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An intensive time-series evaluation of the effectiveness of cognitive

behaviour therapy for hoarding disorder:

A 2-year prospective study.

Abstract

This study evaluated the effectiveness of cognitive-behavioural therapy (CBT) for Hoarding Disorder. An ABC with extended follow-up N=1 single-case experimental design (SCED) measured discard incidence/frequency/volume and associated cognitions, behaviours and emotions in a 644-day time series. Following a 4-week baseline (A), the CBT was initially delivered via out-patient sessions (B) and then out-patient sessions plus domiciliary visits (C). Total treatment duration was 45 sessions (65 weeks) and follow-up was 4 sessions over 23 weeks. There was a significant increase in frequency and volume of discard, with a reliable and clinically significant reduction in hoarding. The addition of domiciliary visits did not significantly improve discard ability. The clinical utility of domiciliary visits whilst treating of hoarding is discussed and study limitations noted.

Keywords: hoarding, single case experimental design, treatment

Introduction

Hoarding has historically been associated with Obsessive-Compulsive Disorder (OCD), but more contemporary evidence supports the separation of hoarding from OCD (see Pertusa, Fullana Singh, Alonso, Menchen & Mataix-Cols, 2010 for review) and the potential recognition of Hoarding Disorder as a distinct diagnostic entity (Mataix-Cols, Frost, Pertusa, Clark, Saxena, Leckman, Stein, Matsunaga & Wilhelm, 2010). Differentiation of hoarding from OCD is clinically vital as evidenced-based treatments for OCD (such as exposure and response prevention/combined treatments) have low efficacy/poor acceptability when used with hoarders (Ball, Baer & Otto, 1996; Black, Monahan, Gabel, Blum, Clancy & Baker, 1998; Mataix-Cols, Baer, Rauch & Jenike, 2000; Mataix-Cols, Marks, Greist, Kobak & Baer, 2002; Abramowitz, Franklin, Schwartz & Furr, 2003). To meet the proposed diagnostic threshold (Mataix-Cols et al, 2010) for Hoarding Disorder, a patient would need to report/display (a) persistent difficulties with discard due to strong urges to save or distress/indecision concerning discard, (b) accumulation of clutter in living spaces preventing the normal use of those living spaces, (c) clinically significant distress, (d) hoarding symptoms not being due to a general medical condition and (e) the hoarding symptoms being restricted to the symptoms of another mental disorder (e.g. obsessions in OCD).

Despite progress in terms of accurate clinical recognition, hoarding is notoriously difficult to treat. Treatment resistance/refusal (Frost & Gross, 1993) and attenuated outcomes (Ayers, Wetherell, Golstan & Saxena, 2011) are accounted for by hoarders tending to deny the severity of their difficulties (Pertusa et al., 2010; Tolin, Fitch, Frost & Steketee, 2010), having low

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motivation to change (Skeketee & Frost, 2003; Tolin, Frost & Steketee, 2007) and viewing hoarding behaviors in an ego-syntonic manner (Frost & Skeketee, 1999; Steketee & Frost, 2003). Hoarders may therefore present to services more due to pressure exerted by family members (or professionals such as housing officers) rather than any personal desire to change (Christensen & Greist, 2001; Greenberg, 1987).

In the context of the drive to recognize hoarding as a distinct diagnostic entity (Mataix-Cols et al., 2010), there has been a reciprocal effort to test the clinical utility of hoarding-specific clinical models (Pertusa et al., 2010). This drive has been grounded in testing the efficacy and effectiveness of the cognitive-behavioural model of hoarding (Frost & Hartl 1996; Steketee & Frost, 2007). A hierarchy of evidence concerning the utility of the CBT treatment model is apparent from qualitative and experimental case studies, to open trials and controlled studies. CBT for hoarding has been delivered via both low (biblio-based self-help) and high intensity (one to one and group psychotherapy) methods. Outcomes have been variously measured via the Clutter Image Rating (Frost, Steketee, Tolin & Renaud, 2008), the Hoarding Rating Scale (Tolin, Frost & Steketee, 2010), the Savings Cognitions Inventory (Steketee, Frost & Kyrios, 2003) and the Savings Inventory-Revised (Frost, Steketee & Grisham, 2003).

The evaluation of treatment of N=1 hoarding cases consists of two qualitative case studies (Cermele, Melendez-Pallitto & Pandina, 2001; Shafron & Tallis, 1996) and two single case experimental designs (Hartl & Frost 1999; Kellett, 2007). The more rigorous experimental studies both indexed reduced hoarding and improved abilities to discard. Tolin, Frost and Steketee (2007)

completed an open trial (*N*=14) of 26 individual CBT sessions; 4 patients dropped out, with 6/10 completers classed as 'treatment responders.' Ayers et al., (2011) applied the same approach in an older adult sample (*N*=12, no drop-outs). Results show that 2 of the patients' hoarding symptoms worsened, with only 3 classed as 'treatment responders.' The gains for the small group of treatment responders were not unfortunately maintained at follow-up. Steketoee, Frost, Tolin, Rasmussen and Brown (2010) completed a waitlist control trial (overall *N*=46, 9 drop outs) of the same one to one CBT approach. Improvement during CBT (*N*=23) was statistically greater than waitlist (*N*=23) across most hoarding measures, with large effect sizes evident; 41 % of completers were classed as 'treatment responders.'

