**Making Space: A Randomized Waitlist-Controlled Trial of an Acceptance and Commitment Therapy Website for Hoarding**

Jennifer Krafft1,2\*, Julie M. Petersen1, Clarissa W. Ong1,3, Michael P. Twohig1, and Michael E. Levin1

1Department of Psychology, Utah State University, Logan, UT, United States of America

2Department of Psychology, Mississippi State University, Mississippi State, MS, United States of America

3Department of Psychology, University of Toledo, Toledo, OH, United States of America

\*Corresponding author

**Author Note**

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 Correspondence concerning this article should be addressed to Jennifer Krafft, Department of Psychology, 110 Magruder Hall, 255 Lee Blvd, Mississippi State, MS 39762. Email: jek299@msstate.edu

**Abstract**

Background: Hoarding disorder causes significant impairment, but existing treatments have notable barriers to access and do not target several psychological processes that may contribute to hoarding. Therefore, this study evaluated an acceptance and commitment therapy (ACT) self-help website for hoarding with minimal coaching in a randomized waitlist-controlled trial to evaluate initial feasibility and efficacy.

Methods: Participants were 73 U.S.-based adults with clinically significant hoarding symptoms. The website comprised 16 self-help sessions to be completed over 8 weeks. Measures were taken at baseline, posttreatment, and 1-month follow-up.

Results: Multilevel models indicated that the ACT condition improved significantly more than waitlist on hoarding symptom severity (the primary outcome; β = 0.74, Holm-corrected *p* = .01) as well as secondary outcomes (e.g., functional impairment, well-being, and progress toward personal values, Holm-corrected *p*s < .05). Rates of reliable (34.61%) and clinically significant (11.54%) change at posttreatment were limited, with no significant differences between groups. Responses indicated that this intervention was acceptable, credible, and easy to use, although adherence could be further improved.

Conclusions: Overall, results suggest that an ACT self-help program for hoarding can be acceptable and efficacious. Limitations include a predominantly White and female sample and the lack of an active control condition.

*Keywords:* compulsive hoarding, eHealth, psychological flexibility, experiential avoidance, mindfulness

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 Hoarding disorder (HD), defined by clutter interfering with living conditions and difficulty discarding items, is a mental health concern in need of greater attention by research. HD appears to be the most common of the obsessive-compulsive and related disorders; based on a recent meta-analysis, the prevalence of hoarding disorder is estimated at 2.5% (Postlethwaite et al., 2019). HD has negative effects on the individual and broader public health. At the individual level, HD is highly comorbid with other disorders (e.g., 76.5% of those with HD have a comorbid anxiety or mood disorder; Burton et al., 2016; Frost, Steketee, et al., 2011) and interferes with functioning and impairment across domains of work, social life, and relationships (Drury et al., 2014; Ong et al., 2015). On a larger scale, HD has negative impacts on individuals’ families, neighbors, and broader communities. For example, the majority of public health departments report hoarding cases with individuals who refuse or are reluctant to engage in treatment (Frost et al., 2000). Hoarding also can be a health risk for anyone living with the individual (e.g., unsanitary conditions, reduced visits from others; Rasmussen et al., 2014; Tolin et al., 2008). Thus, based on the communal and individual consequences of hoarding, it is essential to develop evidence-based treatments for HD that can be easily disseminated into communities.

 Research on the treatment of HD is nascent (e.g., Tolin et al., 2015); however, there remains a need to explore beyond the current standard of care. Research to date has primarily focused on cognitive behavioral therapy (CBT) for HD, which includes the following elements: motivational interviewing, cognitive restructuring, exposure, organizational and problem-solving skills, and relapse prevention (Steketee & Frost, 2007). CBT for HD has been tested in over ten trials (e.g., Mathews et al., 2016; Muroff & Steketee, 2018), resulting in large effects on symptom severity and medium effects on impairment (Tolin et al., 2015). However, only 25-43.3% of individuals treated for hoarding report clinically significant change after CBT (Tolin et al., 2015). Additionally, there are many barriers that prevent individuals in need of hoarding treatment from obtaining CBT. For example, very few therapists are trained to treat hoarding (Frost et al., 2012). If there are trained therapists available, the treatment is very time intensive (e.g., a range of 13-35 sessions; Tolin et al., 2015) and often requires home visits. Furthermore, individuals with HD also tend to report low help-seeking (e.g., Chasson et al., 2018; Rodriguez et al., 2012). Community samples of those with HD appear to have more clutter and less insight than those who typically present in research samples (Woody et al., 2020). Refusal and dropout rates in hoarding treatment studies have also been high (Muroff et al., 2011), suggesting that some individuals in need of treatment for hoarding are not satisfied with the current, most-supported treatment option available (i.e., CBT). In sum, there is a need to develop another evidence-based treatment option for HD that is accessible and palatable while providing robust, clinically significant change.

 To improve access to and engagement in treatment, web-based interventions may provide a promising alternative to in-person care. Mobile and web-based interventions are a growing area of research due to their ease of access and scalability (Andersson & Titov, 2014). Online interventions also have the potential to mitigate defensiveness (a possible contributing factor to low engagement or help-seeking; Frost et al., 2010) by allowing the individual to interact with a website instead of directly engaging with a therapist (Levin et al., 2018). For example, one previous study reported that individuals with hoarding issues discard belongings more easily in low pressure scenarios as compared to in therapy (Frost et al., 2016); it is possible that self-help interventions for HD can provide the ideal balance to improve discarding. Only one previous study examined a web-based peer support group with CBT resources for hoarding (Muroff et al., 2010). In this study, participants reported improvements in hoarding symptom severity over 15 months, with long-term users showing greater improvement overall (Muroff et al., 2010). This study suggests that web-based treatments may be a feasible and effective option for people with HD, but it did not measure treatment acceptability nor utilize randomization (Muroff et al., 2010). Therefore, further research is needed on web-based options for hoarding disorder to replicate this pilot study and gain a deeper understanding of online interventions for HD.

