beliefs, as measured by the Saving Cognitions Inventory (SCI; Steketee et al., 2003), are also predictive of both overall hoarding severity (Steketee et al., 2003; Wheaton et al., 2013) and specific symptoms of hoarding, including excessive acquisition and difficulty discarding (Wheaton et al., 2011; Wheaton et al., 2013). There is inconsistency in understanding how beliefs relate to clutter; whilst Wheaton et al. (2011) found SCI scores to predict clutter in an undergraduate sample, this was not replicated amongst those with clinically significant hoarding (Wheaton et al., 2013).

Self-report and interview methods have highlighted a range of beliefs to be relevant in hoarding, including those concerning emotional attachment to possessions, such that individuals report deriving comfort from their possessions, being emotionally connected with them and finding it distressing to part from them (Hartl et al., 2005; Steketee et al., 2003).

Additionally, researchers have found hoarding symptoms to be associated with beliefs about: (1) possessions representing parts of the self or past, current or future identity (Tinlin et al., 2022), (2) needing to maintain control over possessions (Steketee et al., 2003), (3) being responsible for the appropriate care and/or use of possessions (Steketee et al., 2003; Tinlin et al., 2022), (4) reduced confidence in one's own memory and possessions serving as memory cues (Hartl et al., 2004; Steketee et al., 2003), (5) the beauty or aesthetic appeal of items or possessions (Dozier & Ayers, 2014), (6) possessions having human-like qualities (i.e., anthropomorphism; Yap & Grisham, 2019), (7) acquiring or saving items in order to avoid waste (Dozier & Ayers, 2014; Frost et al., 2015) and (8) the potential future usefulness of items (Tinlin et al., 2022). Evidence suggests that the most relevant belief type(s) may depend on whether the symptom of interest is difficulty discarding, acquiring or clutter (Dozier & Ayers, 2014; Frost et al., 2015). Similarly, a range of beliefs have been implicated in understanding the relationship between HD vulnerability factors and symptom severity. There is evidence to suggest that beliefs about responsibility mediate the relationship between shame/self-criticism and hoarding severity (Chou et al., 2018), beliefs about memory mediate the relationship between inattention symptoms and hoarding severity (Hallion et al., 2015) and beliefs about emotional attachment mediate the relationship between anxiety sensitivity and hoarding severity (Phung et al., 2015).

Changes in beliefs about possessions have been found to mediate improvement in specialised cognitive behavioural therapy for HD (Levy et al., 2017). Evidence suggests that beliefs change and mediate treatment improvement even when they are not the focus of the treatment intervention (Tolin et al., 2019). There is a need to further develop specialised treatment for HD, due to meta-analysis findings that symptoms often remain at the clinically significant level post-treatment (Bodryzlova et al., 2019; Tolin et al., 2015). It is therefore important to further investigate CBT for hoarding, including how best to target and reduce maintaining beliefs about possessions (David et al., 2022).

This evidence shows the important relationship between beliefs about possessions and a range of outcomes in HD, including treatment gains. However, studies such as these are dependent upon the measures used to investigate beliefs about possessions, including whether they are able to reliably and validly measure relevant beliefs about possessions (Ong et al., 2021).

Measures of beliefs about possessions

The SCI (Steketee et al., 2003) has been widely used to investigate beliefs about possessions (e.g., Grisham et al., 2008; Hallion et al., 2015; Hartl et al., 2004). It captures beliefs about emotional attachment to possessions (e.g., *"I love some of my belongings the way I love some people"*), control (e.g., *"I like to maintain sole control over my things"*), responsibility (e.g., *"I am responsible for finding a use for this possession"*) and memory (e.g., *"Saving this means I don't have to rely on my memory"*). Steketee et al. (2003) evaluated the psychometric properties of the SCI, but highlighted concerns that the SCI may not be capturing the full range of beliefs that are relevant to understanding HD. Consistent with this, a recent systematic review evaluating the psychometric properties of HD self-report measures concluded that the SCI lacks evidence of structural and construct validity (Ong et al., 2021). Ong et al. (2021) also highlighted that a notable concern of pre-existing HD self-report measures (including the SCI) has been the lack of engagement with experts by experience in the initial development of measures.

The Hoarding Interview has been used to better understand the motives for both acquiring and saving (Frost et al., 2015). It is a semi-structured interview that assesses the frequency of four motives for both saving and acquiring, which are: (1) Losing important information, (2) Sentimental or emotional significance, (3) Wasting a potentially useful object and (4) Beautiful or aesthetically pleasing. Although not formally psychometrically evaluated, there is preliminary evidence to support the Hoarding Interview's construct validity, for example, higher ratings of motives distinguished those meeting criteria for HD from both an obsessive-compulsive disorder (OCD) and community comparison group (Frost et al., 2015).

Each motive was also found to correlate significantly with either or both of the difficulty discarding and acquiring subscale of the Saving Inventory Revised (SI-R; Frost et al., 2004), although the correlations were all in the small to medium range (r = .259-356). However, limited rationale was provided for the specific items which were included in the Hoarding Interview (Frost et al., 2015). Indeed, it also lacks evidence of face validity since patients and professionals were not consulted in its development. Further, there has been no evaluation of its inter-rater reliability or test-retest reliability.

The Beliefs about Hoarding Questionnaire (BAH; Gordon et al., 2013) is a self-report measure which assesses strength of beliefs associated with harm avoidance (e.g., *"It is important to keep this to make sure nothing bad happens"*), material deprivation (e.g., *"I have to have this if there is even a very slight chance that I will need it"*) and attachment disturbances (e.g., *"It would be disloyal to this item if I don't take care of it"*). The BAH also includes one item concerning the emotional experience associated with acquiring (*"It feels exhilarating and very exciting to get new items to add to my things"*). It is unclear how the categories and individual items of the BAH were arrived at and there is no evidence of service user involvement or empirical studies to generate items (Gordon et al., 2013). The convergent and divergent validity of the BAH has not been investigated and the psychometric properties of the BAH are currently unclear, however, there is emerging evidence to suggest the subscales are more strongly related to acquisition than discarding and not to clutter at all (Walji & Salkovskis, 2024). Ten participants contributed to evaluation of the test-retest reliability of the BAH (Gordon et al., 2013), but this would be considered an inadequate sample size according to guidelines for psychometric evaluation studies (Mokkink et al., 2019).

To begin addressing the issues raised above, Tinlin et al. (2022) used a Q-methodological approach to identify beliefs about possessions based upon the reports of thirty-two individuals with clinically significant hoarding. Tinlin et al. (2022) reported five main belief categories: 1) beliefs related to possessions representing a person's identity; 2)

morality and responsibility related beliefs about possessions; 3) objects being perceived as emotional and meaningful beings; 4) possessions being useful and valuable; and 5) beliefs concerning the stability and predictability of objects and how this contributes to feelings of safety and comfort. This research highlighted that by using previously developed belief measures (e.g., SCI, BAH), researchers and clinicians risk missing relevant belief themes that are endorsed by people with clinically significant hoarding, such as the stability and predictability of objects, and their potential future usefulness (Tinlin et al., 2022).

To develop a comprehensive measure of hoarding-related beliefs, Ragan et al. (unpublished results) initially pooled the items generated by Tinlin et al. (2022), with those from the SCI (Steketee et al., 2003) and the BAH (Gordon et al., 2013). The authors reviewed all items, considering belief themes, removing duplicate items and ensuring that all items related specifically to beliefs about possessions. The authors then collaborated with service users, clinicians and researchers to further refine the measure, before it was subjected to factor analysis which reduced the measure to 21 items, representing three subscales: 1) 'Items create emotional attachment and safety', 2) 'Items represent parts of me and my life' and 3) 'Items are useful and should not be wasted'. Independent clinicians with experience of HD were then invited to review the newly developed questionnaire and provide feedback via an online survey. This provided support for face validity, as all clinicians responded positively to questions concerning the questionnaire having clinical utility and appropriate content. In contrast to other possession belief measures, those with experience of HD (i.e., service users, clinicians, researchers) were substantially involved in both the development of the Q-sort items generated by Tinlin et al. (2022) and the subsequent Hoarding Disorder Beliefs Inventory (HDBI) (Ragan et al., unpublished results).

This study aims to further evaluate the psychometric properties of the HDBI (Ragan et al., unpublished results), including its construct validity (convergent, divergent, known-groups validity) and test-retest reliability. There are three specific hypotheses.