Four outcome studies have tested the utility of the CBT model in a group context. Steketee, Frost, Wincze, Greene and Douglass (2000) had 6 hoarders attend 15 two-hour sessions. Outcomes were assessed via a modified Y-BOCS (Goodman, Price, Rasmussen et al. 1989), with statistically significant pre-post changes recorded. Muroff et al., (2009) delivered the CBT approach in groups of 5-8 to *N*=32 hoarders. Outcomes showed modest (but statistically significant) pre-post reductions. Gilliam, Norberg, Villavicencio, Morrison, Hannan and Tolin (2011) also assessed outcomes for group CBT hoarders (*N*=22, in groups of 5-6). Significant pre-post group change was recorded, but 9 of the original 22 dropped out. Muroff, Steketee and Bratiotis (2010) tested whether increased home-based assistance increased the efficacy of group CBT by randomly allocating to either (a) 20-week group CBT (*N*=13), (b) 20 week group CBT with home assistance (*N*=14) and (c) a bibliotherapy control condition (*N*=13). Both CBT groups showed significant pre-post reductions, with no differences in terms

of outcome between CBT groups. Whilst bibliotherapy was seen to be ineffective for hoarders in this study, Pekareva-Kochergina and Frost (2009) did report significant pre-post reductions for a 13-week bibliotherapy group (*N*=17).

The testing completed of the CBT model undoubtedly shows clinical promise (Muroff et al., 2011), but there remains major room for improvement regarding increasing the acceptability, efficacy and durability of outcomes and identifying the optimal means of service delivery. The outcome literature has also been criticized for failing to investigate the inter-relationship and responsivity of cognitive, affective and behavioural factors during treatment (Steketee & Frost, 2003). Of particular clinical and economic interest is whether domiciliary visits facilitate measurable improvements to clutter outcomes. Such visits enable clinicians to treat hoarders in their home environment and therefore enable the in vivo assessment of the effectiveness of change methods (Nesiroglu, Bubrick & Yaryura-Tobias, 2004; Steketee & Frost, 2007). However, Muroff et al., (2011) labeled domiciliary visits as time consuming, costly and not always feasible.

To address these key hoarding research and treatment issues, the current study utilized an intensive time-series study of discard and hoarding specific cognitions, emotions and behaviors over a 24-month period within a structured single case experimental design time series methodology. Treatment was divided between out-patient appointments and out-patient appointments plus domiciliary visits to enable a comparison of the effectiveness of these approaches. The research hypotheses were therefore: (H1): clutter will significantly decrease during treatment with associated clinically significant psychometric outcomes; (H2): significant reductions in hoarding related

cognitions, behaviour and emotions will occur during treatment and (H3): the incidence and total volume of discard will significantly increase during treatment and be mediated by changes in hoarding related cognitions, emotions and behaviours and (H4): domiciliary visits will significantly increase discard incidence and volume.

Method

Single case experimental design (SCED) methodology

The current study utilised an ABC plus extended follow-up (D) single case experimental design (SCED) spread over 644 continuous days. The baseline 'A' phase lasted for four weeks (N=28 daily measurement) and comprised two assessment sessions. The 'B' phase entailed CBT out-patient sessions ('OPT') that lasted for 35 weeks (N=212 daily measurement) and comprised 23 sessions. The 'C' phase entailed CBT out-patient sessions supplemented with additional domiciliary visits ('OPT + DV') that lasted for 30 weeks (N=192 daily measurement) and comprised 22 sessions. The 'D' follow-up phase lasted for 23 weeks (N=141 daily measurement) and contained four sessions. Local research ethic committee approval for the study was granted.

Participant

The patient was a 63-year old married woman, referred due to problems with OCD, hoarding and depression and was seeking help to reduce her hoarding. The patient had been in psychiatric services for many years due to the chronic co-morbidity and had mainly been treated with medication, although day services had been intermittently involved. Throughout the duration of the study, the patient was prescribed an SSRI anti-depressant (Citalopram) and this was a

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long-term prescription. Onset of hoarding was reported as early adolescence. The patient lived in a 3-bedroom house with her husband. Hoarding behaviour caused on-going and significant difficulties in family relationships and the patient felt too ashamed of the state of the home to allow family/friends to visit. The home environment was moderately cluttered, although two rooms could not be entered due to levels of clutter. The patient described having infrequent surges of motivation to reduce clutter in the home, but struggled to maintain behavioural changes and also had a tendency to 'churn' possessions whilst attempting to discard. Tolin, Frost and Steketee (2007) defined churning as the tendency to move possessions from pile to pile whilst attempting to organise an area of the home, rather than facing the anxiety of discard. The patient had previously been offered a 24-session contract of CBT for her OCD, which had failed to recognise or address hoarding and the patient dropped out of treatment.

Treatment delivery and content

The therapy was provided by a British Association of Behavioural and Cognitive Psychotherapy (BABCP) accredited Cognitive Behavioural Psychotherapist and Consultant Clinical Psychologist. Treatment was delivered under routine care conditions in the National Health Service in the United Kingdom. Therapy implemented the Steketee and Frost (2007) treatment manual for hoarding, in combination with the Object-Affect Fusion (OAF) protocol (Kellett & Knight, 2003) at specific points, particularly regarding heightened sentimental attachment to possessions. The Steketee and Frost (2007) manual details procedures for (1) psycho-education concerning hoarding, (2) training in

speeding up decision making and categorisation of objects, (3) exposure and habituation to discard and (4) cognitive restructuring concerning discard. The OAF procedure (Kellett & Knight, 2003; Kellett, 2006) followed five stages, (1) identification of OAF processes, (2) OAF description, (3) cognitive challenge, (4) affective expression and (5) developing a plan for discard.