 Because there is so little treatment research available on HD overall, it would be helpful to test treatments other than CBT, such as acceptance and commitment therapy (ACT; Hayes et al., 2012). ACT targets psychological inflexibility, which is a core pathological process involved in HD. Psychological inflexibility is defined by the overregulation of behavior by internal experiences (e.g., thoughts, feelings) rather than attending and/or responding to chosen values or the context of the present moment (Hayes et al., 2012). For example, individuals with HD often respond to and engage with thoughts rigidly and literally (Ong et al., 2018); this process is visible with beliefs about possessions (e.g., hearing the thought “It would be too wasteful to discard this” as absolute truth and thus refusing to discard objects). As another example, HD symptoms often result in a preoccupation with the future or an idealized past related to their belongings (e.g., “I might need this item in the future so I can’t throw it away” or “My loved one left this item behind and thus I cannot discard it”). Multiple studies have found hoarding symptoms linked to higher experiential avoidance and general psychological inflexibility (Ayers et al., 2014; Fernández de la Cruz et al., 2013; Krafft et al., 2018; Ong et al., 2018; Wheaton et al., 2011). ACT is therefore theoretically a promising treatment for HD.

Additionally, extensive research has supported the use of ACT as a transdiagnostic treatment; a transdiagnostic approach is especially important for hoarding due to the high comorbidity rates. ACT is also supported for disorders related to hoarding like obsessive-compulsive disorder (OCD), anxiety, and depression, for both in-person (e.g., Bluett et al., 2014) and web-based self-help (Thompson et al., 2021). Only one study, a multiple baseline (n = 6), exists for the use of ACT for hoarding (Ong et al., 2021). In this study, participants received 10-16 sessions of individual ACT focused on hoarding either face-to-face or via telehealth. Five of six individuals showed improvements on their rate of discarding relative to acquisition, along with self-report measures at posttreatment (Ong et al., 2021).

In sum, ACT demonstrates initial promise as a treatment for HD from a theoretical standpoint and from initial multiple baseline data (Ong et al., 2021). However, a study utilizing a randomized-controlled trial (RCT) format may help to identify whether ACT is a viable treatment option for HD. Given the limitations to both treatment provision and treatment seeking described previously, web-based self-help provides a promising treatment format based on potential scalability, accessibility, and ease of use. Thus, the present study developed and tested an ACT-based website for hoarding in an RCT. The first aim was to evaluate the efficacy of an ACT-based guided self-help website for hoarding. The primary outcome of interest was hoarding symptoms, but important secondary outcomes were specific symptom dimensions, global improvement, functional impairment, and overall well-being. The second aim was to evaluate the feasibility of delivering an ACT-based guided self-help website for hoarding as indicated by adherence to the intervention and self-reported acceptability.

**Methods**

**Participants**

 Participants (n = 73) were recruited via online advertisements and postings (e.g., Google ads, Facebook, Reddit), notifications to professional listservs and groups, contacting social services, and contributing to a newspaper article. To participate in the study, participants had to meet the following inclusion criteria: at least 18 years old, currently living in the United States, seeking help for clutter/hoarding, interested in testing a self-help website, and scoring at or above the clinical cutoff of 41 on the Saving Inventory (SI-R; Frost, et al. 2004; Frost & Hristova, 2011). Participants reported an average age of 47.67 (SD = 4.32) and were primarily female (87.67%), White (76.71%), and non-Hispanic/Latinx (93.15%). Only a small percentage had previously sought psychotherapy (24.66%) or medication (6.85%) for hoarding. Participant demographics are reported in Table 1 and participant flow can be found in Figure 1. A sample size of 40-60 was predetermined as this would provide adequate (.80) to good (.95) power to detect a medium effect in a repeated-measures ANOVA even with 27-30% missing data according to G\*Power (Faul et al., 2007).The study was powered for a medium effect given that CBT for hoarding typically has medium or large effects (Tolin et al., 2015), one previous trial of internet-based self-help for hoarding found medium effects on hoarding severity (Muroff et al., 2010), and the self-help content tested in this trial was adapted from a previously evaluated transdiagnostic web program that had medium-to-large effects on mental health (*Citation removed*).