1. Greater correlations will be reported between the HDBI and existing measures of hoarding symptomatology and beliefs about possessions (convergent validity) compared to the correlations reported between the HDBI and measures of general mental health symptomatology and OCD symptomatology and beliefs (divergent validity).
2. Greater scores on the HDBI will differentiate individuals with clinically significant hoarding from a group of non-clinical controls and a group of individuals with clinically significant OCD (known-groups validity). The non-clinical control and OCD group, however, are not expected to differ from one another on this measure.
3. There will be at least good reliability between the first and second measurement of the HDBI ($r > .80$).

Method

Design

The study employed a longitudinal design with three groups (hoarding, OCD and non-clinical control). The study was pre-registered prior to data collection (https://aspredicted.org/3R6_K2B). Ethical approval was granted by Cardiff University (Appendix C).

Participants

G*Power (Faul et al., 2007) was used to calculate an *a-priori* power analysis for an Analysis of Covariance (ANCOVA) with one planned covariate (age)[1]. With statistical power set to 80%, α set to 0.05 and effect size set to 0.884 (based upon group comparison data (i.e., HD vs OCD) from Steketee et al. (2003), a total sample of 16 (i.e., approximately 6 per group) was recommended. As the calculated sample size was substantially below the

[1] This was planned considering empirical evidence that hoarding samples are older than clinical and non-clinical comparison groups (Frost et al., 2004; Steketee et al., 2003).

recommendations for psychometric evaluation studies provided by the Consensus-based Standards for the selection of Health Measurement Instruments (COSMIN; Mokkink et al., 2019), these guidelines were followed instead. For the determination of known-groups validity, convergent validity and reliability, a minimum of 50 participants is recommended for a measurement to be considered adequate (Mokkink et al., 2019).

Participants were eligible to participate if they were at least 18 years old and able to read and write in English. Individuals were not eligible to participate if they self-reported a brain injury or neurological disorder. 162 eligible participants were categorized into one of three groups: Hoarding only (*n* = 45), OCD only (*n* = 63) or non-clinical control group (*n* = 54). The hoarding group was defined as a score of greater than or equal to 14 on the internet-based adaptation (Nutley et al., 2020) of the Hoarding Rating Scale (HRS; Tolin et al., 2010) and a score less than 12 on the Obsessive-Compulsive Inventory-Revised (OCI-R; Foa et al., 2002), with revised scoring guided by Wootton et al. (2015). The OCD group was defined as a score of greater than or equal to 12 based on revised scoring (Wootton et al., 2015) of the OCI-R (Foa et al., 2002) and a score of less than 14 on the internet-based adaptation (Nutley et al., 2020) of the HRS (Tolin et al., 2010). A non-clinical control was defined as a score of less than 14 on the HRS, less than 12 on the OCI-R (revised scoring), less than 10 on the Patient Health Questionnaire (PHQ-8; Kroenke et al., 2001; Kroenke et al., 2009) and less than 8 on the Generalized Anxiety Disorder-7 (GAD-7; Spitzer et al., 2006). Also, non-clinical control group participants did not self-report a current mental health problem or use of psychological therapy or psychiatric medication at the time of the study.

A number of participants did not meet criteria for one of the groups and therefore their data was excluded from analysis (*n* = 120). This included 78 individuals who met criteria for both clinically significant hoarding (HRS > 13) and OCD (OCI-R > 11). The total number excluded from analysis also included 42 individuals who did not meet criteria for the non-clinical control group, due to self-reporting mental health difficulties and/or psychological therapy use and/or mental health medication use and/or scoring over the low mood (PHQ-8 > 9) or anxiety (GAD-7 > 7) clinical severity thresholds. This data was excluded

retrospectively, with these participants having completed the entire survey. As these participant groups were not part of our pre-registered data analysis plan, statistics including this data are not reported here. However, further data analysis is planned. For example, we intend to explore whether those who meet criteria for both clinically significant hoarding and OCD symptoms score significantly differently on the novel belief measure (HDBI) compared to a hoarding only or OCD only group. In future research studies, improved screening procedures will be implemented in order to reduce the chances of this level of unintended retrospective data exclusion.

Participants were recruited from third sector organisations associated with hoarding and/or OCD, who circulated details of the study advert (e.g., via support groups, newsletters, or social media). Study details were also shared via email with individuals who had agreed for their details to be stored in a research database. Twitter and reddit were used to disseminate the study advert via social media. Participants were additionally recruited via a research participation platform (Call for Participants) and psychology students at Cardiff University were invited to complete the study via their research participation platform. Psychology students were allocated course credits in compensation for their participation, whilst all other participants had the opportunity to enter a prize draw following completion of each survey, with the prize draw consisting of eight £25 vouchers.

Financial incentivization was carefully considered prior to recruitment commencing. Although individual payments per participant (e.g., £5) are recommended by Cardiff University's School of Psychology Research Ethics Committee (SREC), it was not possible to offer such compensation due to research budget limits. Therefore, recommendations by SREC were considered, including prizes not exceeding £100 and that offering a draw for several smaller prizes is preferable to providing one larger prize. Due to the online nature of the survey, a prize draw was also considered appropriate to reduce the likelihood of invalid responses that are submitted in the interest of receiving immediate financial payment. The research team are aware that due to the research project being focused on HD, there are ethical concerns around offering prize draw vouchers as a financial incentive, due to

concerns that vouchers may provide an opportunity for hoarding behaviours. However, the chosen financial incentivization procedure was considered appropriate on balance, due to it supporting recruitment and therefore the quality of the current research study which has potential research and clinical implications for those who experience clinically significant hoarding difficulties. The chosen procedure was also reviewed and approved by SREC prior to recruitment commencing.

Measures

Group allocation

Internet based adaptation (Nutley et al., 2020) of the Hoarding Rating Scale (HRS; Tolin et al., 2010). Five items assess the main features of hoarding: difficulty discarding, excessive acquisition, clutter, emotional distress and functional impairment related to hoarding symptoms. Each item is rated on a scale from 0 (*None/not at all*) to 8 (*Extreme*). A total score greater than or equal to 14 indicates clinically significant hoarding (Tolin et al., 2010). Nutley et al. (2020) evaluated the internet-based adaptation of the HRS and recommended that a clinical cut-off score of greater than or equal to 14 is maintained. The internet-based adaptation of the HRS has evidence of good test-retest reliability (r = .88-92) and convergent validity (Nutley et al., 2020). Tolin et al. (2010) reported high internal consistency for the HRS (α = .96-.97) and this was also the case for the internet-based adaptation of the HRS in the current study (α = .90).

Obsessive-Compulsive Inventory-Revised (OCI-R; Foa et al., 2002). An 18-item OCD severity measure, with 6 subscales assessing symptoms associated with washing, checking, obsessing, neutralizing, ordering and hoarding. The measure asks participants to consider the past month and to rate how distressed or bothered they have been by each symptom, on a 5-item scale from 0 (*Not at all*) to 4 (*Extremely*). Based upon Wootton et al. (2015) reanalysis of the OCI-R, the hoarding subscale was removed from the OCI-R for the group allocation. Consistent with Wootton et al. (2015), we will refer to the OCI-R with the hoarding subscale removed as the OCI-OCD. When the hoarding subscale is removed (OCI-OCD), a score of greater than or equal to 12 indicates clinically significant OCD (Wootton et

al., 2015). There is evidence in support of the OCI-R's test-retest reliability (*rho* = .82-.84) and convergent validity, both with the hoarding subscale included (Foa et al., 2002) and excluded (Wootton et al., 2015). Similarly, high internal consistency has been reported for both the OCI-R (α = .90; Foa et al., 2002) and OCI-OCD (α = .92; Wootton et al., 2015). This was also the case in the current study (OCI-R: α = .88; OCI-OCD: α = .91).

Patient Health Questionnaire-8 (Kroenke et al., 2001; Kroenke et al., 2009). Assessing depression symptomatology, eight items are rated on a 4-point scale from 0 (*Not at all*) to 3 (*Nearly every day*). A score greater than or equal to 10 indicates clinically significant depression (Kroenke et al., 2009). The PHQ-9 has been found to have good test-retest reliability (*r* = .84), internal consistency (α = .89) and convergent validity (Kroenke et al., 2001). In the current study, internal consistency was high (α = .88).

Generalized Anxiety Disorder-7 (GAD-7; Spitzer et al., 2006). Assessing anxiety symptomology, seven items are rated on a 4-point scale from 0 (*Not at all*) to 3 (*Nearly every day*). A clinical cut-off score of equal to or greater than 8 indicates clinically significant anxiety (Spitzer et al., 2006). Evidence in support of convergent validity, test-retest reliability and internal consistency (α = .92) has been reported previously (Spitzer et al., 2006). In the current study, internal consistency was high (α = .93).