An important component of the Steketee and Frost (2007) manual is the emphasis placed on the therapeutic alliance within the structured CBT treatment approach of targeted goals, agenda-driven sessions and time-limited approach. The alliance in CBT concerns the provision of the humanistic core conditions, within a collaborative-style relationship in which the Socratic method (rather than direction) is used to facilitate cognitive and behavioral change (Gilbert & Leahy, 2007). Collaboration was achieved by encouraging the patient to consider the alliance as a team (i.e. therapist and patient) working together regarding improving the state of the home. Therefore at each session feedback was provided by therapist and patient on what contributions had been useful (and not useful) in the session that day.

Study measures

Ideographic hoarding measures; cognitions, behaviour and emotions
Six idiosyncratic measures were developed with the patient and collected via a daily diary throughout study phases and were scored on a 0 (not at all) to 9 (totally) likert scale. Diary item 1 was '*I have been living in the past today*,' item 2 was '*I have been sentimentally attached to my possessions today*,' item 3 was '*today, I have felt depressed*,' item 4 was '*today, I have felt anxious*,' item 5 was

'*today, I have felt ashamed*' and item 6 was '*I have avoided throwing things away today.*'

Ideographic hoarding measures: category and volume of discard

The patient recorded daily discard in the diary measure with the resultant data analysed using a system designed for the study. Objects discarded each day were firstly assigned to one of three categories, (a) information based objects (e.g. newspapers, leaflets etc.), (b) household waste objects (e.g. food, packaging etc.) and (c) clothing and footwear objects (e.g. shoes, trousers etc.). A frequency count of objects listed was then calculated, in addition to a total frequency count for each major category. Finally, the total daily volume of discard (each category combined) was calculated using a Volume of Discard Scale (VDS) designed for this study. The VDS is a visual 1-4 analogue scale that measures volume of discard at four levels, (1) 25% of a 60 gallon/227litre household refuse bag, (2) 50% of a 60 gallon/227 litre household refuse bag, (3) 75 % of a 60 gallon/227 litre household refuse bag and (4) 100% of a 60 gallon/227 litre household refuse bag. If the volume of discard exceeded one household bag for one day, then this was recorded as the daily total (for example, 2.25 equalled two bags and one quarter of the third bag).

An inter-rater reliability analysis of the VDS ratings was undertaken with three raters using a sample of 10 days of discard data. Diary samples were selected if they contained a range of items listed, had variations in total volume and contained some objects likely to be ambiguous in how they were categorised or counted. Each rater was provided with instructions for categorising and calculating frequency and provided with a VDS scale. The five-stage rating task was set as follows, (a) examine individual daily discard

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recording, (b) categorise discarded items, (c) calculate frequencies of discarded items, (d) calculate the total frequency of each major category and finally (e) calculate the total volume of daily discard. The internal reliability of discard categories was high across categories (information α = .99, household α = .86 and clothing α = 1.0) and the VDS had high inter-rater reliability (α = .91).

Clutter

Video data of the home environment was gathered at baseline, end of OPT and end of OP+DV. A total of 6 videos were filmed (approximately 10 minutes in length) containing footage of the upstairs and downstairs areas of the home. Three independent raters subsequently rated levels of clutter using the Clutter Image Rating Scale (Frost, Steketee, Tolin & Renaud, 2008). Video excerpts were randomised and raters were blind to stage of treatment. Inter-rater reliability was high (α = .88). The total score of clutter amongst the three raters was averaged to provide a mean rating of clutter for the six videos: baseline (upstairs/downstairs), OPT (upstairs/downstairs), and OPT+DV (upstairs/downstairs).

Nomothetic Measures

The patient completed five validated self-report psychometric outcome measures at assessment, end of OPT, end of OP+DV and end of follow-up.

Saving Inventory Revised (Frost, Steketee & Grisham, 2004). This 23-item scale measures three factors (a) difficulty discarding, (b) excessive clutter and (c) excessive acquisition. It is a valid and reliable measure of hoarding across clinical and non-clinical populations (Coles, Frost, Heimberg & Steketee, 2003).

Compulsive Acquisition Scale (Frost, Kim, Morris, Bloss, Murray-Close & Steketee, 1998). This 18-item scale measures the strength of acquisition compulsions. Two subscales are calculated concerning compulsions to (a) buy items and (b) acquire free items.   It is a reliable and valid measure of compulsive acquisition in clinical samples (Frost &Gross, 1993; Frost *et al.,* 1995).

Beck Depression Inventory-II (Beck, Steer & Brown, 1995). This 21-item scale measures severity of depressive symptomology (Beck *et al.,* 1995).   Cut-off scores are minimal (0–13); mild (14–19); moderate (20–28); and severe (29–63). The measure has been well validated as a measure of the severity of uni-polar depression (Beck et al., 1996).

Brief Symptom Inventory (Derogatis, 1987). This 53-item scale measures nine primary symptom dimensions from which three global indices are calculated, (a) global severity index, (b) positive symptom distress index and (c) positive symptom total. The global severity index (GSI) is typically reported as the main outcome. The measure has good internal and test-retest reliability and good convergent, discriminant and construct validity (Derogatis, 1993).