|  |  |  |  |
| --- | --- | --- | --- |
| Demographics | ACT (*n* = 38) | Waitlist (*n* = 35) | Group comparison at baseline |
|  | *M*(SD)/% | *M*(SD)/% |  |
|  |  |  |  |
| Age | 50.26 (13.39) | 44.86 (14.98) | *t*(68.4) = -1.62, *p* = .11 |
| GenderFemaleMale | 84.21%15.79% | 91.43%8.57% | χ2(1) = 0.88 , *p* = .35 |
| EthnicityHispanicNon-Hispanic | 10.53%89.47% | 2.86%97.14% | χ2(1) = 1.68, *p* = .19 |
| RaceAsian American/Pacific IslanderBlackWhiteMultiracialOther | 10.53%5.26%73.68%5.26%5.26% | 2.86%2.86%80.00%5.71%8.57% | χ2(4) = 2.21, *p* = .70 |
| Marital statusSingleMarriedCohabitatingDivorcedWidowed | 26.32%34.21%13.16%21.05%5.26% | 37.14%22.86%11.43%20.00%8.57% | χ2(4) = 1.84, *p* = .77 |
| Estimated household income< $20,000$20,000-39,999$40,000-59,999$60,000-79,999$80,000-99,999> $100,000Unknown | 10.53%10.53%21.05%13.16%15.79%18.42%10.53% | 22.86%8.57%17.14%11.43%8.57%20.00%11.43% | χ2(6) = 2.75, *p* = .84 |
| Employment statusWorking full-timeWorking part-timeRetiredUnemployedStudentOther | 34.21%13.16%15.79%10.53%10.53%15.79% | 34.29%20.00%5.71%22.86%2.86%14.29% | χ2(5) = 5.48, *p* = .36 |
| COVID impact | 5.71 (1.47) | 5.24 (1.68) | *t*(63.3) = -1.00, *p* = .23 |

**Table 1**. ***Participant Demographics by Group at Baseline***



**Figure 1. *Diagram of Study Enrollment***

**Procedures**

 This study utilized a randomized controlled trial format with parallel conditions and a 1:1 allocation ratio. All procedures were approved by the university institutional review board. Study aims and procedures were preregistered at ClinicalTrials.gov (ID# *removed for masked review*). The only change to study methods after trial registration was the addition of questions regarding the impact of the COVID-19 pandemic. All study procedures took place online apart from phone coaching (see Coaching section). Participants first completed a brief automated online screening form for inclusion criteria and then, if eligible, provided informed consent and completed the baseline survey. After baseline completion, participants were randomly assigned to use the *Making Space* program (i.e., ACT self-help website and supportive coaching) for the next eight weeks or were placed on a waitlist. Randomization was automated within Qualtrics with blocks of 10. After the eight weeks, all participants were sent a posttreatment survey and then a final follow-up survey four weeks later. Once the follow-up point was reached, waitlist participants received access to the website. Participants received a $10 USD gift card after completing each of the final two questionnaires (at post-treatment and follow-up). No financial incentives were provided for completing the baseline survey or website sessions. Measures were administered at all 3 timepoints unless otherwise noted. No masking was employed, and outcome data were collected through online self-report. Prior to data analysis, responses were screened for potentially invalid responses (e.g., bots); some responses (n = 23) were removed based on suspicious response patterns (e.g., consent lacking a valid signature, completing the study survey in less than five minutes). Recruitment and data collection began in February 2020; recruitment ended in August 2020 given requisite sample size was met, and data collection ended in November 2020.

**Intervention**

 **Intervention structure.** The self-help website landing page was hosted on the Weebly platform, and the sessions were hosted through Qualtrics. The website consisted of 16 brief self-help sessions that took approximately 15-20 minutes each to complete. Sessions were designed to be brief and engaging, ending with clear overviews and session summaries. Within each session, participants were able to select answers in response to various questions or exercises; the selected answers were then piped throughout the session(s) to create interactivity and coherence. For example, a participant could identify “I might need this later” as a thought that they fuse with from a list of options. It would then be integrated into the skills being taught in session, such as a defusion metaphor asking the participant to imagine “I might need this later” as a passenger on a bus they are driving. Some sessions also included audio and/or visual components (e.g., guided meditation recordings). Sessions frequently included existing ACT exercises and metaphors (e.g., the tombstone exercise; Hayes et al., 2012) adapted for hoarding. Some sessions were adapted from transdiagnostic online ACT content that has been previously developed and evaluated (Levin et al., 2020). At the end of each session, participants were asked to develop a commitment to practice a skill they learned, typically in association with their hoarding symptoms (e.g., practicing mindful awareness while discarding an item in Session 10).

 **Session overview.** The start of the program, session one, focused on psychoeducation and improving motivation. Participants also explored their current clutter and acquiring and saving behaviors with a focus on values. Sessions two and three then focused on identifying avoidance and practicing acceptance. Sessions five and six focused on identifying cognitive fusion and practicing defusion. Sessions four and seven were aimed at applying ACT skills and concepts to shame and self-stigma to target barriers to treatment engagement and success. Session eight taught self-as-context, teaching participants a new perspective (i.e., the “observer self”) on their self, internal experiences, and behavior. Sessions nine and ten were centered on mindful awareness; participants practiced mindfulness and applied these concepts to discarding. Session 11 returned to values, similar to the concepts in session one. Sessions 12 and 13 then linked these values to specific behaviors via committed action. Sessions 13 and 14 presented a broader perspective by turning the focus to functioning and how psychological flexibility skills can help (as opposed to focusing on HD symptoms specifically). Lastly, session 16 was on relapse prevention; participants reviewed skills, prepared for possible lapses, and created an individualized plan for after the program. Table 2 provides an overview of session-by-session content.