Convergent validity

Hoarding Disorder Beliefs Inventory (HDBI: Ragan et al., unpublished data). The HDBI has 21 items that assess hoarding-related beliefs about possessions. It has three subscales, including 'Items create emotional attachment and safety' (e.g., *"I keep items around me because they keep me safe"*), 'Items represent parts of me and my life' (e.g., *"I don't discard items because it would be like losing part of myself"*) and 'Items are useful and should not be wasted' (e.g., *"I acquire items because I plan to fix, recycle, or find use for everything"*). For each item, strength of belief is rated on a Likert scale from 0 (*Not at all*) to 4 (*Very strongly*), with higher scores reflecting stronger beliefs about possessions. The current study aimed to evaluate the HDBI's psychometric properties, including construct validity (i.e., convergent, divergent and known groups validity) and test-retest reliability. Internal

consistency was good for the HDBI (α = .92) and for each of its subscales (Items create emotional attachment and safety: α = .88; Items represent parts of me and my life: α = .90; Items are useful and should not be wasted: α = .88).

Saving Inventory-Revised (SI-R; Frost et al., 2004). 23 items assess severity of hoarding symptoms, including three subscales of acquisition, difficulty discarding and clutter. Each item is rated on a Likert scale from 0 to 4, with higher scores indicating more severe hoarding. Frost et al. (2004) reported evidence of good convergent validity, test-retest reliability (*r* = .86) and internal consistency (SI-R total: α = .96; Discarding: α = .88; Clutter: α = .91; Acquisition: α = .87). In the current study, internal consistency was good for the SI-R (α = .94) and for each of its subscales (Difficulty discarding: α = .92; Clutter: α = .96; Acquisition: α = .80).

Saving Cognitions Inventory (SCI; Steketee et al., 2003). The 24 item SCI assesses hoarding-related beliefs about possessions. It has four subscales: 1) emotional attachment to possessions (e.g., *"I love some of my belongings the way I love some people"*); 2) control (e.g., *"No one has the right to touch my belongings"*); 3) memory (e.g., *"I must remember something about this, and I can't if I throw this away"*) and 4) responsibility (e.g., *"I'm ashamed when I don't have something like this when I need it"*). Items are rated on a Likert scale from 0 (*Not at all*) to 7 (*Very much*), with higher scores reflecting greater strength of hoarding-related beliefs about possessions. There is evidence to support convergent and known-groups validity (Steketee et al., 2003). Good internal consistency has been reported previously for the SCI (α = .96) and for each of its subscales (α = .86-95). This was also the case in the current study (SCI: α = .94; Emotional attachment: α = .95; Control: α = .80; Memory: α = .84; Responsibility: α = .78).

Divergent validity

The PHQ-8 (Kroenke et al., 2001; Kroenke et al., 2009) and GAD-7 (Spitzer et al., 2006) were also used to determine divergent validity of the HDBI. Similarly, the OCI-R (Foa et al., 2002) was used, but due to the inclusion of hoarding symptoms in the OCI-R, the OCI-

OCD (Wootton et al., 2015) was used when assessing the divergent validity of the HDBI. The following was also used as a further test of divergent validity.

Obsessive Beliefs Questionnaire-9 (OBQ-9; Gagné et al., 2018). Nine item measure which assesses beliefs associated with OCD. It has three subscales: (1) Perfectionism and intolerance for uncertainty, (2) Responsibility and threat overestimation and (3) Importance of and control over thoughts. The measure is a 9-item abbreviated version of the OBQ-44 (Obsessive Compulsive Cognitions Working Group, 2005). Each item is rated on a scale from 0 (*Disagree very much*) to 7 (*Agree very much*. Higher scores indicate stronger OCD-related beliefs. There is evidence to support good test-retest reliability (r = .86) and convergent validity (Gagné et al., 2018). Good internal consistency has been reported previously (α = .85; Gagné et al., 2018) and this was also the case in the current study (α = .76).

Procedure

The study was administered online via Qualtrics (https://www.qualtrics.com/). The survey began with an initial screening questionnaire to confirm study eligibility (Appendix D). Participants then provided informed consent before providing demographic details. To support non-clinical group categorisation (see above), participants were asked to self-report whether they have a mental health problem and whether they were currently receiving psychiatric medication or psychology therapy (Appendix E). Finally, self-report measures were completed before participants were debriefed. To establish test-retest reliability, on completing the first survey participants were asked for permission to be contacted to complete a revised second survey two weeks later. The second survey comprised the HDBI (Ragan et al., unpublished results) and the HRS-SR (Nutley et al., 2020). Participants were also asked whether there had been a change in relation to their use of psychological therapy and/or psychotropic medication since completion of the first survey (Appendix F). The HRS-SR and the additional questions were included to assess changes which may have impacted upon recompletion of the HDBI (e.g., a reduction in hoarding severity). Cardiff University students followed a similar procedure but participated via an internal participation platform.

Service User & Carer Consultancy

Across the surveys participants were asked about their use of psychological therapy and psychiatric medication. In the first survey, they were also asked whether they considered themselves to have a mental health problem. The wording of these questions was informed by consultation with a service user with lived experience of mental health difficulties, to ensure that the language used was sensitive, clear and appropriate.

Data analysis

Due to the online nature of data collection, a bot detection feature (CAPTCHA) was included at the start of the survey to reduce the likelihood of invalid responses. Additionally, at the data analysis stage, validity checks were implemented to increase confidence in data quality. Specifically, it was agreed that completion of survey one should take at least five minutes and completion of survey two should take at least two minutes, with responses faster than this indicating potentially invalid responses. Each survey completion was also reviewed to monitor for signs of inattentive responses, including selecting the lowest or highest score consistently for all questionnaires. No data met criteria for concern and therefore none was deleted at the validity checks stage.

For the total sample and for each group, normal q-q plots for self-report measure variables (i.e., totals and subscales) were visually assessed for significant deviations from normality. Outliers, identified through inspection of boxplots, were checked for accuracy and none were removed. Several variables were successfully transformed in response to non-normality. Square root transformations were applied to the emotional subscale of the HDBI, the clutter subscale of the SI-R and OCI-OCD total. Logarithmic transformations were also applied to the SCI total and the SCI emotional attachment subscale. There were four incidences of missing data which related to four participants (one item from the PHQ-8, one item from the SCI, two items from the HDBI). In each case, the mean score across the other items in the measure (for that individual) was imputed.

Regarding categorical demographic variables, chi-square tests of independence were used to investigate between-group differences. Several categories were collapsed

together for the purpose of analysis, to ensure all expected cell frequencies were greater than five. Due to heterogeneity of variances, a Welch ANOVA was used to investigate between group differences in age, with multiple comparisons (Games-Howell) to investigate a significant main effect.

To evaluate convergent validity, Pearson's product-moment correlations were used to assess the relationship between the HDBI, and self-report measures hypothesised to be measuring a related hoarding concept, i.e., hoarding symptom severity (SI-R) and beliefs about possessions (SCI). To evaluate divergent validity, Pearson's correlations were used to assess the association between the HDBI, and self-report measures hypothesised to be assessing an unrelated concept, i.e., OCD symptoms (OCI-OCD) and beliefs (OBQ-9), depression symptomatology (PHQ-8) and anxiety symptomatology (GAD-7). Standard conventions to interpret Pearson's product-moment correlations were used (Cohen, 1988). Prior to calculation of the correlations, assumptions were checked, including there being a linear relationship between variables, normality of variables and absence of significant outliers.

To test known-groups validity, those in the hoarding, OCD and non-clinical control group were compared on the HDBI, including its total and each subscale. The groups were similarly compared on other self-report measures included in the study (SI-R, SCI, OCI-OCD, OBQ-9, PHQ-8, GAD-7). One-way between-subjects analysis of variance (ANOVA) were used to evaluate differences between groups (i.e., hoarding, OCD, non-clinical control). Where the assumption of homogeneity of variances was violated, the Welch ANOVA was used. For significant main effects, multiple comparisons were run. Prior to analysis, assumptions were checked, including normality of variables for each group and absence of significant outliers. Prior to recruitment, we had preregistered our intention to complete an ANCOVA with one covariate (age). This was planned considering empirical evidence that hoarding samples are older than clinical and non-clinical comparison groups (Frost et al., 2004; Steketee et al., 2003). However, the data did not meet the assumptions for this statistical test and ANOVAs were more appropriate. Finally, to evaluate test-retest reliability,

Pearson's product-moment correlations were also calculated between HDBI total and subscales for completion at time one and time two. Again, assumptions were checked prior to analysis.

