The Efficacy and Feasibility of Web-Based Acceptance-Enhanced Behavioral Treatment for Trichotillomania in Adults: A Randomized Waitlist-Controlled Trial

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THE EFFICACY AND FEASIBILITY OF WEB-BASED ACCEPTANCE-ENHANCED BEHAVIORAL TREATMENT FOR TRICHOTILLOMANIA IN ADULTS:
A RANDOMIZED WAITLIST-CONTROLLED TRIAL

by

Leila K. Capel

A thesis submitted in partial fulfillment of the requirements for the degree of
MASTER OF SCIENCE
in
Psychology

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UTOAH STATE UNIVERSITY
Logan, Utah

2022
ABSTRACT

The Efficacy and Feasibility of Web-Based Acceptance-Enhanced Behavioral Treatment for Trichotillomania in Adults: A Randomized Waitlist-Controlled Trial

by

Leila K. Capel, Master of Science
Utah State University, 2022

Major Professor: Michael P. Twohig, Ph.D.
Department: Psychology

Treatment access for those with trichotillomania is limited by several issues including professionals’ lack of knowledge of the disorder, proximity to providers, and financial constraints. Acceptance and commitment therapy-enhanced behavioral therapy (AEBT) has been implemented using telehealth to reach a larger population in adults (42.2% symptom decrease pre-to-post treatment) and adolescents (a significant decrease of symptom severity and a large group difference pre- to post-treatment; Hedges’ g = 1.55), but telehealth still requires therapist time and incurs notable costs (). This study aimed to address the gap in trichotillomania treatment accessibility by examining the feasibility and efficacy of a web-based AEBT treatment for adults with trichotillomania across the U.S. We created an eight-module asynchronous program that was completed over 8 weeks. The effects of the website were compared to a waitlist control group with 81 adults with trichotillomania. Results of this study demonstrated statistically significant
decreases in trichotillomania symptom severity, total distress, depression, and stress from pre- to post-treatment and gains were maintained at follow-up. Additionally, trichotillomania-specific psychological flexibility and quality of life significantly improved pre- to post-treatment and at follow-up. Interestingly, anxiety did not significantly decrease between conditions but did significantly decrease across time. Of participants in the treatment condition, 52.78% met treatment responder status from pre- to post-treatment and 30.5% met responder status from pre-treatment to follow-up. Implications of these findings are discussed.
The Efficacy and Feasibility of Web-Based Acceptance-Enhanced Behavioral Treatment for Trichotillomania in Adults: A Randomized Waitlist-Controlled Trial

Leila K. Capel

Trichotillomania, or chronic hair pulling, impacts several aspects of a person’s everyday life and functioning including making it difficult to fully engage in school, work, romantic relationships, and other social relationships. There are several treatment options for trichotillomania and one that is particularly promising is acceptance and commitment therapy-enhanced behavioral therapy (AEBT). Several studies have been done in person and through telehealth and this treatment has helped participants.

Many people in the U.S. struggle with trichotillomania but many people are not able to access treatment for their hair pulling because clinicians are not available in their area, clinicians are not trained to help with hair pulling, and the financial burden of therapy on the individual. Telehealth has helped individuals to access clinicians, but it still causes a financial burden to access telehealth services. This study was designed to test a web-based treatment, that could be accessed from anywhere, that delivered AEBT through a fully automated, modular system to address all barriers and limitations to accessing treatment. The treatment was tested against a waitlist condition (delayed access to treatment) in a sample of 81 adults in the U.S. with trichotillomania. Results are discussed.
ACKNOWLEDGMENTS

I want to thank the Huntsman Foundation for supporting the development of the website used in this study. Additionally, I want to thank my committee members for all your support and encouragement. Finally, I want to thank my family, especially my mom, brother, and sister-in-law for always supporting me and believing in me throughout this process even when I doubted myself.

Leila K. Capel
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CHAPTER I
INTRODUCTION

Trichotillomania is characterized by hair pulling that is repetitive in nature, leads to notable hair loss, causes clinically significant distress, and results in impairment across social and functional domains (American Psychiatric Association [APA], 2013). Social and functional impairments caused by trichotillomania include disruptions in close relationships, difficulty in pursuing occupational changes or advancement, and interference with schooling (Grant et al., 2017; Woods, Flessner, Franklin, Wetterneck, et al., 2006). The standard treatment of trichotillomania has traditionally been Habit Reversal Training (HRT; Twohig, Bluett, et al., 2014). Another form of treatment that is gaining empirical support is Acceptance and Commitment Therapy (ACT) which has been studied in four randomized controlled trials, one studying ACT as a standalone treatment (Lee, Homan, et al., 2018), and three examining ACT combined with HRT also known as acceptance and commitment therapy-enhanced behavior therapy (AEBT; Lee, Haeger, et al., 2018; Woods, Wetterneck, et al., 2006) in adolescents and adults. All treatments demonstrated efficacy in decreasing pulling severity.