|  |  |  |
| --- | --- | --- |
| Session | Description | Session Content |
| 1 | Psychoeducation and Values | * Psychoeducation on hoarding
* Reflecting on values and the impact of saving/acquiring on values
* Identifying what is important about participation
 |
| 2 | Noticing Avoidance | * Noticing avoidance repertoire in relation to workability
 |
| 3 | Acceptance | * Teaching acceptance as an alternative to avoidance
 |
| 4 | Acceptance of shame and self-judgment | * Normalizing shame and self-judgment
* Reflecting on why avoiding shame doesn’t work
* “Passengers on the bus” metaphor
 |
| 5 | Noticing fusion | * Introducing idea of being hooked by thoughts
* Increasing awareness of what happens when fused and signs you are fused
 |
| 6 | Defusion | * Practicing defusing from thoughts with “Leaves on a stream” and “Labeling” exercises
 |
| 7 | Defusion from self-stigmatizing thoughts | * Normalizing self-judgment
* Identifying costs of fusing with self-judgment
* “I can’t walk” exercise
 |
| 8 | Self-as-context | * Experiential exercise observing thoughts, feelings, memories, and belongings as “paint on the canvas” of the self, rather than the whole self
* Audio exercise observing different “selves” over time
 |
| 9 | Awareness | * Teaching the difference between being present and not being present
* Teaching how to notice where your attention goes
 |
| 10 | Awareness | * Teaching a series of brief skills to increase present-moment awareness
* Practicing awareness while discarding
 |
| 11 | Values | * Identifying values as qualities of action
* Tombstone exercise
 |
| 12 | Values and committed action | * Values sorting exercise
* Identifying values that are served by saving and discarding items
* Practice setting short-term and long-term goals
* Brainstorming values-consistent alternatives to saving
 |
| 13 | Committed action | * Introducing “fail-give up” and “fail-recommit” patterns
* Identifying warning signs for drifting from commitments and ways to recommit
 |
| 14 | Generalizing acceptance | * Identifying unwanted thoughts/feelings in life broadly
* “Tin can monster” exercise to practice awareness, acceptance and defusion
 |
| 15 | Generalizing committed action | * Describing common barriers
* Teaching strategies to overcome barriers
 |
| 16 | Relapse prevention | * Helping participants see progress by re-evaluating progress on goals and values consistency
* Recapping core ideas from each session and guiding participants to explore what they learned and what they want to keep practicing
* Creating summary for clients of their main takeaways and what they’d like to continue practicing
* Sharing links to further resources: psychoeducation, hoarding treatment, ACT
 |

**Table 2. *Treatment Outline***

 **Coaching.** The active condition received coaching based on the supportive accountability model of eHealth (Mohr et al., 2011). In this model, human support is fostered using trust, benevolence, and expertise to establish accountability and subsequently improve adherence. Coaching in the present study was broadly intended to aid participants in engaging with and adhering to the online intervention. The coaching protocol consisted of an initial phone call of 10-15 minutes at the start of treatment and then weekly supportive coaching emails throughout the eight-week period. Weekly coaching emails included in-depth discussion and feedback regarding adherence, while additional emails sent were 1) responses to any replies regarding coaching emails and 2) reminders if participants were behind the two session-weekly schedule. The initial phone call was designed to establish a relationship between the participant and the coach so that the participant views the coach was trustworthy, benevolent, and having expertise, along with setting clear engagement expectations linked to collaboratively established goals for each participant (Mohr et al., 2011). The coaching emails were focused on monitoring engagement, providing feedback, answering questions, and supportive problem-solving. Coaching was incorporated in the present study based on successful past online interventions for anxiety and depression (Spek et al., 2007). In-person coaching has also been evaluated for hoarding with promising results (Crone et al., 2020; Linkovski et al., 2018). Coaches were two graduate students trained in clinical psychology.

**Measures**

 **Demographics**. Participants completed standard demographics at baseline: race, age, gender, ethnicity, marital status, employment status, and household income. Participants were also asked to report counseling and psychotropic medication use.

 **Saving inventory-revised** (SI-R; Frost et al., 2004). The SI-R is a 23-item measure of hoarding severity including three subscales of difficulty discarding, acquisition, and clutter. Participants are asked to rank each item on a 5-point Likert Scale (0 = *Low frequency/intensity*, 4 = *High frequency/intensity*). Higher scores indicate greater hoarding severity, with an overall cutoff score of 41 to indicate clinical levels (Frost & Hristova, 2011). Example items include “To what extent do you have so many things that your room(s) are cluttered?” and “How strong is your urge to save something you know you may never use?” The SI-R has established good consistency, reliability, and validity in clinical samples (Frost et al., 2004). In the present study, internal consistency was excellent (Total α = .93, Difficulty Discarding α = .88, Excessive Acquisition α = .85, and Clutter α = .93).

 **Sheehan disability scale** (SDS; Sheehan et al., 1996). The SDS is a three-item measure of functional impairment in work, social life, and family domains. The SDS was slightly adapted for the present study to specify impairment due to hoarding, as done in previous research (Fitch & Cougle, 2013). Participants rank each item on an 11-point Likert scale (0 = *Not at all*, 10 = *Extremely*), with higher scores indicating greater impairment. One sample item is “The symptoms have disrupted your work/schoolwork.” Internal consistency of the SDS is considered good in both past studies and the current sample (α = .83).

 **Clinical global impression – improvement** (CGI-I; Guy, 1976). The CGI-I is a single-item measure of symptom improvement. The CGI-I is typically clinician-rated but was adapted into self-report for the current study. At posttreatment, participants rated their own perceptions of their symptom improvement over the last eight weeks on a 7-point Likert scale (1 = *Very much improved*, 7 = *Very much worse*); higher scores indicate worsening of symptoms. The CGI-I has demonstrated sufficient sensitivity in previous hoarding research (Muroff et al., 2010).