Results

Demographics

Sociodemographic information for each of the groups can be seen in Table 1. Participants ranged in age from 18 to 79 and the mean age of participants (n = 161) was 34.4 (SD = 18.5). The mean age of the hoarding, OCD and non-clinical control group was 49.3 (SD = 18.9), 24.5 (SD = 10.7) and 33.4 (SD = 17.4), respectively. Due to the assumption of homogeneity being violated (Levene's test for equality of variances $p < .001$), a one-way between subjects Welch ANOVA was used to assess for between group differences in age (Welch's $F(2, 87.785) = 32.396$, $p < .001$). Games-Howell post hoc analysis indicated that the hoarding group was significantly older than both the OCD ($p <$ .001, 95% CI [17.2, 32.2]) and non-clinical control group ($p <$.001, 95% CI [7.1, 24.6]). The non-clinical control group was also older than the OCD group (p = .005, 95% CI [2.4, 15.4]). Further, most participants were female (87.0%), white (81.5%), single (46.3%) and were sharing a house or flat with other people (46.3%). In relation to their highest level of education, most reported that they had A level qualifications (42.6%). Considering all participants, 33.3% self-reported a mental health difficulty, and 12.3% and 15.4% respectively self-reported use of psychological therapy and psychotropic medication. Groups were compared to examine differences on sociodemographic variables; there were no differences between groups for gender, marital status or education level, but groups did differ on ethnicity and living situation (see Appendix G).

Table 1

Sociodemographic Characteristics of Participants by Group

	Hoarding (*n* = 45)		OCD (*n* = 63)		Non-clinical control (*n* = 54)	
	n	%	*n*	%	*n*	%
Gender						
Female	41	91.1	50	79.4	50	92.6
Male	2	4.4	13	20.6	4	7.4
Gender non-conforming	1	2.2	0	0	0	0
Prefer not to say	1	2.2	0	0	0	0
Ethnicity						
Asian or Asian British	1	2.2	13	20.6	3	5.6
Black, Black British, Caribbean or African	2	4.4	1	1.6	3	5.6
Mixed or multiple ethnic groups	2	4.4	3	4.8	0	0
White	40	88.9	44	69.8	48	88.9
Other ethnic group	0	0	1	1.6	0	0
Prefer not to say	0	0	1	1.6	0	0
Marital status						
Married	16	35.6	9	14.3	12	22.2
Widowed	3	6.7	0	0	1	1.9
Divorced/separated	4	8.9	0	0	1	1.9
Civil partnership	1	2.2	0	0	0	0
Cohabitation	1	2.2	0	0	3	5.6
Single	13	28.9	36	57.1	26	48.1

	Hoarding (*n* = 45)		OCD (*n* = 63)		Non-clinical control (*n* = 54)	
In a relationship	7	15.6	18	28.6	11	20.4
Current living situation						
Alone	18	40.0	8	12.7	8	14.8
Spouse/partner (with or without children)	17	37.8	11	17.5	15	27.8
Sharing a flat/house with others	6	13.3	40	63.5	29	53.7
Other	3	6.7	3	4.8	2	3.7
Prefer not to say	1	2.2	1	1.6	0	0
Highest education level						
City and guilds	1	2.2	0	0	0	0
G.C.S.E.s	1	2.2	1	1.6	0	0
A' levels	11	24.4	38	60.3	20	37.0
University Degree	15	33.3	14	22.2	17	31.5
Master's Degree	9	20.0	7	11.1	12	22.2
PhD	1	2.2	3	4.8	3	5.6
Other	7	15.6	0	0	2	3.7

Construct validity

Convergent and divergent validity

Correlations for the entire sample are displayed in Table 2. As hypothesised, HDBI total and subscales were found to have stronger associations with measures of HD severity and related processes (i.e., SI-R, SCI), compared to measures related to other mental health disorder symptomatology (i.e., PHQ-8, GAD-7, OCI-R, OBQ-9). Statistically significant

medium to large correlations were found between the total and subscales of the HDBI and SI-R (r = .34-.69, p < .001). This was also the case when considering the associations between the total and subscales of the HDBI and SCI (r = .37-.80), p < .001). The strongest relationship was that between HDBI total and SCI total (r = .80, p < .001), whilst the weakest association was that between HDBI identity and SI-R acquisition (r = .34, p < .001). In comparison to these medium to large correlations and, as predicted, small to moderate correlations were found between the HDBI (total and subscales) and measures related to OCD, low mood and anxiety (r = .08-.33).

Table 2

Pearson's correlations between the HDBI and other self-report measures for the total sample (n = 162)

	HDBI Total	HDBI Emotional	HDBI Identity	HDBI Useful
SI-R Total	.69***	.57***	.50***	.65***
SI-R Acquisition	.59***	.65***	.34***	.53***
SI-R Difficulty discarding	.69***	.50***	.53***	.67***
SI-R Clutter	.57***	.47***	.45***	.53***
SCI Total	.80***	.69***	.74***	.56***
SCI Emotional attachment	.74***	.66***	.78***	.40***
SCI Control	.46***	.40***	.40***	.37***
SCI Responsibility	.70***	.64***	.44***	.68***
SCI Memory	.66***	.51***	.66***	.44***
OCI-OCD[a]	.19*	.33***	.16*	.08
OBQ-9	.26***	.31***	.23**	.16*
PHQ-8	.28***	.30***	.22**	.23**

	HDBI Total	HDBI Emotional	HDBI Identity	HDBI Useful
GAD-7	.25**	.28***	.20*	.19*

Note. The following variables were transformed prior to calculation of the Pearson's correlations: SCI Total, SCI Emotional attachment, SIR Clutter, OCI-OCD.

[a] OCI-R with the hoarding subscale removed.

*p < .05. **p < .01. ***p < .001.

Similar patterns of correlations were found in the hoarding only group (Table 3). However, when considering HDBI total, medium to large associations were found with the SI-R and each of its subscales (r = .36-.50, p < .05). Overall, HDBI appeared to have a marginally weaker relationship with the clutter subscale of the SI-R (r = .10-36), compared to the difficulty discarding (r = .19-.47) and acquisition subscales (r = .11-.52). HDBI total was also found to relate significantly and to a large degree with the SCI and the three subscales (emotional attachment, responsibility, memory; r = .58-.75, p < .001). Whilst the HDBI was also significantly associated with the control subscale of the SCI, this was a somewhat weaker relationship, with a medium sized correlation being found (r = .44, p < .01). When considering subscales of both the SCI and HDBI, large associations (r = .53-.79) were found between: (1) HDBI emotional and SCI emotional attachment, (2) HDBI identity and both the SCI emotional attachment and SCI memory subscales, (3) HDBI useful and SCI responsibility. Again, whilst significant relationships were found, the control subscale of the SCI had weaker associations with the HDBI subscales (r = .29-.34). Consistent with our hypothesis, all the correlations between the HDBI (total and subscales) and measures unrelated to hoarding (i.e., OCI-OCD, OBQ-9, PHQ-8, GAD-7) were small and not statistically significant (r = -.02-.26, p > .05). The HDBI having generally stronger associations with hoarding-related measures and weaker associations with measures

assessing low mood, anxiety and OCD was also found when these correlations were analysed separately for the OCD only and non-clinical control group (Appendix H).

Table 3

Pearson's correlations between the HDBI and other self-report measures for the hoarding group (*n* = 45)

	HDBI Total	HDBI Emotional	HDBI Identity	HDBI Useful
SI-R Total	.50***	.31*	.32*	.39**
SI-R Acquisition	.40**	.52***	.11	.29
SI-R Difficulty discarding	.47**	.19	.37*	.34*
SI-R Clutter	.36*	.10	.32*	.29
SCI Total	.75***	.53***	.71***	.33*
SCI Emotional attachment	.67***	.53***	.79***	.08
SCI Control	.44**	.29	.32*	.34*
SCI Responsibility	.63***	.48***	.21	.65***
SCI Memory	.58***	.37*	.64***	.18
OCI-OCD[a]	.11	.26	.14	-.04
OBQ-9	-.02	.13	-.13	-.06
PHQ-8	-.01	.16	-.11	-.07
GAD-7	.05	.16	-.05	-.02

Note. The following variables were transformed prior to calculation of the Pearson's correlations: SCI Total, SCI Emotional attachment, SIR Clutter, OCI-OCD.

[a] OCI-R with the hoarding subscale removed.

*p < .05. **p < .01. ***p < .001.

Due to the pooling of items from multiple sources during the initial development of the HDBI, three items had similar content to those included in the SCI. Therefore, as a sensitivity analysis, these three items were removed from the SCI before the correlations were again run between the SCI and HDBI. For the total sample, large significant correlations were still found between the HDBI (total and subscales) and the SCI total (r = .54-.78, p < .001). This was largely also the case for the hoarding group (r = .53-.75, p < .001), except for a medium association between SCI total and the useful subscale of the HDBI (r = .33, p < .05).