The prevalence of trichotillomania in the U.S. is 1-2% of the population and yet treatment access is limited by many issues including professionals’ lack of knowledge of the disorder, proximity to a clinician, and financial constraints (Walther et al., 2010). AEBT has been implemented using telehealth to reach a larger population in adults (42.2% symptom decrease pre-to-post treatment; Lee, Haeger, et al., 2018) and adolescents (a significant decrease of symptom severity and a large group difference pre-
to post-treatment Hedges’ $g = 1.55$; Twohig et al., 2021), but telehealth still requires therapist time and incurs notable costs (Lee, Haeger, et al., 2018). This study aimed to address the gap in trichotillomania treatment accessibility by examining the feasibility and efficacy of a fully automated, web-based AEBT treatment for adults with trichotillomania across the United States compared to waitlist control. We predicted that hair pulling severity would significantly decrease by engagement in treatment compared to waitlist controls. We also predicted that psychological flexibility and quality of life, which have been shown to be related to trichotillomania, would improve through treatment.
CHAPTER II
REVIEW OF THE LITERATURE

Defining Trichotillomania

Trichotillomania is characterized by hair pulling that is repetitive in nature. This condition leads to notable hair loss and causes clinically significant distress and impairments across social and functional domains (APA, 2013). The social impairment of trichotillomania includes negative impact on close relationships, reduced likelihood of pursuing occupational changes or advancement, and interference with schooling (Grant et al., 2017; Woods, Flessner, Franklin, Wetterneck, et al., 2006). As a result, quality of life is often negatively impacted (Odlaug et al., 2010).

Typical age of onset for trichotillomania is 13 years old (Mansueto et al., 1997) and often fluctuates in severity over time (Stein et al., 1999). Prevalence rates of trichotillomania range from 1-2% in adults and adolescents in the U.S. (APA, 2013; Duke et al., 2010). Previously, trichotillomania was thought to be more commonly diagnosed in women, with research suggesting a ratio of 3-9 females for every male diagnosed with trichotillomania (Christenson et al., 1994). A recent study suggested that diagnosis and prevalence rates are more equal across genders however, women are more likely to seek treatment (Grant et al., 2020).

There are two types of pulling, automatic and focused. Automatic pulling occurs outside of awareness and typically happens when the individual is immersed in another task (Christenson et al., 1994). Focused pulling is when an individual engages in pulling
intentionally and often is used to control internal sensations (Christenson et al., 1994). Both types of pulling typically occur for all people with trichotillomania. The two pulling types can occur separately, or in combination, such as when the individual notices they are pulling during an automatic pulling episode, and then begins engaging in focused pulling (Woods & Twohig, 2008). As a result, many individuals find it difficult to differentiate between the types of pulling they engage in. Research has previously examined whether the different subtypes of pulling require a different treatment approach, however results of a recent study by Grant and Chamberlin (2021) suggested that the subtypes may not have clinical utility.

In addition to social and functional impairments caused by hair pulling, there are also physical difficulties that arise from pulling. Many people who pull like to inspect and manipulate the hair after pulling (Rapp et al., 2000), 48-77% of people like to place the hair near or in their mouth and approximately 5-18% of people eat the hair (Christenson & Mansueto, 1999). Eating the hair can result in trichobezoars, which is the formation of a mass of hair and food in the intestine which may require surgical removal and can lead to weight loss, anemia, pain, vomiting, distension, and steatorrhea among other medical conditions (Phillips et al., 1998). Other medical concerns that result from hair pulling include scalp irritation, carpal tunnel, muscle fatigue, and atypical hair regrowth (Keuthen et al., 2001). In a study examining the impact of trichotillomania in adults, 70% reported feeling as though trichotillomania had led them to develop more psychiatric concerns (Woods, Flessner, Franklin, Keuthen, et al., 2006). Trichotillomania is associated with comorbid psychiatric disorders including major depression in
approximately 35-55%, anxiety disorders in 50-70%, substance use disorder in 22-35%, and history of eating disorders in 20% of individuals (Christenson et al., 1991, 1994).

Despite prevalence rates of trichotillomania and associated impacts across physical, social and functional domains, treatment is not widely available or understood; nor is there widespread knowledge of resources for referral if needed (Marcks et al., 2006).

**Treatment of Trichotillomania**

Treatment for Trichotillomania has been using Habit Reversal Training (HRT) or a combined cognitive intervention with HRT such as Dialectical Behavior Therapy (DBT; Flessner, Busch, et al., 2008; Keuthen et al., 2011, 2012), or Acceptance and Commitment Therapy (ACT; Lee, Homan, et al., 2018).