 **General health questionnaire-12** (GHQ-12; Goldberg, 1978). The GHQ-12 is a 12-item measure of overall well-being. Participants rate each item on a 4-point Likert scale (1 = *Much less than usual*, 4 = *Better than usual*). Higher scores represent greater distress (i.e., lower well-being). Sample items include “Have you recently lost much sleep over worry?” and “Have you recently been thinking of yourself as a worthless person?” The GHQ-12 is a commonly used measure and has established good validity (Goldberg et al., 1997). The internal consistency in the present study was excellent (α = .91).

 **Credibility/expectancy questionnaire** (CEQ; Devilly & Borkovec, 2000). The CEQ is a 6-item self-report measure of treatment credibility and expectancy. In the present study, the CEQ was slightly altered so that all items referred to “treatment” rather than “therapy,” and to “clutter and/or hoarding” rather than “anxiety” symptoms. This measure was administered directly after completion of the first website session. Participants rank some items on a 9-point Likert scale and others on a scale of 0-100%. In the current study, internal consistency was inadequate for credibility (α = .59) and good for expectancy (α = .82).

 **System usability scale** (SUS; Tullis & Albert, 2008). The SUS is a 10-item questionnaire assessing the usability of technological systems. The present study adapted the SUS to refer specifically to the self-help website for hoarding; this measure was administered at posttreatment only. Participants ranked each item on a 5-point Likert scale (1 = *Strongly disagree*, 5 = *Strongly agree*). In the present study, internal consistency was good (α = .87).

**Treatment evaluation inventory-short form** (TEI-SF; Kelley et al., 1989). The TEI-SF is a 9-item questionnaire of treatment acceptability; it was administered at posttreatment. In past studies and the present study, the measure was revised to include only seven of the original nine items, as two were not applicable to an adult sample (Twohig et al., 2010). One item was also revised to specify “clutter and/or hoarding” rather than “anxiety.” Participants are asked to rank each item on a 5-point Likert scale (1 = *Strongly disagree*, 5 = *Strongly agree*). The TEI-SF had good internal consistency in the present study (α = .89).

**General satisfaction**. Participants were asked to respond to ten questions assessing satisfaction, suitability, and effectiveness of the self-help website at posttreatment. Participants ranked each item on a 6-point Likert scale (1 = *Strongly disagree*, 6 = *Strongly agree*). Previous studies have used similar questions to assess satisfaction with technological mental health interventions (e.g., Krafft et al., 2017; Levin et al., 2017).

**Analysis Plan**

Groups were compared on baseline variables and any variables that differed significantly were included as covariates in analyses. Variables were inspected for normality. Missingness was evaluated and a series of generalized linear models were used to assess whether potential predictors of missingness on the primary outcome were statistically significant.

 Treatment acceptability, credibility, and ease of use were evaluated among posttreatment responders and compared to pre-determined benchmarks. Treatment adherence was calculated, and the association between adherence and change on the SI-R was evaluated in a linear regression model (among those with adequate data to calculate change scores).

 Efficacy was investigated using a series of multilevel models with time by condition interactions (i.e., determining whether the intervention group improved significantly more on outcomes compared to the waitlist group from baseline to follow-up.) These models included random intercepts (modeling varying values of the dependent variable by participant). Random slopes (modeling varying slopes for the dependent variable by participant) were also tested to determine if they improved model fit for each dependent variable. Maximum likelihood estimation was used; this method provides accurate parameter estimates assuming data are missing at random (Kwok et al., 2008). Statistical significance was determined using the lmerTest package (Kuznetsova et al., 2017), which appears to provide accurate *p*-values (Luke, 2017).

 Condition was dummy coded with 0 representing the waitlist group and 1 the ACT group. Time was dummy coded with 0 representing the baseline timepoint, 0.67 representing the posttreatment timepoint, and 1 representing the follow-up timepoint. This dummy coding helps make results readily interpretable. Outcome variables were standardized in these models using grand mean centering to provide a standardized metric for interpreting effect size (Lorah, 2018). As such, time by condition coefficients indicate the change in treatment (relative to waitlist) from baseline to follow-up. While these coefficients are not exactly comparable to Cohen’s *d*, given that they account for other effects within the multilevel models, they are similar in that they estimate change in terms of standard deviations. Model fit was assessed using residual plots. R statistical software was used for all analyses (R Core Team, 2018).

 Rates of reliable change and clinically significant change were calculated for those who completed the posttreatment survey (n = 51). Reliable change was calculated according to the Jacobson and Truax (1991) guidelines using norms (M = 59.17, SD = 13.56) obtained from a recent, large study of the SI-R (Kellman-McFarlane et al., 2019) and published test-retest reliability (α = .86; Frost et al., 2004), which resulted in a cutoff of 15 or more points of change on the SI-R indicating reliable change. Clinically significant change was defined as falling below the clinical cutoff score of 41 on the SI-R (Frost & Hristova, 2011). Given the large number of study hypotheses tested, the Holm correction was used to control the family-wise error rate (Holm, 1979) and *p*-values were adjusted accordingly.

**Results**

The two groups differed significantly on one variable (CGI-I score) at baseline, and this was included as a covariate in analyses. All variables used for further analyses were adequately

normally distributed. Descriptive statistics were calculated for demographics (Table 1) and other variables (Table 3). Residuals for multilevel models were adequately normally distributed. When modeling predicted vs. observed values, some nonlinearity was observed. However, it was not feasible to improve model fit as nonlinearity was not consistent across conditions.