Known-groups validity

Means and standard deviations for study measures, and comparisons between groups on these measures can be seen in Table 4. The hoarding group reported a higher severity of hoarding symptoms compared to both the OCD and non-clinical control group, as assessed by the SI-R total and its subscales (acquisition, difficulty discarding, clutter). Somewhat unexpectedly, in relation to overall hoarding severity, difficulty discarding and excessive acquisition symptoms, the OCD group were also found to endorse a higher severity of symptoms compared to the non-clinical control group. This was not the case for the clutter subscale of the SI-R. Similarly, whilst the OCD group had more severe obsessive-compulsive symptoms compared to both the hoarding and non-clinical control group, the hoarding group were also found to report a higher severity of OCD symptoms relative to the non-clinical control group. Consistent with this, the OCD group reported more severe OCD related beliefs on the OBQ-9 compared to both comparison groups, but the hoarding group were again found to report more severe scores compared to the non-clinical control group. The hoarding and OCD group did not differ to one another in terms of depression symptoms, and both had significantly higher levels of depressive symptoms compared to the non-clinical control group. In relation to anxiety symptoms, the OCD group reported a higher frequency

of these compared to the hoarding group, who in turn reported a higher frequency of these compared to the non-clinical control group.

In terms of group differences on measures of beliefs about possessions, the hoarding group scored significantly higher on the total score of the HDBI and two of its subscales (identity, useful) compared to both comparison groups. However, there were no significant differences between the hoarding and OCD group on the emotional subscale of the HDBI. The hoarding group scored significantly higher on the SCI than both comparison groups across all elements of the SCI, except for the control subscale, where the hoarding and OCD group were not found to differ. The OCD group also scored significantly higher on all elements of the HDBI compared to the non-clinical control group. A similar pattern was found for the SCI, with the OCD group scoring higher than the non-clinical control group on all aspects of the SCI (i.e., totals and subscales).

Table 4

Means, Standard Deviations, and One-Way Analyses of Variance in study self-report measures

Measure	Total sample		Hoarding		OCD		Non-clinical controls		Simple main effects		
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*F*	df	*p*
SI-R	27.27	18.34	49.22[a]	15.33	22.29[b]	11.29	14.78[c]	8.92	88.01	(2, 94.83)	<.001
Acquisition	7.72	5.16	11.76[a]	5.28	7.60[b]	4.70	4.50[c]	2.77	37.61	(2, 92.68)	<.001
Difficulty discarding	9.99	6.67	17.84[a]	5.18	8.32[b]	4.50	5.39[c]	3.43	94.67	(2, 97.16)	<.001
Clutter	9.56	9.22	19.62[a]	9.10	6.37[b]	5.37	4.89[b]	5.94	58.21	(2, 159)	<.001
HDBI	25.36	15.26	37.96[a]	14.98	25.40[b]	12.25	14.81[c]	9.87	41.82	(2, 96.79)	<.001
Emotional	4.14	5.27	7.20[a]	6.70	4.62[a]	4.76	1.04[b]	1.60	37.86	(2, 95.98)	<.001
Identity	10.28	6.83	14.27[a]	7.69	10.49[b]	5.83	6.70[c]	5.13	17.46	(2, 96.26)	<.001
Useful	10.94	6.60	16.49[a]	6.30	10.29[b]	5.16	7.07[c]	5.13	36.81	(2, 159)	<.001
SCI	56.97	26.31	76.00[a]	28.48	57.38[b]	21.95	40.63[c]	16.92	33.21	(2, 159)	<.001
Emotional attachment	21.81	13.43	29.84[a]	15.95	22.27[b]	12.38	14.57[c]	7.01	23.95	(2, 96.57)	<.001

Measure	Total sample		Hoarding		OCD		Non-clinical controls		Simple main effects		
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*F*	df	*p*
Control	10.62	4.94	13.09[a]	5.46	10.78[a]	4.39	8.39[b]	4.09	12.06	(2, 97.55)	<.001
Responsibility	13.06	6.32	17.29[a]	6.32	12.73[b]	5.59	9.93[c]	5.12	20.97	(2, 159)	<.001
Memory	11.48	6.63	15.78[a]	7.97	11.60[b]	5.65	7.74[c]	3.68	24.15	(2, 91.30)	<.001
OCI-OCD	11.72	10.70	6.56[b]	3.60	22.41[a]	9.38	3.56[c]	2.80	168.37	(2, 159)	<.001
OBQ-9	27.66	8.50	27.78[b]	8.36	32.13[a]	7.20	22.35[c]	6.94	24.99	(2, 159)	<.001
PHQ-8	7.71	5.65	9.53[a]	5.15	10.10[a]	5.95	3.41[b]	2.29	53.15	(2, 86.35)	<.001
GAD-7	6.72	5.91	7.00[b]	5.55	10.37[a]	5.82	2.22[c]	2.13	61.85	(2, 83.54)	<.001

[abc]. Means with differing letters differ significantly.

The following variables were transformed prior to calculation of the ANOVA: SI-R clutter, HDBI emotional, SCI, SCI emotional attachment, OCI-OCD.

Test-retest reliability

All participants (*n* = 162) were sent the second survey, with 134 completing this (83%). This included 36 individuals from the hoarding group, 53 from the OCD group and 45 from the non-clinical control group. Participants completed the second survey between 13 and 40 days later, with an average of 16 days between completion of survey one and two. A significant correlation was found between HDBI completed during survey one and survey two ($r = .82$, $p < .001$), indicating good test-retest reliability. Significant and large correlations were also found for each of the subscales between survey one and survey two: items create emotional attachment and safety ($r = .87$, $p < .001$), items represent parts of me and my life ($r = .76$, $p < .001$) and items are useful and should not be wasted ($r = .79$, $p < .001$). To monitor for stability in hoarding symptoms between the surveys, participants completed the internet adapted version (Nutley et al., 2020) of the HRS-SR (Tolin et al., 2010) again during survey two. HRS-SR score was not found to differ significantly between survey one (M = 9.98, SD = 8.76) and survey two (M = 9.75, SD = 9.63), for those who completed both surveys ($t(133) = -0.532$, $p = .596$). In survey two, participants were also asked whether they had stopped or started psychological therapy or psychiatric medication during the time between completion of survey one and survey two. One individual reported that they had stopped both therapy and medication and three individuals reported that they had started therapy.

Discussion

The study provided partial support for our *a priori* hypotheses. Regarding convergent and divergent validity, the HDBI was found to have stronger associations with measures assessing hoarding-related features (i.e., symptom severity, beliefs about possessions), compared to measures assessing symptoms or beliefs associated with OCD, depression or anxiety. Whilst this was the case for all participants, this pattern was particularly prevalent when considering the correlations for the hoarding group participants only. Indeed, for the hoarding group, no significant associations were present between the HDBI (total or subscales), and measures related to OCD (i.e., OCI-OCD, OBQ-9), depression (i.e., PHQ-8)

or anxiety (i.e., GAD-7). In comparison, the HDBI was found to relate significantly and to a medium to large degree with many aspects of hoarding severity and beliefs about possessions, as measured by the SI-R and SCI. For the hoarding group, the largest correlation was that between HDBI and SCI total score. As the SCI is a widely used self-report measure of beliefs about possessions (Steketee et al., 2003), this provides evidence to support the novel measure's construct validity; that is, the HDBI appears to be capturing what it was designed to assess (beliefs about possessions).

When considering specific symptoms of hoarding, the weakest relationship (albeit still a significant relationship), was that between total beliefs about possessions (as assessed by the HDBI) and clutter. This was the case for all participants and for the hoarding group participants only. This finding is consistent with previous research looking at the relationship between beliefs about possessions and hoarding symptoms (Dozier & Ayers, 2014; Wheaton et al., 2013). Indeed, beliefs about possessions, as assessed by the SCI, have not been found to be predictive of clutter amongst those meeting criteria for HD (Wheaton et al., 2013). In comparison, there is relatively consistent evidence that beliefs about possessions are predictors of both acquisition and difficulty discarding (Dozier & Ayers, 2014; Frost et al., 2015; Wheaton et al., 2013).