A core of the treatment for trichotillomania is HRT and has been studied in adults and children (Twohig, Morrison, et al., 2014). HRT helps build awareness of the antecedents to pulling and builds competing responses for moments where urges to pull are strong. Self-monitoring includes building awareness around when urges to pull are high. Treatments for trichotillomania can also include stimulus control, which involves identifying what in the environment makes it more likely for the individual to engage in pulling and then removing or altering those stimuli (e.g., removing a mirror from the hallway or sitting in a different seat when watching TV). This treatment has been shown to be effective at reducing pulling, however gains during treatment are not always maintained at follow-up assessment (Rogers et al., 2014).
DBT-enhanced cognitive-behavioral treatment has been examined as a treatment for trichotillomania in adults. DBT presents four types of skills; emotion regulation, distress tolerance, mindfulness, and interpersonal effectiveness to help manage internal experiences associated with pulling in addition to the behavioral strategies taught using HRT. In a randomized controlled trial by Keuthen et al. (2012), participants demonstrated significant improvement in pulling severity ($z = 5.02, p < .001$), pulling related impairment ($z = 4.40, p < .001$), ability to regulate emotions ($z = 4.43, p < .001$), experiential avoidance ($z = 2.38, p < .02$), anxiety ($z = 3.56, p < .001$) and depression ($z = 2.83, p < .01$); these results were partially maintained at follow-up (Keuthen et al., 2012). This study demonstrates preliminary efficacy of this treatment approach.

Longitudinal data from an open trial by Keuthen et al. (2010) showed maintained treatment gains at 3- and 6-month follow-up with 5 of 10 participants meeting responder status and 4 of 10 participants meeting partial responder status (Keuthen et al., 2010). These findings suggest that this combined treatment approach helps to maintain gains over time.

While these current treatments are relatively effective in the treatment of trichotillomania in adults and adolescents there are still notable gaps in the maintenance of treatment gains. AEBT is shown to target psychological inflexibility. This is a logical approach to provide a treatment that targets core components of trichotillomania found to be related to hair pulling severity.

**Psychological Flexibility in Trichotillomania**

Psychological inflexibility refers to when a person sees their thoughts and internal
experiences as what governs their lives and prevents them from living a meaningful life. Individuals with trichotillomania who also have high psychological inflexibility tend to believe that they have to engage with their urges to pull instead of engaging with their valued activities. There is empirical evidence supporting an association of psychological inflexibility with trichotillomania (Begotka et al., 2004; Houghton et al., 2014).

Psychological inflexibility has been found to be correlated with hair pulling severity and urges to pull (Begotka et al., 2004). Findings suggest that psychological inflexibility may be a risk factor for higher levels of impairment due to trichotillomania-related symptoms (Alexander et al., 2017; Houghton et al., 2014). This suggests that treatments that specifically target psychological inflexibility in trichotillomania may be beneficial to reduce symptom severity.

Psychological inflexibility has been shown in cross sectional studies to mediate trichotillomania symptom severity and treatment outcomes. Studies have demonstrated that psychological flexibility mediates trichotillomania symptom severity and treatment outcomes (Bluett et al., 2014; Houghton et al., 2014). Additionally, psychological inflexibility is associated with increased pulling severity, pulling urges, and distress related to pulling (Bluett et al., 2014; Lee, Homan, et al., 2018; Twohig, Morrison, et al., 2014).

There is further supporting evidence that psychological inflexibility mediates the relationship between hair pulling severity and affect (Houghton et al., 2014; Norberg et al., 2007). In a study examining the role of psychological inflexibility in trichotillomania, depression and anxiety predicted trichotillomania-related psychological inflexibility and
hair pulling (Houghton et al., 2014).

Psychological inflexibility is typically measured using the Acceptance and Action Questionnaire-II (AAQ-I; Bond et al., 2011) but this measure has not been shown to be as reliable as a disorder specific measure (Houghton et al., 2014). As a result, a trichotillomania specific measure was created called the Acceptance and Action Questionnaire-Trichotillomania (AAQ-TTM) and has been shown to be reliable and valid (Houghton et al., 2014). Additionally, it has demonstrated clinical specificity compared to the AAQ-II (Ong, Lee, Levin, et al., 2019) and has greater clinical utility (Houghton et al., 2014)

**ACT as a treatment for Trichotillomania**

ACT has growing empirical support as a treatment for trichotillomania (e.g., Twohig et al, 2021; Lee, Homan, et al., 2018) ACT is often used in conjunction with HRT and is called ACT enhanced behavior therapy (Woods & Twohig, 2008). This intervention delivers traditional HRT and adds components of skill building around targeted psychological processes to help individuals more adaptively respond to their hair pulling urges. As previously mentioned, most individuals engage in both focused and automatic pulling, albeit typically they engage in one more than the other (Flessner, Conelea, et al., 2008). The goal of AEBT is to address both focused and automatic hair pulling types in trichotillomania (Woods & Twohig, 2008). The 10-session AEBT treatment begins with HRT and then transitions to ACT-focused sessions. This combined treatment is equipped to target both types of pulling because it implements both HRT and ACT. HRT is used to target automatic pulling and ACT targets focused pulling by
increasing valued living and psychological flexibility (Woods & Twohig, 2008). At this time, there are eight studies examining combined AEBT and one randomized control trial examining the efficacy of ACT as a standalone treatment for trichotillomania with adults. Please see Table 1 for a summary of these efficacy trials.