**Table 3. *Descriptive Statistics by Group at Baseline, Posttreatment and Follow-up***

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Baseline | Group comparison at baseline | Posttreatment | Follow-up |
|  | ACT (n = 38)M(SD)/% | Waitlist (n = 35)M(SD)/% |  | ACT (n = 26)M(SD)/% | Waitlist (n = 26)M(SD)/% | ACT (n = 25)M(SD)/% | Waitlist (n = 29)M(SD)/% |
| SI-R Total | 66.25 (11.96) | 67.18 (14.84) | t(65.4) = -0.734, p = .47 | 54.46 (13.40) | 59.15 (12.18) | 46.72 (13.40) | 55.55 (14.86) |
| SI-R Difficulty Discarding | 20.94 (4.20) | 20.88 (5.48) | t(60.2) = -0.68, p = .50 | 17.62 (4.53) | 18.58 (4.43) | 14.68 (4.54) | 17.93 (4.61) |
| SI-R Excessive Acquisition | 17.69 (5.02) | 18.59 (4.50) | t(70) = -0.30, p = .77 | 14.15 (4.09) | 16.19 (4.62) | 11.52 (4.81) | 15.07 (5.06) |
| SI-R Clutter | 27.62 (5.95) | 27.71 (7.61) | t(68) = -0.76, p = .45 | 22.69 (7.17) | 24.38 (6.46) | 20.52 (6.93) | 22.55 (7.23) |
| SDS Total | 22.06 (6.17) | 22.94 (6.04) | t(52.6) = 0.75, p = .46 | 16.88 (6.64) | 19.23 (7.86) | 13.40 (7.99) | 18.79 (7.84) |
| SDS Work | 6.38 (2.75) | 6.94 (2.25) | t(52.9) = 0.42, p = .67 | 4.58 (2.82) | 5.38 (2.87) | 3.92 (2.80) | 5.55 (3.04) |
| SDS Social | 7.69 (1.99) | 7.88 (2.69) | t(69.8) = 0.09, p = .93 | 6.00 (2.67) | 6.77 (2.97) | 4.04 (2.95) | 6.86 (2.59) |
| SDS Home | 8.00 (2.07) | 8.12 (2.42) | t(70) = -0.79, p = .43 | 6.31 (2.45) | 7.08 (2.74) | 5.44 (3.24) | 6.38 (2.74) |
| CGI-I | 4.31 (0.87) | 3.76 (0.90) | t(68.3) = -2.81, p = .006 | 2.69 (0.79) | 3.65 (1.38) | 2.76 (1.05) | 3.66 (1.01) |
| GHQ-12 | 26.19 (7.39) | 27.35 (8.01) | t(70.6) = 1.75, p = .08 | 36.15 (6.93) | 30.35 (6.51) | 36.12 (7.21) | 31.76 (5.37) |
| VQ Progress | 12.06 (7.08 | 12.82 (7.60) | t(70.6) = 1.24, p = .22 | 17.27 (6.85) | 13.58 (7.74) | 18.36 (7.58) | 15.14 (6.02) |

 There were 52 respondents at posttreatment (71.23%) and 56 at follow-up (76.71%). No variables tested (baseline scores on outcome variables, baseline treatment utilization, age, gender, and credibility and expectancy) significantly predicted missingness on the SI-R at posttreatment.

 Participants generally reported at baseline that the COVID-19 pandemic had made it harder to function recently (see Table 1). However, responses for ACT condition participants at posttreatment did not suggest that the COVID-19 pandemic created substantial barriers to using the intervention. 44% reported it made study participation easier, compared to 24% who said it neither helped nor hurt, and 32% who reported it made participation harder. Questions on COVID-19 were added after the study launched, and not administered in the earliest baseline (n = 5) and posttreatment (n = 2) surveys.

**Treatment Acceptability**

Average TEI-SF score (*M* = 25.46, SD = 6.33) exceeded the cutoff of 21 (Twohig et al., 2006). Average CEQ-Credibility score (*M* = 6.62, SD = 1.23) and CEQ-Expectancy score (*M* = 61.09, SD = 21.27) also exceeded pre-specified cutoffs of 6 and 60. Average SUS score (*M* = 86.46, SD = 13.43) met the cutoff of 85.58 (Bangor et al., 2008) for excellent ease of use. Scores on novel individual satisfaction items also indicated adequate acceptability, with scores between “4 - slightly agree” and “5 - agree” (6 “strongly agree” is the maximum) for: “Overall, I was satisfied with the quality of the program” (*M* = 4.69, SD = 1.26), “I felt the program was made for someone like me” (*M* = 4.73, SD = 1.46), “I would recommend the program to other people with a clutter and/or hoarding problem” (*M* = 4.88, SD = 1.40), “The psychological skills taught (ex. mindfulness, opening up) were helpful to me” (*M* = 4.96, SD = 1.37), and “Overall, I was satisfied with the coaching that I received” (*M* = 4.73, SD = 1.43)

**Treatment Adherence**

The average number of sessions completed by participants assigned to use the ACT website was 6.89 (SD = 5.71) by posttreatment. At posttreatment, out of the 38 individuals assigned to use the website, 9 had completed no sessions, 7 had completed between 2 and 4 sessions, 5 had completed between 5 and 7 sessions, 4 had completed between 8 and 10 sessions, 8 had completed between 11 and 13 sessions, and only 5 had completed all 16 sessions. Thus, adherence was variable, but only a small minority (13.2%) completed all website content within the planned timeframe. Although participants in the treatment condition could access all sessions at any time, they were encouraged to complete sessions in sequence and almost always did. Thus, participants had greater exposure to topics covered in early sessions (e.g., acceptance, defusion) compared to other topics (e.g., values, committed action). The number of sessions a participant had done by posttreatment was not significantly related to SI-R change score (*b* = -0.21, SE = 0.47, *p* = 1). Baseline hoarding severity did not significantly predict number of sessions completed (*b* = -0.03, SE = 0.08, *p* = 1). Regarding treatment dropout, there was only one individual who explicitly withdrew from participating in the study (see Figure 1).