As other studies have done (Dozier & Ayers, 2014; Frost et al., 2015), it is of interest to consider whether the relationships between beliefs and symptoms of hoarding are dependent upon the specific belief sub-types assessed by the HDBI (i.e., Items create emotional attachment and safety; Items represent parts of me and my life; Items are useful and should not be wasted). For all participants, the associations between HDBI subscales and symptoms of clutter, excessive acquiring and difficulty discarding were significant, with medium to large associations being found. For individuals in the hoarding group only, a slightly different pattern was found when looking at the relationship between belief themes and specific symptoms of hoarding. Several medium to large significant associations were found, with the largest relationship being that between acquiring and beliefs about emotional attachment and safety. Notably, medium significant associations were found between the

'Items are useful and should not be wasted' subscale of the HDBI and both overall hoarding severity and difficulty discarding. As previously developed measures of beliefs about possessions have not included items relating to the potential future usefulness of objects (except one item in the Hoarding Interview), these correlations provide further evidence for the suggestion that researchers and clinicians may be missing key belief themes by relying on existing measures of beliefs about possessions (Tinlin et al., 2022). For the hoarding group, several non-significant associations were found between belief themes and hoarding symptom severity, including between: (1) HDBI emotional attachment and safety and both difficulty discarding and clutter, (2) HDBI identity and acquiring, (3) HDBI useful and acquiring. Whilst these may be the result of the reduction in variability of scores, due to the focus on the hoarding group participants only, it is important to consider potential reasons for the different pattern of associations. The non-significant association between HDBI identity (e.g., *"I keep items because they have life stories and relationships attached to them"*) and acquiring would appear to make sense, given that items that have not yet been acquired have had less opportunity or time to become associated with a person's identity, including the development of personal memories or stories linked with the item. Regarding the non-significant association between acquiring and the useful subscale of the HDBI, it is possible that beliefs included in this subscale, including those about potentially needing a possession in the future or avoiding wastefulness are more relevant when trying to make decisions to discard, rather than when acquiring new items. It is also notable that only one item within this subscale is structured in a way to think about acquiring ("I acquire items because I plan to fix, recycle, or find use for everything"). All other items within this subscale begin with "I don't discard because" or "I keep items because". Therefore, the lack of an association between acquiring and the useful subscale may reflect the structure of the subscale items. The absence of a significant association between the emotional attachment and safety subscale and difficulty discarding is surprising, given previous empirical evidence of a relationship between this belief type and saving behaviour (Dozier & Ayers, 2014; Fontenelle et al., 2021).). In addition, when considering the belief measure, for the emotional attachment and

safety subscale, the majority of the items are structured around decisions to keep or discard ("I don't discard items because.."). However, looking at the specific items that make up the 'Items create emotional attachment and safety' subscale of the HDBI (Ragan et al., unpublished results) may help explain why this subscale was more strongly associated with acquiring rather than difficulty discarding. Specifically, whilst the emotional attachment subscale of the SCI has items that are focused on the negative emotional consequences associated with discarding (e.g., I could not tolerate it if I were to get rid of this", "Losing this possession is like losing a friend"; Steketee et al., 2003), the items that make up the emotional attachment subscale of the HDBI are more focused on the positive emotional consequences associated with possessions (e.g., "I keep items because my possessions make me feel important", "I keep items because they make me feel in control"). Beliefs about the positive emotional consequences of owning possessions may motivate acquiring behaviour, in comparison to saving behaviour (i.e., difficulty discarding).

It is also of interest to consider how the HDBI subscales related to each of the SCI subscales, as the measures include different belief types. The SCI assesses beliefs related to emotional attachment, control, responsibility and memory (Steketee et al., 2003), whereas the HDBI assesses beliefs related to emotional attachment and safety, identity and potential future usefulness (Ragan et al., unpublished results). Given that the control is a subscale that does not overlap between the measures, it is not surprising that there are generally smaller (and sometimes non-significant) associations between the HDBI subscales and this subscale of the SCI. Large associations were found between the following subscales of the HDBI and SCI:(1) HDBI emotional attachment and safety and HDBI identity with the emotional attachment subscale of the SCI, (2) HDBI useful with the responsibility subscale of the SCI and (3) HDBI identity with the memory subscale of the SCI. Whilst the latter four subscales of the HDBI and SCI are not the same , looking at the items of both measures highlights that there is some overlap in content or concept. For example, the identity subscale of the HDBI and the memory subscale both ask about possessions serving as memory prompts, although the SCI asks about possessions serving as memory aides (e.g.,

"Saving this means I don't have to rely on my memory", "If I put this in a filing system, I'll forget about it completely"), whereas the HDBI is more focused on the use of possessions as autobiographical memory cues (e.g., *"I keep items because they bring memories back for me", "I don't discard items because they will tell people who I am when I am no longer here"*). Similarly, looking at the useful subscale of the HDBI and the responsibility subscale of the SCI, there is some overlap in content. For example, assessing beliefs about being prepared for a future need (e.g., SCI "I'm ashamed when I don't have something like this when I need it", HDBI "I don't discard items because I worry that I will need them later").

Regarding our second hypothesis concerning known-groups validity, our hypotheses were partially supported. Consistent with our hypothesis, the HDBI was found to distinguish the hoarding group from both the OCD control group and the non-clinical group, on total score and two of its subscales (identity, useful). However, there were several surprising findings. Firstly, the OCD group scored higher than the non-clinical control group on all aspects of the HDBI. There was also no significant difference between the OCD and hoarding group on the emotional attachment and safety subscale of the HDBI. Whilst this is inconsistent with our a priori hypotheses, scores on the self-report measures included in the study may help explain this unexpected finding. Specifically, we found that the OCD group had higher hoarding severity compared to the non-clinical control group on the SI-R (Frost et al., 2004). Therefore, although we used self-report measures (i.e., HRS-SR, OCI-OCD; Foa et al., 2002; Tolin et al., 2010) to categorise participants, with the aim of having a hoarding without OCD group, and an OCD without hoarding group, it appears that our OCD comparison group still had a heightened level of hoarding symptoms compared to the non-clinical control group, which may help explain the significant differences between the OCD and non-clinical control group on the novel beliefs measure.

All participants who completed the first survey agreed to complete the second survey. Of these, a high proportion completed the second survey, allowing for analysis of the HDBI's test-retest reliability. Consistent with our *a priori* hypothesis, we found good test-retest reliability between the first and second completion of the HDBI (r = .82). These results

suggest that the HDBI is a reliable assessment of beliefs about possessions, which compares favourably to a lack of evidence concerning the test-retest properties of the SCI (Steketee et al., 2003) and test-retest data of the BAH which is reliant upon an insufficient sample size (Gordon et al., 2013). Further, consistent with recommendations for psychometric evaluation studies (Mokkink et al., 2019), we included methods to check whether there had been a change which may have impacted upon recompletion of the HDBI. Specifically, between completion of survey one and two, participants were not found to differ in relation to hoarding severity as assessed by the HRS-SR (Nutley et al., 2020; Tolin et al., 2010).

Limitations

The study relied solely on self-report measures, which may have resulted in more noise between the groups. Specifically, it appears that both the OCD only and hoarding only groups had higher levels of hoarding and OCD symptoms respectively, compared to a non-clinical control group. We can hypothesise that by using formal interviews based on DSM-5 criteria, we may have been able to better control the differences between the groups.

Overall, the study recruited sufficient numbers for between-groups comparisons (>150), although the hoarding group were marginally under the recommended 50 per group for known-groups validity (Mokkink et al., 2019).

Future research

Although this study has successfully evaluated several of the HDBI's psychometric properties, bearing gold standard methodology guidelines in mind (Mokkink et al., 2019), there is further work to be done to confirm that the HDBI is a valid, reliable and useful tool for both research and clinical practice. For example, it would be of interest to assess sensitivity to change, as change in previously developed belief measures (SCI) has been found to mediate symptom improvement in CBT for hoarding (Levy et al., 2017). It would also be of interest in future research to evaluate use of the HDBI in a clinical sample who have been formally diagnosed with HD.

In the current study, our *a priori* prediction that the clinical (OCD) and non-clinical control group would not report statistically different scores on the novel beliefs measure (HDBI) was not supported. As discussed, this may be due to the elevated hoarding symptoms in the clinical control group compared to the non-clinical control group. Due to this, it would be beneficial to investigate known groups validity further using clinical and non-clinical control groups that have been assessed as having equivalent sub-clinical levels of HD symptomatology. It is also notable that the current study included a primarily female, white group of individuals and therefore, it is important to evaluate use of the HDBI in more diverse groups.