Table 1

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<th>Study design</th>
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<tr>
<td>Woods, Wetterneck, et al., 2006</td>
<td>In-person</td>
<td>25</td>
<td>Randomized controlled trial</td>
<td>Decreased symptom severity, impairment, experiential avoidance, and anxiety, and depressive symptoms.</td>
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<td>Twohig &amp; Woods, 2004</td>
<td>In-person</td>
<td>6</td>
<td>Multiple baseline</td>
<td>Clinically significant change in # of hairs pulled and maintained at 3-month follow-up for 4 of 6 participants.</td>
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<td>Crosby et al., 2012</td>
<td>In-person</td>
<td>5</td>
<td>Multiple baseline</td>
<td>88.7% reduction in pulling, maintained by 2 participants, partially maintained by 2 participants, and one returned to baseline level of pulling</td>
</tr>
<tr>
<td>Haaland, 2017</td>
<td>In-person (group)</td>
<td>53</td>
<td>Multiple baseline</td>
<td>Clinically significant reduction in pulling severity, maintained by 60% of participants at follow-up</td>
</tr>
<tr>
<td>Lee, Homan, et al., 2018</td>
<td>In-person</td>
<td>39</td>
<td>Randomized controlled trial</td>
<td>Clinically significant decrease in hair pulling severity and increase in psychological flexibility</td>
</tr>
<tr>
<td>Lee, Haeger, et al., 2018</td>
<td>Telehealth</td>
<td>22</td>
<td>Randomized controlled trial</td>
<td>Clinically significant decrease in symptom severity, and increase in psychological flexibility</td>
</tr>
<tr>
<td>Twohig et al., 2021</td>
<td>Telehealth</td>
<td>28</td>
<td>Randomized controlled trial</td>
<td>Clinically significant decrease in symptom severity and a moderate increase in psychological flexibility</td>
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In the first study examining combined ACT and HRT, there were twenty-five participants with trichotillomania. The participants were split into treatment and waitlist conditions. Results of these 10 sessions, in-person study demonstrated significantly reduced symptom severity ($d = 1.81$), impairment ($d = 1.58$) and experiential avoidance (13% reduction pre-to-post treatment), anxiety (8% reduction pre-to-post) and depressive...
(8% pre-to-post) symptoms compared to the control group (Woods, Wetterneck, et al., 2006). The results of this study provided preliminary evidence that the intervention is efficacious for adults with trichotillomania.

In another study, combined ACT and HRT was evaluated in-person with six adults with trichotillomania using two multiple baseline designs. For four of the participants, the daily number of hairs pulled was significantly reduced and at the three-month follow-up, these results were maintained for three of the four participants. For the remaining two participants, clinically significant change was not observed (Twohig & Woods, 2004). These results provide preliminary evidence that the intervention was acceptable.

An eight-session, in person combined ACT and HRT program was evaluated with five adults with trichotillomania using a multiple baseline design. The participants all demonstrated high pulling severity at pre-treatment and the intervention resulted in 88.7% reduction in pulling from pre- to post-treatment; these gains were maintained at 3-month follow-up for 2 participants, half of treatment gains were maintained by 2 participants, and one participant returned to pre-treatment levels at follow-up (Crosby et al., 2012). These results replicate prior results supporting the relative efficacy of AEBT as a treatment of trichotillomania.

AEBT for trichotillomania has also been studied in a group treatment setting in Finland. This study had 53 participants with trichotillomania placed into groups of 3-7 participants with two therapists facilitating each group in an in-person setting. The treatment followed the AEBT manual (Woods & Twohig, 2008). Each group met three
hours weekly over the course of 10 weeks. Results showed clinically significant reduction in symptom severity, after treatment 87.5% of participants no longer met criteria for trichotillomania, this was maintained by 60% of participants at one year follow-up (Haaland, 2017). AEBT is the nationalized treatment for trichotillomania in Finland and led to the translation of the treatment manual.

One study examined the efficacy of ACT without combined behavioral treatment. The study examined ACT as a treatment for trichotillomania in adults and adolescents. The study used 39 participants and randomized them into treatment and waitlist conditions. The treatment consisted of 10, in-person sessions of ACT and results showed clinically significant decreases in symptom severity and hairs pulled daily from pre- to post-treatment (39.4%; Lee, Homan, et al., 2018).

In a study examining the efficacy of teletherapy for trichotillomania, AEBT intervention was examined in adults. The study had 22 participants randomized into treatment and waitlist groups. The results showed significant decrease in hair pulling severity from pre-to post treatment (42.2% decrease) and psychological flexibility significantly increased (71.9%; Lee, Haeger, et al., 2018)

In the most recent study of AEBT delivered through telehealth, 28 adolescents with trichotillomania were randomized into treatment and waitlist conditions. Results indicated that pulling severity decreased significantly through treatment (Hedge’s $g = .85$) accompanied by a moderate increase in psychological flexibility from pre-to post-treatment (Hedge’s $g = -.53$; Twohig et al., 2021).