Inventory of Interpersonal Problems-32 (Barkham, Hardy & Startup, 1996). This 32-item scale measure contains four scales that index deficits in interpersonal functioning and four scales that index dysfunctional interpersonal strategies. The measure has sound psychometric reliability and validity (Hughes & Barkham, 2005).

Analysis strategy

All variables were screened for normality prior to statistical analysis. A visual inspection of frequency histograms for the measures showed that frequency of types of objects discarded and the total volume discarded were either positively or negatively skewed. This was caused by high levels of variability within daily discard frequency totals and a square root transform failed to solve this problem. Dichotomising these variables would have led to information regarding the patient's pattern of discard being lost. Therefore a decision was made to proceed with the statistical analysis of these variables on the basis that the chosen parametric test (ANOVA) is robust to deviations from normality (Lindman, 1974). For the time series data, only those results significant at $p < 0.01$ are reported in order to reduce the possibility of a type II error.

Time-series data of the length used in the current study contains long-term trends and cycles both within and between variables which can lead to a misinterpretation of treatment effect when not adequately accounted for (Reis & Judd, 2000). The issue of serial dependency concerns the phenomenon whereby individual observations are influenced by previous recordings or show similar patterns at certain intervals over time (Reis & Judd, 2000). Creating a first-order 'lag' variable that equals the previous value of the variable it lags and using it as an explanatory factor in the analysis, ensures each observation can be treated as independent (Chatfield, 2003). Lag variables for each variable in the current data set were therefore created to remove serial dependency. Partial autocorrelations (PACF) of the time-series for the variables were examined to ensure that the first-order lag was the most appropriate to use.

Figure 1shows the PACF for volume of discard. As well as indicating that the use of the first order lag was appropriate for the analysis, the significant lag 7 effect shown in the figure suggests that the patient probably had a weekly cycle in discard behavior.

insert figure 1 here

The psychometric outcome measures were analysed used the Jacobson and Traux (1991) reliable change formula. To achieve a *reliable change* on the primary outcome measure of the SI-R, a patient needs to drop 14 points between measurement points and for this change to be *clinically significant* then the final score needs to be >50 (Muroff et al., 2011). *Reliable and clinically significant change* therefore occurs when there is both a positive RCI and the termination score places the patient within a community norm – this is being increasingly taken as evidence of recovery and classifies 'treatment responders' (Barkham, Stiles, Connell & Mellor-Clark, 2011). In terms of levels of clutter in the home, video data for the follow-up period was not collected. Therefore only comparisons between baseline and the two treatment phases were possible.

Results

In order to contextualise the results, Table 1 reports the means and SDs of the ideographic measures according to phase of study. In terms of levels of clutter in the home, comparisons between baseline and OPT showed significant reductions in clutter for the upstairs (RCI = 2.63, $p < .05$), but not the downstairs

(RCI = -0.40, *p* ns). This finding was replicated during baseline and OPT+DV comparisons, but with evidence of a larger RCI for the upstairs (RCI = 3.51, *p* <.05; downstairs RCI = 0.29, *p* ns). Table 2 summarises the results of the nomothetic measures according to the phase of the study. Baseline to follow-up reliable change analyses of psychometric outcomes demonstrates reliable reductions in depression, psychiatric symptoms, compulsive buying and hoarding. In terms of the primary outcome SI-R measure, the patient was 'recovered' by end of out-patient treatment (14 point pre-post reduction, plus post SI-R score < 50). The patient experienced another reliable reduction in the SI-R following the addition of domiciliary visits phase (with SIR score remaining <50).

Insert tables 1 and 2 here please

Figure 2 illustrates change in the psychological ideographic measures over time according to phase of the study. Simple contrasts concerning cognitive, emotional and behavioural variables indicated that during the OPT phase (compared to baseline) there was a statistically significant reduction in sentimentality towards possessions (M = 6.91; $t(569)$ = -3.32, p < .01, partial η^2 = .02), shame (M = 6.93; $t(574)$ = -2.49 p < .01, partial η^2 = .01) and avoidance of discard (M = 6.54; $t(561)$ = -3.42, p < .01, partial η^2 = .03). Comparing OPT+DV to baseline showed a statistically significant reduction in sentimentality (M = 5.89; $t(569)$ = -6.58 p <.01, partial η^2 = .10) and avoidance of discard (M = 5.70, $t(561)$ = -5.98, p <.01, partial η^2 = .10). Baseline to follow-up comparisons showed decreased living in the past (M = 5.91; $t(572)$ = -2.96, p <.01, partial η^2 = .06), sentimentality (M = 5.40; $t(569)$ = -1.39, p <.01, partial η^2 = .13),

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avoidance of discard (M= 5.38; t(561) = -6.09, p <.01, partial η^2 = .11) and anxiety (M = 6.70; t(575) = -2.60, p <.01, partial η^2 = .03). These significant changes are highlighted in bold in table 1. Significant reductions occurred in the context of stable baselines evidenced by the small SDs during the baseline phase, indicating that the ideographic hoarding and psychological measures were not responding solely to therapist contact.