 Initial phone coaching call length ranged from 12 to 28 minutes (*M* = 19.05 minutes, *SD* = 5.07), while 28.95% of participants (n = 11) never scheduled a phone call to begin coaching, and 2.63% (n = 1) opted to begin coaching over email instead. On average, coaches spent 32.92 minutes (*SD* = 18.14) emailing each participant. Overall, approximately 52 minutes of total coaching time (phone and email) was required per participant on average.

**Outcome Analyses**

 Random slopes were found to significantly improve the fit of models for all dependent variables (*p*s < .05) and were consequently retained.

 The interaction of time and condition significantly predicted SI-R total (the pre-specified primary outcome), SI-R Difficulty Discarding, SI-R Excessive Acquisition, SDS total, SDS Social/Leisure, SDS Family/Home, CGI-I, GHQ-12, and VQ Progress, with superior outcomes for the ACT website condition relative to the waitlist (see Table 4). Time by condition did not significantly predict SIR Clutter or SDS Work using Holm-adjusted p-values.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Outcome | Time *β* | Condition *β* | Time\*Condition *β* | Holm-adjusted *p* value | Baseline CGI-I *β* |
|  |  |  |  |  |  |
| SI-R Total | -0.59\*\*\* | 0.04 | -0.74\* | 0.01 | 0.14 |
| SI-R Difficulty Discarding | -0.46\*\* | 0.11 | -0.74\* | 0.02 | 0.07 |
| SI-R Excessive Acquisition | -0.51\*\*\* | -0.05 | -0.78\*\* | 0.004 | 0.16 |
| SI-R Clutter | -0.53\*\*\* | 0.05 | -0.45 | 0.23 | 0.11 |
| SDS Total | -0.28\* | -0.05 | -0.73\*\* | 0.003 | 0.05 |
| SDS Work/School | -0.15 | -0.04 | -0.57 | 0.12 | 0.03 |
| SDS Social | -0.17 | -0.02 | -0.90\*\*\* | 0.0008 | 0.13 |
| SDS Home/Family | -0.33\* | 0.07 | -0.66\* | 0.04 | 0.08 |
| CGI-I | -0.17 | 0.44\* | -1.42\*\*\* | 0.00009 |  |
| GHQ | 0.45\* | -0.17\* | 1.14\*\* | 0.003 | -0.29\*\*\* |
| VQ Progress | 0.09 | -0.03 | 0.91\*\* | 0.003 | -0.35\*\*\* |

*Notes*. \**p* < 0.05, \*\**p* < 0.01, \*\*\**p* < 0.001. Time is coded as 0 = Baseline, .67 = Posttreatment, 1 = Follow-up. Condition is coded as 0 = Waitlist, 1 = ACT.

**Table 4**. ***Time by Condition Models***

 These models indicate that the ACT condition improved by 1.33 SD on SI-R total, 1.20 SD on SI-R Difficulty Discarding, 1.29 SD on SI-R Excessive Acquisition, 0.98 SD on SI-R Clutter, 1.01 SD on SDS total, 0.72 SD on SDS Work, 1.07 SD on SDS Social/Leisure, 0.99 SD on SDS Family/Home, 1.59 SD on CGI-I, 1.59 SD on GHQ-12, and 1.00 SD on VQ Progress from baseline to follow-up. In contrast, the waitlist condition improved by 0.59 SD on SI-R total, 0.46 SD on SI-R Difficulty Discarding, 0.51 SD on SI-R Excessive Acquisition, 0.53 SD on SI-R Clutter, 0.27 SD on SDS Total, 0.15 SD on SDS Work, 0.17 SD on SDS Social/Leisure, 0.33 SD on SDS Family/Home, 0.17 SD on CGI-I, 0.44 SD on GHQ-12, and 0.08 SD on VQ Progress from baseline to follow-up.

**Treatment Response**

By posttreatment, 34.61% of participants in the ACT condition had achieved reliable change(n = 9). This was not a statistically significant difference compared to rates of reliable change in the waitlist condition (c2(1) = 1.45, Holm-corrected *p* = 0.92). Additionally, only 11.54% of participants in the ACT condition achieved clinically significant change by posttreatment (n = 3). Rates of clinically significant change were also equivalent between the ACT condition and waitlist at posttreatment (c2(1) = 0.00, *p* = 1.00).

Post-hoc exploratory analyses were conducted evaluating reliable and clinically significant change at follow-up. At this timepoint, 64.00% of participants in the ACT condition (n = 16) achieved reliable change, which was not significantly different to the waitlist condition (c2(1) = 5.30, Holm-corrected *p* = .14). Finally, 37.04% of participants in the ACT condition (n = 10) achieved clinically significant change by follow-up, which was not significantly different from waitlist (c2(1) = 1.67, Holm-corrected *p* = .1)

**Discussion**

In the current study, we examined the acceptability and efficacy of an ACT self-help website for hoarding, *Making Space*. The primary reason for using an online-delivered format was to increase accessibility of the intervention, especially for people living in rural areas or far from healthcare providers experienced in treating hoarding. In addition, the format of the website may have the secondary effect of circumventing treatment barriers related to affordability and beliefs about need for self-reliance (Robertson et al., 2020).