In summary, AEBT has shown efficacy in a variety of formats, group and
individual as well as delivered in-person and through telehealth for adults. There is preliminary data supporting its efficacy for treating adults and adolescents. Evidence suggests that the core processes targeted through ACT, specifically psychological inflexibility, is particularly beneficial in treatment of trichotillomania. This makes AEBT a logical and compelling treatment option for trichotillomania. However, treatment accessibility through these formats can be difficult.

**Treatment Accessibility**

In the last decade there has been increased awareness of the social, physical and functional impairment caused by trichotillomania. However, there are still significant issues with the accessibility of these treatments due to lack of awareness of evidence-based treatments by clients and clinicians, availability and proximity to trained clinicians, and the financial burden of seeking treatment (Woods, Flessner, Franklin, Wetterneck, et al., 2006).

To address access barriers like proximity to trained clinicians, AEBT has been studied using teletherapy (Lee, Haeger, et al., 2018; Twohig et al., 2021). To address barriers around cost, one study examined a stepped care model of treatment. This intervention included multiple phases of treatment: one that involved a web-based HRT, and the second phase that involved in-person HRT. The first phase of treatment used a web-based self-help format to deliver HRT. Participants then opted to participate in the second phase which included eight sessions of in-person HRT. Results for the first step provided preliminary evidence that a web-based self-help format would be efficacious for
the treatment of trichotillomania but had a small effect size \( (d = .21; \text{Rogers et al., 2014}).\)

These studies have made an effort to increase accessibility of treatment for trichotillomania. However, despite these modalities’ ability to increase the number of people that can receive treatment at a given time, the requirement of therapist time and cost associated with these options remain significant. There is still a need for greater treatment accessibility for rural communities and communities that do not have expert clinicians for treatment of trichotillomania. One solution to this issue could be web-based treatment delivery.

**Web-Based Interventions as a Solution to Accessibility Barriers**

One method to increase treatment accessibility that has not yet been fully explored is a web-based application for treatment of trichotillomania. Web-based treatments have been studied in a variety of populations including agoraphobia (Alcañiz et al., 2003), smoking cessation (Bricker et al., 2013), trauma (Fiorillo et al., 2017), chronic tinnitus (Jasper et al., 2014) and has been studied in a transdiagnostic setting to treat a variety of disorders (Levin et al., 2017), hoarding disorder (Krafft, 2021) perfectionism (Ong, Lee, Krafft, et al., 2019) and a stepped care model for trichotillomania (Rogers et al., 2014). ACT in a web-based format has been studied in a variety of populations (Lappalainen & Lappalainen, 2020). The websites are designed using short (15-20 minute) modules where the individual is provided information in an interactive and engaging format and then homework is assigned to practice the skills learned during the session. Brief phone check-ins are used to provide participants with
technical support and plan module completion. Check-ins are empirically supported by previous research to promote program engagement (Richards & Richardson, 2012; Spek et al., 2007). This treatment modality addresses barriers to treatment accessibility including proximity to clinicians, travel, and financial concerns. Thousands of people can access a website at any given time while delivering information from expert clinicians.

A web-based self-help treatment is a logical solution to treatment barriers and accessibility for trichotillomania. This study aimed to address the gap in trichotillomania treatment accessibility by examining the feasibility and efficacy of a web-based ACT-enhanced behavior treatment for adults with trichotillomania and to assess if addressing processes around psychological flexibility can improve treatment outcomes.

The current study aimed to develop and test an AEBT website for trichotillomania in an effort to address the following questions.

1. Is an AEBT self-help website an effective treatment for trichotillomania? The primary outcomes are hair pulling severity and psychological inflexibility. The secondary outcomes are quality of life and distress, stress, depression, and anxiety.

2. Is an AEBT self-help website feasible? This will be measured through treatment adherence, reports of usability, and treatment evaluations.
CHAPTER III

METHODS

This study examined the efficacy of an AEBT self-help website for trichotillomania assessed by a randomized waitlist-controlled trial.

Participants

Participants were recruited via advertising on google ads, Facebook trichotillomania groups, and Reddit trichotillomania group pages. Participants were included in the study if they (a) met the DSM-5 criteria for trichotillomania; (b) were searching for trichotillomania-based treatment (c) were at least 18 years old at intake; and (d) were fluent English speakers. Participants were excluded from the study if they (a) were modifying or starting psychotropic medication; (b) were living outside the United States, (c) were under the age of 18, (d) did not at time of intake session, meet DSM-5 diagnostic criteria for trichotillomania.