Insert figure 2 here please

Figures 3 and 4 illustrate item discard rates by day (figure 3) and by week (figure 4) according to study phase. Both daily and weekly discard rate graphs illustrate an increase in possessions being discarded during active treatment compared to baseline. Trend lines show a deceleration in discard during the follow-up phase. Stage of treatment was significant for the total frequency of discard (F(3,636) = 11.76, p <.01), but with a small effect size (partial η^2) of .03. Discard frequency was greater during each stage compared to baseline: OPT F(1,636) = 4.59, p <.01 (small effect size: partial η^2 = .01); OPT+DV F(1,636) = 0.47, p <.01 (small effect size:partial η^2 =.02) and follow-up F(1,636) = 2.77, p <.01 (small effect size: partial η^2 = .01). There was no significant difference between type of object discarded (information/household/clothing) compared to baseline during OPT or OPT+DV. In terms of daily amount of discard, figure 3 demonstrates that during active treatment on some days over 40 items could be discarded, compared to virtual absence of discard during the baseline.

Stage of treatment was significant for volume of discard $F(3,635) = 4.50$, $p < .01$, with a small effect size (partial η^2) of .02. Discard volume was greater during each stage compared to baseline: OPT $F(1,635) = 3.33$, $p < .01$ (small effect size: partial $\eta^2 = .02$), OPT+DV $F(1,635) = 3.60$, $p < .01$ (small effect size: partial $\eta^2 = .02$), and follow-up $F(1,635) = 2.89$, $p < .01$ (small effect size: partial $\eta^2 = .01$). In order to examine whether this finding could be accounted for via reductions to daily cognitive, emotional or behavioural variables, the ANOVA was repeated with all psychological ideographic variables entered as additional covariates. Stage of treatment remained significant for volume of discard during OPT $F(1,571) = 3.52$, $p < .01$ and OPT+DV $F(1,571) = 3.29$, $p < .01$. Two of the ideographic variables were significant: sentimentality $F(1,571) = 10.68$, $p < .01$ and shame $F(1,571) = 8.07$, $p < .01$. This indicates that whilst total volume of discard increased over time, this increase was partially accounted for by reductions to hoarding specific cognitions and emotions.

A binary logistic regression was used to predict incidence of discard (patient did vs. did not discard items) from stage of treatment. The regression model as a whole was significant ($\chi^2 (3) = 24.11$, $p < .01$) and classified 69.7% of incidents of discard correctly (75% patient did discard, 62% patient did not discard). The Nagelkerke pseudo R^2 (indicating goodness of fit of the logistic regression model) was .04. Stage of treatment was significant for OPT Wald $\chi^2(1) = 11.6$, $p < .01$ and OPT+DV Wald $\chi^2(1) = 12.4$, $p < .01$. The odds in favour of discard were more than seven times higher during both OPT (7.13) and OPT+DV (7.72) and reduced in likelihood during follow-up to 3.88.

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In order to examine in more detail whether the stage of treatment effects could be accounted for by changes in thinking, feeling and behaving, the logistic regression analysis was re-run with the ideographic cognition, emotion and behavioural daily measures as additional covariates. Stage of treatment remained significant for OPT (Wald $\chi^2(1)$ = 12.05, $p < .01$) but not for OPT+DV (Wald $\chi^2(1)$ = 1.66, n.s.). Of the daily variables only living in the past (Wald $\chi^2(1)$ = 5.90, $p < .01$), sentimentality (Wald $\chi^2(1)$ = 12.50, $p < .01$) and avoidance (Wald $\chi^2(1)$ = 9.17, $p < .01$) were significant when entered into the model. This suggests that reductions to living in the past, sentimentality and behavioural avoidance were partial mediators of incidence of discard. A binary logistic regression tested whether there was a significant increase in the incidence of discard due to the addition of DVs. No significant increases in discard incidence was found between OPT and OPT+DV (Wald $\chi^2(1)$ = .14, n.s., odds ratio 0.92). Similarly, there was no significant increase in the total volume of objects discarded between OPT and OPT + DV ($t(450)$ = -.0.61, n.s.).

Discussion

The results of the current study illustrate a partially effective treatment for Hoarding Disorder. It is interesting that whilst there was a reliable and clinically significant reduction in hoarding (the primary outcome measure would be coded recovered), reliable reductions in actual physical clutter were limited to the upstairs of the home. This may be due to the upstairs being more cluttered prior to intervention and much of the clinical work concerned helping the patient to organise and de-clutter the upstairs rooms, as this was consistent with the

goals of the therapy. Outcome measurement in hoarding research should therefore be wary of solely relying on self-report, as visible and measurable reductions to environmental clutter is the best index of behavioural change. Such is the magnitude of backlog of some hoards that only sustained behavioural change can achieve widespread visible impact. Specific, measurable, achievable, realistic and time sensitive clinical goals are particularly useful in hoarding treatment. Reduced clutter in specified areas provides incontrovertible and positively reinforcing visual evidence of behavioural and environmental change (Kellett, 2007).

Total volume of discard did increase as a result of CBT, with volume of discard also partially influenced by reductions to cognitive, behavioural and emotional variables (particularly sentimental attachment and shame). Similarly, initiation of discard was also found to be influenced by reduced focus on the past, sentimentality and avoidance. Whilst treatment significantly reduced focus on the past, sentimental attachment, avoidance, and anxiety, it did not result in a significant decrease in depression or shame. Outcomes of depression did decrease however on the formal BDI-II measure (Beck et al., 1995). It is interesting to note in the daily number of objects discarded that on some days up to fifty objects could be discarded during active treatment. However, if such objects are small (e.g. a train timetable), this would not significantly reduce observable clutter. And yet given the emotional significance of possessions in hoarders' lives (Kellett, 2007), such discard may actually represent a substantial step forward (particularly given the relative absence of discard during the baseline).