Participants in the ACT condition on average reported improvement relative to waitlist across nearly all outcomes measured including hoarding severity, functioning, well-being, and valued action over the course of the study, consistent with findings from a previous multiple baseline trial that supported the efficacy of ACT for hoarding disorder (Ong et al., 2021). There were no significant differences between groups on rates of reliable and clinically significant change at posttreatment or follow-up. Together, this pattern of results suggests that the treatment was effective overall but lacks evidence for reliable and clinically significant change (rates in other studies range from 25 to 43%; Tolin et al., 2015). It is possible that the website may be limited in the degree of change evoked, which is similar to findings for online ACT interventions for other concerns (Thompson et al., 2021). Thus, it may be more useful as an introduction to treatment—especially for people without easy access to individual or group therapy—which is then followed up with more intensive treatment à la a stepped care model.

Using the website as an initial intervention may be particularly important for providing psychoeducation and exposure to psychological skills, increasing users’ amenability to evidence-based treatment later on. Additionally, it may be useful in future research to identify moderators that predict treatment response when using online interventions for hoarding, to help guide decision-making. Despite limitations to the degree of change, it is promising that improvements generalized across a range of important outcomes, including not only hoarding symptoms but also overall well-being and progress toward personal values, which is consistent with the primary aims of ACT.

 On average, our sample reported that treatment was acceptable and the coaching component was useful. The additional accountability afforded by regular coaching may have been helpful for keeping participants on track and clarifying any confusion with the website. However, these participants appear to have been in the minority as we observed a completion rate of 13.2 % for the full treatment (44.7% completed at least half of the treatment), indicating that most participants did not fully engage with the treatment as designed. It could be that the ratio of self-directed to guided content was inadequate for bolstering engagement and other forms of accountability may have been helpful for boosting retention (e.g., weekly meetings with other study participants).

 The low completion rate is not surprising as adherence has been a noted problem in both past hoarding studies (Steketee et al., 2000; Tolin et al., 2007) and web-based interventions broadly (Kelders et al., 2012). At the same time, people with significant hoarding symptoms have reported a preference for low-intensity remote interventions (Robertson et al., 2020). It is notable that adherence was not related to change in hoarding symptoms; however, previous self-help trials have also found that adherence is not always necessary for improvement (Farvolden et al., 2005). The nonsignificant relationship between adherence and improvement could also be due to low power or to the impact of the COVID-19 pandemic. Future research should assess adherence in more depth (e.g., measuring time spent practicing skills between sessions) and examine potential predictors of adherence such as baseline motivation and inattention. It will also be important to evaluate potential methods for improving adherence, such as increasing the initial focus on values clarification to facilitate motivation, involving supportive friends or family in reinforcing progress and encouraging adherence, combining regular online peer support with this program, or integrating reminders into users’ phones or calendars.

It is difficult to compare attrition in this study with those in other trials because most studies to date examined individual therapy, group therapy, or peer-led self-help groups, all of which incorporate stronger accountability measures (e.g., meeting with a therapist face-to-face, reporting back to other group members). In addition to less accountability, it may be that the ability to choose among modules in our website was challenging or aversive to participants, given that inattention and indecisiveness are common in hoarding (Frost, Tolin, et al., 2011; Tolin & Villavicencio, 2011). For instance, participants may have gotten distracted or felt overwhelmed by the multiple options available to them. If this is the case, a more directed treatment plan, at least initially, may do a better job of supporting treatment engagement.

**Limitations**

 A major limitation of this study is the use of a waitlist control; it is unclear how efficacy would compare to an active treatment, and RCTs that use waitlist controls generally have larger effect sizes than those that employ other types of controls (Furukawa et al., 2014). Data for this study were collected during the COVID-19 pandemic, which may have uniquely affected participants’ functioning. While we found that the pandemic had mixed effects on study participation (easier for some, more challenging for others), it may be difficult to quantify its overall impact on participants’ lives and concomitant effects on their research participation. For example, the isolation imposed by quarantine and physical distancing requirements might have exacerbated a sense of loneliness that was not captured by current measures. In addition, the low completion rate makes it challenging to determine exactly how efficacious the website would be if more people engaged with it as designed. On one hand, this could indicate poor ability of the website to keep users engaged. On the other hand, it is possible that low engagement was related to the pandemic rather than website content. Thus, we cannot be certain of the generalizability of our findings and replication attempts post-pandemic are needed.

Additionally, while this sample was slightly more racially diverse than is common in hoarding research (Muroff et al., 2010, 2011), participants were largely non-Hispanic White and female, similar to past hoarding intervention studies (Muroff et al., 2011; Tolin et al., 2015), and replication of these findings among diverse individuals is essential. Finally, participants were not formally diagnosed with hoarding disorder. This may have been helpful in reaching individuals who face barriers to accessing professional treatment, but limits our ability to determine whether this intervention is adequate for the treatment of clinical hoarding disorder.

 This study evaluated an online self-help ACT intervention with supportive coaching for hoarding. Despite adherence that fell below benchmarks, the results suggested such an intervention holds significant promise. Improvements occurred across nearly all outcomes of interest for those in the ACT condition relative to the waitlist, including not only hoarding symptoms, but functional impairment, well-being, and values progress. Additionally, the intervention was perceived as credible and acceptable. This intervention has the potential to help provide efficacious hoarding treatment while overcoming barriers of access, cost, and stigma.

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