To determine the number of participants to include in the study, a power analysis using G*Power software was conducted (Faul et al., 2007). This study is the first to examine a web-based treatment for trichotillomania therefore, a between group effect size ($d = .4$) was assumed, power was set at .8 and alpha was set at .05 specifying a sample of 80. See Figure 1 for participant flowchart.
Figure 1

*Participant Flowchart*

Procedures

The current study was reviewed by the Utah State University Institutional Review Board. During the intake session, which was conducted over Zoom, informed consent, and baseline assessment of hair pulling severity was completed. Participants were then randomized into the treatment or delayed treatment waitlist condition. Conducting intake
sessions in this fashion ensures that all participants were truly interested in the study versus someone who is signing up for other reasons (e.g., signing up to receive compensation). Participants placed in the treatment group then completed the eight-module web-based treatment program and assessments (described below). Participants in the waitlist group completed assessments at mid-waitlist and post-waitlist; all participants will complete assessments following completion of the fourth week after their intake session, after the eighth week, and at a 12-week follow-up. Assessment timing was yoked to when the participant specifically started treatment due to uncertainties and variability in the speed of module progress. Participants received weekly check-ins via telephone to assess module progress and establish plans for completing consecutive modules. All treatment, excluding Zoom-based intake and phone-based weekly check-ins, utilized the web-based treatment site. Participants completed treatment on their home computers, other available computers, or using their tablets or smartphones. The web-based platform is HIPAA compliant and all assessments were completed using an online survey tool (Qualtrics).

**Intervention**

The intervention consisted of eight, 20- to 30-minute modules developed based on the empirically supported ACT-enhanced behavior therapy manual (Woods & Twohig, 2008). Module 1 was an introduction to the program and psychoeducation. Module 2 introduced stimulus control. Module 3 addressed competing responses and behavioral techniques to manage pulling. Module 4 introduced values as motivation for change.
Modules 5 and 6 introduced acceptance and defusion skills. Module 7 built upon values, acceptance, and defusion strategies. Module 8 reviewed treatment and relapse prevention.

Phone check-ins were completed weekly. See Table 2 for an outline of the treatment.

**Table 2**

*Treatment Outline Developed From Trichotillomania Treatment Manual*

<table>
<thead>
<tr>
<th>Module</th>
<th>Description</th>
<th>Exercises and Session Content</th>
</tr>
</thead>
</table>
| 1      | Psychoeducation and treatment overview | − discuss use of web-based application  
− psychoeducation on trichotillomania  
Homework: track pulling over the next week |
| 2      | Habit Reversal Training-Stimulus control | − setting up surroundings for success  
− identifying tools and settings where pulling is more likely to occur.  
Homework: track pulling and modify environment to make it harder to pull. |
| 3      | Habit reversal training-making fists | − explaining competing responses  
− practicing making fists  
Homework: making fists every time experiencing urges |
| 4      | Values | − using values as motivation for treatment and making difficult changes  
− Tombstone exercise  
Homework: track number of hairs pulled; implement cognitive skill |
| 5-6    | Acceptance and Defusion | − introduce acceptance and defusion  
− willingness  
− thoughts are separate from actions  
− passengers on the bus  
Homework: track number of hairs pulled; implement cognitive skill |
| 7      | Values, acceptance and defusion | − review values, acceptance and defusion  
Homework: track number of hairs pulled; implement cognitive skill |
| 8      | Review | − Review what was learned  
− Review areas that are important to remember and continue to use |
|        | Relapse Prevention | − Discussion of lapse vs relapse  
− Discuss how to notice when individual is moving back toward old behaviors |
|        | Celebrate completion | − Celebrate progress and accomplishments |

Measures

Screening Measures

**Eligibility Questions**

Prior to the baseline assessment, participants were asked questions about eligibility for participation in the study. Questions included participants’ age, if they are seeking help for trichotillomania, if they were living in the U.S., and if they were currently or if they planned to add or modify psychotropic medications during the course of the study. Additionally, a semistructured diagnostic interview was used to assess if participants met diagnostic criteria for trichotillomania. If they met eligibility criteria participants completed the informed consent and baseline assessment.

*Diagnostic Interview for Anxiety, Mood, and Obsessive-Compulsive and Related Neuropsychiatric Disorders*

The Diagnostic Interview for Anxiety, Mood, and Obsessive-Compulsive and Related Neuropsychiatric Disorders (DIAMOND; Tolin et al., 2016) is a semistructured diagnostic interview designed to assess for DSM-V psychiatric disorders in adults (ages 18 and above). The interview is administered in approximately one hour. For this study, only the trichotillomania section was administered and took approximately 10 minutes per participant. The DIAMOND has good inter-rater reliability, test-retest reliability, and convergent and divergent validity (Tolin et al., 2018)
Outcome Measures Administered at Baseline, Mid-, Post-Treatment, and Follow-Up

The Massachusetts General Hospital Hair Pulling Scale (MGH-HPS; Keuthen et al., 1995). The MGH-HPS assesses urges to pull, pulling behavior, and the distress caused by pulling through a seven-item self-report measure. Items are rated individually on a scale from 0-4 and then the total scale is summed from 0- to 28-point total score. Higher scores indicate greater hair pulling severity. An example item from this scale is “On an average day, how often did you feel the urge to pull.” Treatment response is indicated by a seven-point reduction in score (Houghton et al., 2015). The MGH-HPS demonstrates good internal consistency (Keuthen et al., 1995), test-retest reliability and convergent and divergent validity (O’Sullivan et al., 1995). In the present sample, internal consistency was good (Cronbach’s alpha = 0.79).