Several researchers have previously reported on the association between specific beliefs about possessions and symptoms of HD (e.g., Dozier & Ayers, 2014; Walji et al., 2024), shedding light on whether specific beliefs are differentially associated with acquiring, difficulty discarding or clutter. With the aim of evaluating convergent validity, we also reported on the associations between beliefs about possessions (as measured by the novel HDBI) and the three symptoms of hoarding. Due to the cross-sectional nature of previous research and our reporting of associations, it would be beneficial for future research to utilise longitudinal methods to further investigate whether the association between beliefs about possessions and hoarding symptoms is dependent on the specific belief theme and symptom being considered. Whilst this was not explored during the current study, it is also possible that the most relevant belief theme may depend upon the type of item that is being acquired or saved. For example, an individual may keep their children's clothes due to sentimental or emotional beliefs, whereas they may hold different beliefs about keeping paperwork (e.g., beliefs about these providing cues for memory). Therefore, this is an area for future research to explore, to consider whether assessment of beliefs and HD treatment needs to take into account the type of items that have been hoarded.

Clinical implications

In the current study, beliefs about possessions, as assessed by the HDBI, were found to have a large and significant association with hoarding severity. With two exceptions

(emotional attachment subscale of the HDBI, control subscale of the SCI), elevated levels of beliefs about possessions were also found to distinguish the hoarding group from both a non-clinical and clinical control group (OCD). These results therefore support the cognitive behavioural model of hoarding (Frost & Hartl, 1996) and its associated CBT treatment approach (e.g., Steketee & Frost, 2006), which highlights the role of beliefs about possessions in the continuation of hoarding symptoms. However, clinicians should be aware that belief themes which are not currently captured within the cognitive behavioural model may be relevant to formulating and intervening with hoarding. For example, the cognitive behavioural model does not specify beliefs about the role of possessions as representing parts of the self (i.e., identity). In the current study, the HDBI subscale 'Items represent parts of me and my life' which includes items about possessions representing aspects of an individual's life (e.g., "I keep items because they have life stories and relationships attached to them") was found to be significantly associated with overall hoarding severity, difficulty discarding and clutter. Therefore, clinicians should be conscious that the cognitive behavioural model (Frost & Hartl, 1996; Steketee & Frost, 2006) may not include all relevant belief themes and therefore, they should carefully assess for the full range of beliefs which may be contributing to the continuation of hoarding.

These results also further highlight the risk that previously developed hoarding-related belief questionnaires are missing key belief themes (Tinlin et al., 2022). This has important repercussions for practice, as clinicians may be limited in their ability to routinely assess the range of beliefs which may be important to understanding and formulating an individual's hoarding difficulties. Tools such as these can help bring awareness to beliefs that are playing a maintaining role, which may not consistently be discovered using unstructured interview techniques. As such, as part of delivering CBT for hoarding, clinicians are encouraged to use tools such as these (Steketee & Frost, 2006). Considering the HDBI has been developed in collaboration with service users and professionals with expertise in relation to hoarding (content validity) (Ragan et al., unpublished results) and several of its psychometric properties have been formally evaluated (structural validity, convergent and

divergent validity, known-groups specificity), the HDBI may serve as an appropriate tool for clinicians supporting those who experience HD.

Our results suggest that the strength of the relationship between beliefs about possessions and the three symptoms of hoarding (acquiring, difficulty discarding, clutter) varies depending on the type of belief being assessed (e.g., emotional attachment vs responsibility-related beliefs). This has implications for clinical practice, as clinicians should not assume that beliefs drive all symptoms and instead they should assess and formulate for the role of particular belief themes in maintaining specific facets of hoarding. For example, the results of the current study would suggest that clinicians should assess for whether beliefs about ‘Items create emotional attachment and safety‘ are maintaining acquiring behaviour, whereas beliefs about ‘Items represent parts of me and my life’ and ‘Items are useful and should not be wasted’ would appear to be less relevant for understanding acquiring symptoms. In comparison, these latter beliefs may be more relevant in formulating difficulty discarding and clutter symptoms.

Conclusions

This study represents a robust psychometric evaluation of a novel self-report measure assessing beliefs about possessions, the Hoarding Disorder Beliefs Inventory (HDBI). In combination with the results from its development paper (Ragan et al., unpublished results), there is evidence to support the HDBI’s face validity, construct validity, internal consistency and test-retest reliability and therefore its potential research and clinical utility.

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Appendix A

Quality Assessment Tool for Observational Cohort and Cross-Sectional Studies	
Question number	Assessment item
1	Was the research question or objective in this paper clearly stated?
2	Was the study population clearly specified and defined?
3	Was the participation rate of eligible persons at least 50%?
4	Were all the subjects selected or recruited from the same or similar populations (including the same time period)? Were inclusion and exclusion criteria for being in the study prespecified and applied uniformly to all participants?
5	Was a sample size justification, power description, or variance and effect estimates provided?
6	For the analyses in the paper, were the exposure(s) of interest measured prior to the outcome(s) being measured?
7	Was the timeframe sufficient so that one could reasonably expect to see an association between exposure and outcome if it existed?
8	For exposure(s) that vary in amount or level, did the study examine different levels of the exposure as related to the outcome (e.g., categories of exposure or exposure measured as a continuous variable)?
9	Were the exposure measures (independent variables) clearly defined, valid, reliable and implemented consistently across all study participants?
10	Was the exposure(s) assessed more than once over time?
11	Were the outcome measures (dependent variables) clearly defined, valid, reliable and implemented consistently across all study participants?
12	Were the outcome assessors blinded to the exposure status of participants?
13	Was loss to follow up after baseline 20% or less?
14	Were key potential confounding variables measured and adjusted statistically for their impact on the relationship between exposure(s) and outcome(s)

Quality Assessment Tool for Case-Control Studies	
Question number	Assessment item
4	Were controls selected or recruited from the same or similar population that gave rise to the cases (including the same timeframe)?
5	Were the definitions, inclusion and exclusion criteria, algorithms or processes used to identify or select cases and controls valid, reliable and implemented consistently across all study participants?
6	Were the cases clearly defined and differentiated from controls?
7	If less than 100 percent of eligible cases and/or controls were selected for the study, were the cases and/or controls randomly selected from those eligible?
8	Was there use of concurrent controls?
9	Were the investigators able to confirm that the exposure/risk occurred prior to the development of the condition or event that defined a participant as a case?
11	Were the assessors of exposure/risk blinded to the case or control status of participants?

Note. Question number refers to that in the initial tool developed by the National Heart, Lung and Blood Institute (NHLBI).

Appendix B

Quality Assessment Tool for Observational Cohort and Cross-Sectional Studies

QN	Study ID																													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
2	Y	Y	Y	N	N	N	Y	N	N	N	N	Y	N	N	N	N	Y	Y	N	N	N	N	N	N	Y	Y	N	Y	Y	N
3	C	C	C	C	C	N	C	Y	C	C	Y	Y	C	C	C	C	C	C	C	C	C	C	C	C	C	C	Y	C	C	C
4	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	Y	C
5	N	N	N	N	N	N	N	N	Y	N	N	Y	N	Y	N	N	Y	N	Y	N	N	N	N	N	N	N	Y	N	Y	N
6	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
7	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
8	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	C	Y	Y
9	N	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	N	N	Y	Y	Y	N	N	Y	N
10	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
11	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
12	A	A	A	A	Y	A	A	A	A	A	A	A	A	Y	Y	Y	A	Y	A	A	A	A	Y	Y	N	N	Y	Y	A	Y
13	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
14	Y	Y	N	Y	N	Y	N	N	N	N	Y	N	N	Y	N	N	N	N	Y	Y	Y	A	N	N	Y	N	N	N	N	N

Quality Assessment Tool for Case-Control Studies

QN	Study ID																													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
4	A	A	Y	Y	M	A	A	A	Y	Y	A	Y	C	C	C	Y	Y	N	Y	C	Y	A	C	C	Y	Y	Y	Y	Y	C
5	A	A	N	N	N	A	A	A	N	N	A	N	N	N	N	N	N	Y	N	N	N	A	N	N	N	N	N	N	Y	C
6	A	A	Y	Y	Y	A	A	A	Y	Y	A	Y	Y	Y	Y	Y	Y	Y	Y	N	N	A	Y	Y	Y	Y	N	Y	Y	Y
7	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
8	A	A	Y	M	M	A	A	A	M	M	A	Y	M	M	M	M	Y	N	M	M	M	A	M	M	Y	Y	M	Y	Y	M
9	A	A	N	N	N	A	A	A	N	N	A	N	N	N	N	N	N	N	N	N	N	A	N	N	N	N	N	N	N	N
11	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	N	A	A	N	A	N

	Study ID																													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Overall Study Rating	F	F	F	F	P	F	F	F	F	P	F	F	P	F	P	F	F	F	F	P	P	P	P	P	F	F	F	F	F	P

Note. QN = Question number, Y = Yes, N = No, C = Cannot determine, A = Not Applicable, M = Missing (Not Reported), F = Fair, P = Poor.