These findings throw empirical light on the stages of change in hoarding treatment for the first time. The results for the odds in favour of discard were impressive for the treatment phases. Whilst frequency of discard increased as a result of intervention, the downward trend during follow-up indicates that sustained discard may be difficult to sustain without on-going therapeutic support. True long-term follow-up studies would enhance the hoarding evidence base by benchmarking durability of interventions and the role of long-term booster sessions is also worthy of investigation.

Household waste objects proved the most frequently discarded possession category. Household waste objects may have been perceived as having less intrinsic, sentimental or emotional value (Furby, 1978). Further research examining 'in-vivo' commentaries/observations are needed to elucidate the cognitive and emotional processes involved in decision-making regarding the discard of differing types of object (Smyth & Stone, 2003). Whilst domiciliary visits have been proposed to enhance treatment adherence and ability to discard (Nesiroglu et al., 2004; Steketee & Frost, 2007; Tolin et al., 2007), the current study challenges these opinions. There was no evidence that DVs facilitated increased discard, suggesting that DVs may not be an essential component of hoarding treatment (Muroff et al., 2011). There was a reliable reduction in compulsive acquisition over treatment and this was an early treatment target in the attempt to reduce the 'inflow' of objects into the home, before concentrating on increasing 'outflow' via improved discard.

The N=1 sample represents the main methodological weakness of the current study, as results may not generalize to other hoarding patients (Barlow, Andrasik & Hersen, 2008). The results should therefore be considered as

indicative and need to be replicated in larger samples. The absence of clutter ratings for the follow-up phase is acknowledged as a study flaw. As sessions were not recorded, revised Cognitive Therapy Scale ratings (CTS-R; Blackburn, James, Milne, Baker, Standart, Garland & Reichelt, 2001) were unattainable and therefore there can be no certainty that competent CBT was delivered. The development of a measure of hoarding specific CBT treatment competency would be helpful in terms of training and supervision. Another methodological limitation is the treatment design. The OAF component ran across both the OPT and OPT+DV phases. It was not possible therefore to specify whether object affect fusion treatment (either over and above or in conjunction with CBT) was the primary mechanism for change. A different single case experimental design; A/B/C/D whereby B is CBT only; C is OAF only and D is CBT+OAF would have clarified whether OAF alone or as an adjunct to CBT is most effective in facilitating discard. The hoarding literature would benefit from performing deconstruction trials (Jacobson, Dobson, Truax, Addis, Koerner, Gollan, Gortner & Prince, 1996) comparing the cognitive and behavioural components of the treatment model. Future studies might also consider the use of vector autoregression for assessing the interdependencies between the different time-series (e.g., Binder & Coad, 2010). For example, it could be used to explain how discard frequency changes over time based on its own lags and the lags of other variables (such as cognition and affect variables).

The patient treated presented with co-morbid OCD. Whilst no attempts were made to treat the OCD, the inclusion of an OCD measure (e.g. the Yale-Brown Obsessive Compulsive Scale (YBOCS; Goodman, Price, Rasmussen et al. 1989) would have been useful to evidence any responsivity of OCD

symptoms to treatment. As the patient was also receiving on-going pharmacological treatment for OCD symptoms, it is possible that medication may have had some role in the changes evidenced in the time series. The baselines for discard variables however were stable, suggesting that the resultant changes observed were due to the introduction of targeted CBT for hoarding, rather than the on-going pharmacological intervention.

The current study supplements the hoarding outcome evidence, particularly as only two single case experimental design studiess have previously been completed and the current study assessed outcomes more thoroughly over a long period with greater follow-up. The hoarding evidence base contains the single CBT trial, which illustrates how difficult RCTs are to conduct and complete when patients are acknowledged to be reluctant to engage in treatment (Bower & Gilbody, 2010; Steketee & Frost, 2003). Single case experimental design addresses the idiosyncratic needs of the particular patient being treated (Newall & Burnard, 2006) and illuminates the shape of symptomatic change in a manner not possible in group studies (Barlow, Andrasik & Hersen, 2008). For hoarding outcome research to progress, appreciation and synthesis of both evidence-based practice and practice-based evidence is required (Barkham et al., 2010). Development of practice-research networks (Castonguay, Locke & Hayes, 2011) may be an efficient manner of combining data across sites and clinicians.

In conclusion, the current study has provided an intricate, client-centred and longitudinal insight into the day-to-day existence of a hoarder undergoing CBT. Compulsive hoarding is viewed as difficult to address with risk of drop-out, poor outcome and behavioural relapse (Muroff et al., 2011). The

intervention was successful in increasing the frequency, volume and overall incidence of discard and this had a significant environmental impact in terms of reduced clutter in the upstairs of the home. DVs do not appear to add clinical value, but similarly there was no evidence of DVs being an impediment to change. To have real clinical validity, outcomes in hoarding need to be triangulated across psychometric, clinician rated and environmental indices. The unfortunate absence of evidence for other psychotherapies for hoarding means that the possibility of comparing treatments against active controls in a trial setting is currently severely limited.