The Mental Health Continuum Short Form (MHC-SF; Lamers et al., 2011) is a 14-item self-report questionnaire assessing emotional, psychological, and social well-being. Items are rated on a Likert type scale from 0 (never) to 5 (every day). Higher scores indicate greater well-being across these domains. The MHC-SF has demonstrated excellent validity and reliability (Lamers et al., 2011). In the present sample, internal consistency was excellent (Cronbach’s alpha 0.90).

The Depression, Anxiety, Stress Scale-21 Items (DASS-21; Lovibond & Lovibond, 1995) is a shortened version of the DASS, which is a 42 item self-report questionnaire. The DASS-21 measures negative emotional states, specifically depression, anxiety, and stress. Each item is rated on a Likert-type scale of 0 (did not apply to me at all) to 3 (applied to me very much, or most of the time). The DASS-21 demonstrates
good validity and reliability (Henry & Crawford, 2005). In the present sample, internal consistency was good (Cronbach’s alpha = 0.87).

**Process Measure Administered at Baseline, Mid-, Post-Treatment, and Follow-Up**

*The Acceptance and Action Questionnaire for Trichotillomania* (AAQ- TTM; Houghton et al., 2014) assesses psychological flexibility through a nine-item self-report measure designed for individuals with trichotillomania. Each item is rated from 1 (never true) to 7 (always true) and totals range from 7-63 points, higher scores indicate less psychological flexibility. The AAQ-TTM has good internal consistency (Houghton et al., 2015) and good convergent and divergent validity (Bond et al., 2011). In the present sample, the internal consistency at pre-treatment was considered unacceptable (Cronbach’s alpha = 0.66). However, at all other time-points, the internal consistency was good (Cronbach’s alpha = 0.79).

**Measures Administered at Baseline**

*Demographics.* Participants were asked questions about age, sex assigned at birth, gender, race, ethnicity, and zip code.

**Acceptability Measures Administered at Post-Treatment**

The *System Usability Scale* (SUS; Tullis & Albert, 2008) measures the usability of technology-based systems using a 10-item self-report measure. Items are rated from 1 (strongly disagree) to 5 (strongly agree). Items are modified to refer to self-help website for trichotillomania. The SUS demonstrates good reliability and validity (Tullis & Albert,
2008). This measure will be administered only to participants who use the website.

The *Treatment Evaluation Inventory-Short Form* (TEI-SF; Kelley et al., 1989) assesses treatment acceptability using a 9-item self-report measure. The 7-item version is used to be relevant in an adult treatment study, another item will be modified to refer to “hair pulling” rather than “anxiety”. This version of the TEI-SF has been used in previous research (Twohig et al., 2010). Each item is rated from 1 (strongly disagree) to 5 (strongly agree). The TEI-SF demonstrates good reliability and validity (Kelley et al., 1989). This measure will be administered only to participants who used the website.

*Treatment adherence and engagement* was assessed; based on previous trials of trichotillomania, attrition rates ranged from 0-35%, therefore, if 65% of participants completed all modules and questionnaire assessments that indicated good adherence and engagement.

**Statistical Analyses**

Analyses for the present study were conducted in R version 3.6.3 (R. C. Team, 2020) in R Studio (R. Team, 2020) using the following packages: tidyverse (Wickham, 2017), lme4 (Bates et al., 2015), texreg (Leifeld, 2013), cowplot (Wilke, 2018), effects (Fox & Weisberg, 2019), effsize (Torchiano, 2017), psych (Revelle, 2018), and furniture (Barrett & Brignone, 2017).

To assess within and between-group differences over time, multilevel models were used for seven outcomes: trichotillomania related psychological inflexibility (AAQ-TTM), trichotillomania severity (MGH-HPS), quality of life (MHC-SF), distress (DASS-
21 Total), stress (DASS-21 Stress), depression (DASS-21 Depression), and anxiety (DASS-21 Anxiety). The primary outcomes of this study were trichotillomania symptom severity and psychological flexibility. The other outcomes are secondary but important in understanding treatment outcomes and wellbeing.

For both primary and secondary outcomes, four nested models were created to assess the best fitting model by comparing each model to the previous model. Each outcome was fitted starting with the null model, which looked only at random intercepts. Then we added additional fixed effects to each subsequent model. We added a fixed effect of time only in the second model, condition only in the third model, and then an interaction of time and condition in the fourth model.

When comparing models to identify the best fitting model, each model was compared to the last best fitting model (e.g., null model to time only) using likelihood ratio tests at \( p < .05 \). Maximum likelihood criterion was used to estimate the final models and unstandardized coefficients are reported for each best-fitting model.

Hedges’ \( g \) effect sizes were calculated for between-group differences from pre- to post-treatment and pre-treatment to follow-up. Additionally, we assessed within-group change in the treatment group from pre- to post-treatment and pre-treatment to follow-up to assess treatment response. The following values were used as benchmarks: 0.2 is a small effect, 0.5 is a medium effect, and 0.8 is a large effect.