Appendix C

Ethics Feedback - EC.23.02.07.6726R

psychethics <psychethics@cardiff.ac.uk>
Fri 03/03/2023 11:46

Just to note, the committee appreciated that the documents were updated to the latest versions.

The Ethics Committee has considered your revised PG project proposal: Investigating the psychometric properties of the Beliefs about Possessions in Hoarding Disorder (BAP-HD) (EC.23.02.07.6726R).

Your revised project proposal has received a **Favourable Opinion** based on the information described in the proforma and supporting documentation.

Additional approvals
This letter provides an ethical opinion only. You must not start your research project until all appropriate approvals are in place.

Conditions of the favourable opinion
The favourable opinion is subject to the following conditions being met:

- You must retain a copy of this decision letter with your Research records.
- Please note that if any changes are made to the above project then you must notify the Ethics Committee.
- Please use the EC reference number on all future correspondence.
- The Committee must be informed of any unexpected ethical issues or unexpected adverse events that arise during the research project.
- The Committee must be informed when your research project has ended. This notification should be made to psychethics@cardiff.ac.uk within three months of research project completion.
- All data will be retained/processed/destroyed in line with University policy.

Amendments
Any substantial amendments to proposal previously reviewed by the Committee must be submitted to the Committee via psychethics@cardiff.ac.uk for consideration using the PSYCH amendment form and cannot be implemented until the Committee has confirmed it is satisfied with the proposed amendments.

Complaints/Appeals
If you are dissatisfied with the decision made by the Committee, please contact psychethics@cardiff.ac.uk in the first instance to discuss your complaint. If this discussion does not resolve the issue, you are entitled to refer the matter to the Head of School for further consideration.
The Head of School may refer the matter to the Open Research Integrity and Ethics Committee (ORIEC), where this is appropriate.
Please be advised that ORIEC will not normally interfere with a decision of the Committee and is concerned only with the general principles of natural justice, reasonableness and fairness of the decision.

The Committee reminds you that it is your responsibility to conduct your research project to the highest ethical standards and to keep all ethical issues arising from your research project under regular review.

You are expected to comply with Cardiff University's policies, procedures and guidance at all times, including, but not limited to, its Policy on the Ethical Conduct of Research involving

Human Participants, Human Material or Human Data and our Research Integrity and Governance Code of Practice.

Kind regards,
Deborah

School of Psychology Research Ethics Committee
https://cf.sharepoint.com/teams/InsidePsych/Ethics/

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The University welcomes correspondence in Welsh or English. Corresponding in Welsh will not lead to any delay.

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Mae'r Brifysgol yn croesawu gohebiaeth yn Gymraeg neu yn Saesneg. Ni fydd gohebu yn Gymraeg yn creu unrhyw oedi.

Appendix D

SCREENING QUESTIONNAIRE

Thank you for your interest in this research study, we appreciate your time. To ensure your eligibility to participate, please confirm the following:

I am 18 years old or older	o Yes o No
I am able to read and write in English	o Yes o No
Do you have a brain injury or neurological disorder? This includes dementia, infections of the central nervous system (e.g., herpes simplex encephalitis), cerebrovascular disease (e.g., stroke) and neurogenetic conditions (e.g., Prader-Willi syndrome). For this research project, this **does not include** autism, attention deficit disorder or attention deficit hyperactivity disorder.	o Yes o No

If you have any questions about the eligibility criteria, please contact the lead researcher (EMAIL) before submitting this page.

Participants will need to confirm 'yes' to the first two questions and 'no' to the final question before they are able to proceed with the survey

Appendix E

Do you feel you are currently experiencing difficulties with your mental health?

- ○ Yes
- ○ No

Are you currently receiving any psychological therapy?
For example, speaking with a counsellor or psychologist, or attending a therapy group.

- ○ Yes
- ○ No

Are you currently taking any medication for a mental health problem?
For example, anti-depressants, anti-anxiety medication or anti-psychotics.

- ○ Yes
- ○ No

Appendix F

We just want to check, since you last completed the survey, have you started psychological therapy?

- ○ Yes
- ○ No

Since you last completed the survey, have you stopped psychological therapy?

- ○ Yes
- ○ No

Since you last completed the survey, have you started medication for your mental health?

- ○ Yes
- ○ No

Since you last completed the survey, have you stopped medication for your mental health?

- ○ Yes
- ○ No

Appendix G

To investigate between-group differences, a chi-square test of independence was conducted for gender (female, other). Male, gender non-conforming and prefer not to say categories were collapsed together for the purpose of analysis. Groups did not differ in relation to gender ($\chi^2(2) = 5.43$, $p = .066$) and the association between group and gender was small (Cohen, 1988), Cramer's V = .183.

A chi-square test of independence was conducted between group and marital status (in a relationship, other). 'In a relationship' included: married, cohabitation, civil partnership, in a relationship. 'Other' included: widowed, divorced/separated, single. Groups did not differ in relation to marital status ($\chi^2(2) = 1.70$, $p = .428$) and the association between group and marital status was small (Cohen, 1988), Cramer's V = .102.

A chi-square test of independence was conducted between group and ethnicity (white, not white). Groups differed in relation to ethnicity ($\chi^2(2) = 9.26$, $p = .010$), with a small association being found between group and ethnicity (Cohen, 1988), Cramer's V = .239.

A chi-square test of independence was conducted between group and living situation (living with others, other living arrangement). 'Living with others' included: spouse/partner (with or without children) and sharing a flat/house with others. 'Other living arrangement' included: alone, other, and prefer not to say. Groups differed in relation to their living situation ($\chi^2(2) = 14.87$, $p < .001$), with a medium association being found between group and living situation (Cohen, 1988), Cramer's V = .303.

A chi-square test of independence was conducted between group and education level (Up to secondary school/college, Beyond secondary school/college). 'Up to secondary school/college' included: City and guilds, GCSEs, 'A' levels and other. 'Beyond secondary school/college' included the following: university degree, master's degree and PhD. Groups did not differ in relation to education level ($\chi^2(2) = 5.98$, $p = .050$). The association between group and education level was small (Cohen, 1988), Cramer's V = .192.

Appendix H

Pearson's correlations between the HDBI and other self-report measures for the OCD group (*n* = 63)

	HDBI Total	HDBI Emotional	HDBI Identity	HDBI Useful
SI-R Total	.47***	.48***	.25*	.45***
SI-R Acquisition	.32*	.51***	.01	.33**
SI-R Difficulty discarding	.43***	.26*	.35**	.43***
SI-R Clutter	.34**	.35**	.26*	.26*
SCI Total	.67***	.56***	.64***	.35**
SCI Emotional attachment	.62***	.52***	.68***	.19
SCI Control	.25*	.25	.28*	.12
SCI Responsibility	.58***	.61***	.26*	.54***
SCI Memory	.47***	.25	.51***	.28*
OCI-OCD[a]	.31*	.34**	.18	.24
OBQ-9	.25*	.21	.29*	.11
PHQ-8	.05	-.03	.11	.08
GAD-7	.12	.01	.14	.14

Note. The following variables were transformed prior to calculation of the Pearson's correlations: SCI Total, SCI Emotional attachment, SIR Clutter, OCI-OCD.

[a] OCI-R with the hoarding subscale removed.

*p < .05. **p < .01. ***p < .001.

Pearson's correlations between the HDBI and other self-report measures for the non-clinical control group (*n* = 54)

	HDBI Total	HDBI Emotional	HDBI Identity	HDBI Useful
SI-R Total	.54***	.49***	.42**	.47***
SI-R Acquisition	.56***	.61***	.48***	.42***
SI-R Difficulty discarding	.61***	.53***	.38**	.65***
SI-R Clutter	.33*	.28*	.24	.29*
SCI Total	.70***	.64***	.64***	.51***
SCI Emotional attachment	.72***	.69***	.71***	.45***
SCI Control	.25	.28*	.21	.17
SCI Responsibility	.62***	.54***	.51***	.51***
SCI Memory	.59***	.60***	.57***	.35*
OCI-OCD[a]	.09	.21	.03	.07
OBQ-9	.31*	.15	.35*	.19
PHQ-8	.19	.12	.20	.09
GAD-7	.21	.07	.18	.18

Note. The following variables were transformed prior to calculation of the Pearson's correlations: SCI Total, SCI Emotional attachment, SIR Clutter, OCI-OCD.

[a] OCI-R with the hoarding subscale removed.

*p < .05. **p < .01. ***p < .001.