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Table 1; descriptive statistics for ideographic measures, with effect size (partial η^2) comparisons between study phases

Ideographic Measures	Baseline Mean (SD)	Outpatient theory Mean (SD)	Baseline – outpatient effect size	Outpatient plus domiciliary visits Mean (SD)	Baseline – outpatient plus visits effect size	Follow-up Mean (SD)	Baseline – follow-up effect size
Living in the past	7.57 (0.80)	7.08 (0.80)	0.01	6.27 (0.70)	0.04	**5.91** (0.80)	0.06
Sentimentality	7.71 (0.80)	**6.91** (0.70)	0.02	**5.89** (0.60)	0.10	**5.40** (0.50)	0.13
Avoidance	7.59 (1.00)	**6.54** (0.60)	0.03	**5.70** (0.60)	0.10	**5.38** (0.64)	0.11
Anxiety	7.89 (0.80)	7.48 (0.70)	<0.01	7.29 (0.60)	0.01	**6.70** (0.70)	0.03
Depression	7.71 (0.70)	7.40 (0.80)	<0.01	7.29 (0.70)	<0.01	6.72 (0.65)	0.02
Shame	7.53 (1.00)	**6.93** (0.70)	0.01	6.89 (0.70)	0.01	7.05 (0.61)	<0.01
Discard - information	0.07 (0.30)	2.07 (6.10)	<0.01	3.64 (8.10)	0.01	1.03 (3.90)	<0.01
Discard - household	0.14 (0.40)	1.97 (4.10)	<0.01	4.16 (6.90)	0.01	4.10 (6.90)	0.01
Discard - clothing	0.03 (0.10)	2.55 (4.40)	0.01	1.81 (3.80)	0.01	1.15 (3.30)	<0.01
Discard volume	0.28 (0.80)	**1.91** (1.50)	0.02	**2.06** (1.60)	0.02	**1.73** (2.00)	0.01

Note: Significant effects ($p < .01$) marked in **bold**.

Table 2: *psychometric outcomes and associated reliable change analyses*

	Baseline	OPT	OPT+DV	Follow-up	RCI
BDI-II	41	32	24	12	**8.38****
BSI-GSI	2.15	2.01	2.20	1.37	**2.51***
IIP-32	1.43	1.62	1.68	1.09	**0.35**
CAS	65	56	29	29	**5.94****
SI-R	86	42	23	16	**11.34****
CIR (upstairs)	7.33	4.66	3.33		**3.51***
CIR (downstairs)	4.66	5.11	4.33		0.29

Bold = reliable change at $^*p < 0.05$, $^{**}p < 0.01$

Clutter Image Rating RCI refers to baseline versus end of active treatment

(OPT+DV) comparison, all other RCIs refer to baseline versus end of follow-up

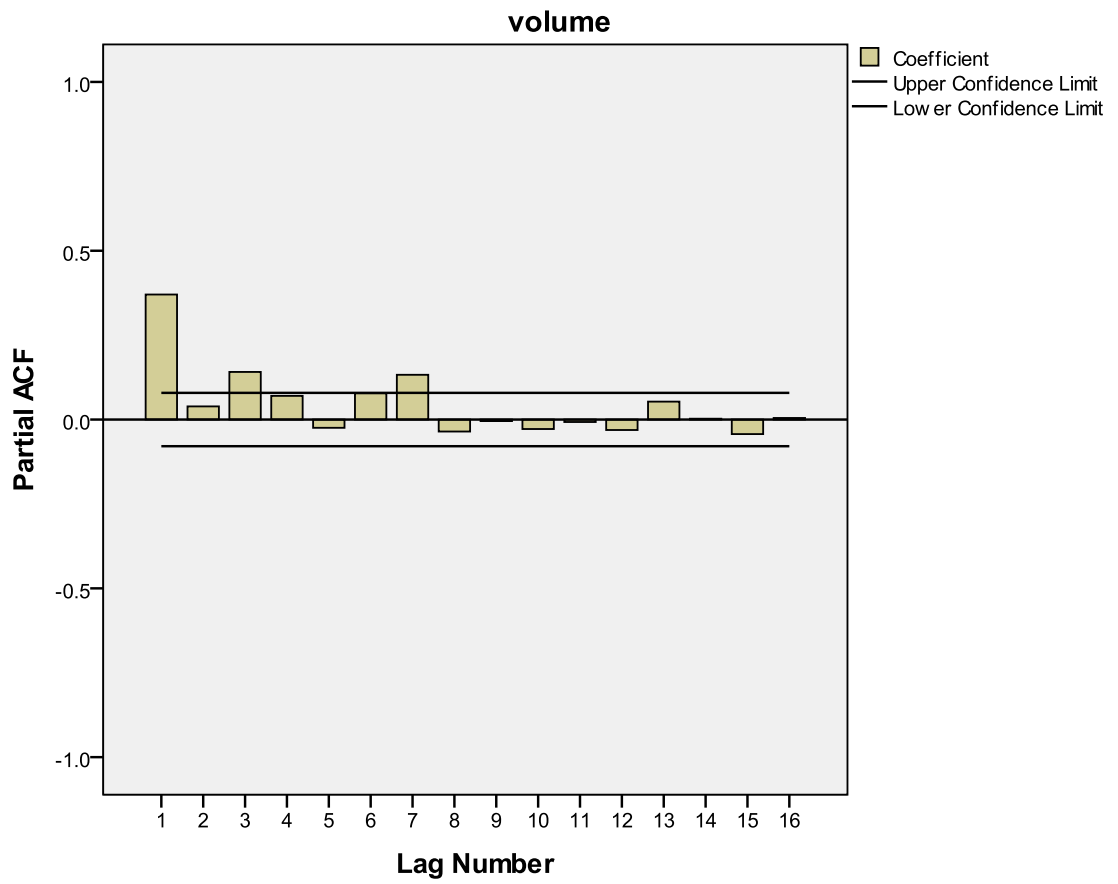Figure 1; Partial autocorrelation function (PACF) plot of volume of discard

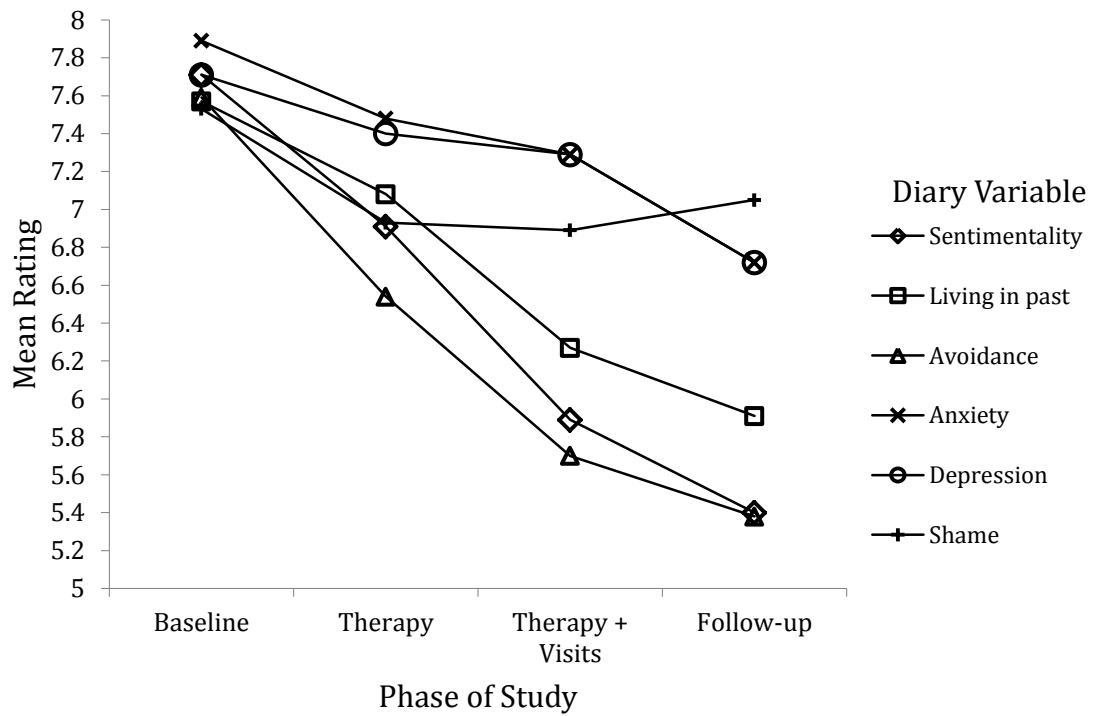Figure 2; *change in cognitive, emotional and behavioural ideographic variables over study phases*

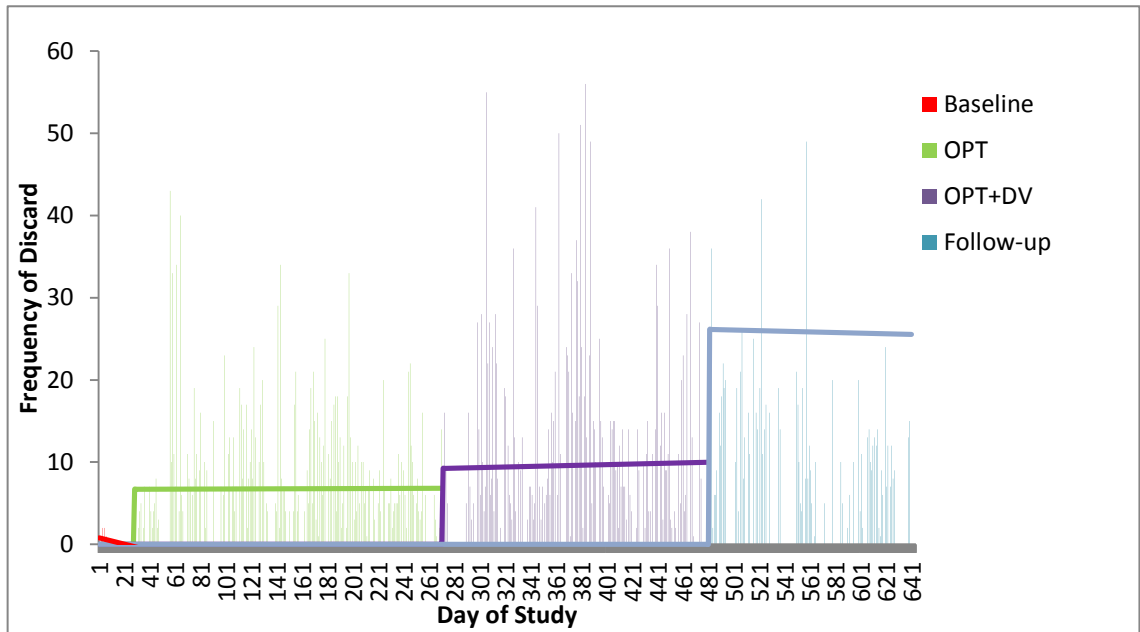Figure 3; *frequency of daily discard during study phases*

Figure 4; *mean frequency of daily discard during study phases (aggregated by week)*