Percentage change in pulling was used to assess responder status on hair pulling severity in the treatment group. Therefore, if pulling was reduced by 45% (Houghton et al., 2015), that indicated significant change and responder status. Treatment adherence
was assessed by number of modules completed by all participants, therefore if 65% or more of participants completed all modules, this was considered good treatment adherence. To assess treatment feasibility and usability, descriptive statistics were used.

One participant was not included in the data analyses due to completing the pre-treatment survey and then contacting the research team to be removed from the study at the request of their medical doctor. All other participants were included in the data analyses (see Figure 2 for consort diagram).

**Figure 2**

*CONSORT Diagram for Participant Flow in the Full Sample*
CHAPTER 4

RESULTS

The participant sample was primarily White, non-Hispanic, females. Participant demographics are reported in Table 3. Means, standard deviations, within-group and between group effect sizes are reported in Table 4. Effect sizes for between and within group differences are reported in Table 5. For the best fitting models of all outcomes, the regression coefficients and 95% confidence intervals are reported in Table 6.

Table 3

Demographics for the Entire Sample and By Condition

<table>
<thead>
<tr>
<th>Demographic</th>
<th>Entire sample (N = 81)</th>
<th>Group ACT (n = 13)</th>
<th>Waitlist (n = 13)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (SD)</td>
<td>30.62 (7.87)</td>
<td>30.53 (7.36)</td>
<td>30.55 (8.46)</td>
</tr>
<tr>
<td>Gender (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Man</td>
<td>8.64</td>
<td>14.63</td>
<td>2.5</td>
</tr>
<tr>
<td>Woman</td>
<td>86.42</td>
<td>80.49</td>
<td>92.50</td>
</tr>
<tr>
<td>Agender</td>
<td>1.23</td>
<td>0</td>
<td>2.50</td>
</tr>
<tr>
<td>Non-binary</td>
<td>3.70</td>
<td>4.88</td>
<td>2.50</td>
</tr>
<tr>
<td>Sex at birth (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>7.41</td>
<td>12.20</td>
<td>2.50</td>
</tr>
<tr>
<td>Female</td>
<td>92.59</td>
<td>87.80</td>
<td>97.50</td>
</tr>
<tr>
<td>Race (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White or Caucasian</td>
<td>67 (82.72)</td>
<td>36 (87.80)</td>
<td>31 (77.50)</td>
</tr>
<tr>
<td>Hispanic</td>
<td>1 (1.23)</td>
<td>1 (2.44)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Black</td>
<td>1 (1.23)</td>
<td>1 (2.44)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Biracial</td>
<td>3 (3.70)</td>
<td>3 (7.32)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Asian</td>
<td>9(11.11)</td>
<td>0 (0)</td>
<td>9 (22.5)</td>
</tr>
<tr>
<td>Ethnicity (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White/Non-Hispanic</td>
<td>63 (77.78)</td>
<td>37 (90.24)</td>
<td>25 (62.50)</td>
</tr>
<tr>
<td>Hispanic/Latinx</td>
<td>4 (4.94)</td>
<td>1 (2.44)</td>
<td>3 (7.50)</td>
</tr>
<tr>
<td>Black</td>
<td>1 (1.23)</td>
<td>1 (2.44)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Biracial</td>
<td>1 (1.23)</td>
<td>1 (2.44)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Asian</td>
<td>10 (12.35)</td>
<td>1 (2.44)</td>
<td>9 (22.50)</td>
</tr>
<tr>
<td>Prefer Not to Answer</td>
<td>2 (2.47)</td>
<td>0 (0)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Demography (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rural</td>
<td>17 (21)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban</td>
<td>63 (78)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Table 4

**Means and Standard Deviations of Outcome Measures for Full Sample**

<table>
<thead>
<tr>
<th></th>
<th>Treatment</th>
<th></th>
<th></th>
<th></th>
<th>Waitlist</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre-treatment (n = 40)</td>
<td>Mid-treatment (n = 40)</td>
<td>Post-treatment (n = 40)</td>
<td>One month follow-up (n = 40)</td>
<td>Pre-treatment (n = 40)</td>
<td>Mid-treatment (n = 40)</td>
<td>Post-treatment (n = 40)</td>
<td>One month follow-up (n = 40)</td>
</tr>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>AAQ-TTM</td>
<td>45.2</td>
<td>7.5</td>
<td>38.2</td>
<td>7.2</td>
<td>35.2</td>
<td>8.1</td>
<td>34.7</td>
<td>7.4</td>
</tr>
<tr>
<td>MGH-HPS¹</td>
<td>17.9</td>
<td>4.4</td>
<td>12.5</td>
<td>5.5</td>
<td>10.9</td>
<td>5.5</td>
<td>11.9</td>
<td>5.6</td>
</tr>
<tr>
<td>MHC-SF</td>
<td>50.3</td>
<td>13.0</td>
<td>53.7</td>
<td>13.3</td>
<td>54.2</td>
<td>14.8</td>
<td>55.7</td>
<td>14.7</td>
</tr>
<tr>
<td>DASS-21</td>
<td>20.1</td>
<td>9.2</td>
<td>18.1</td>
<td>8.4</td>
<td>14.2</td>
<td>9.6</td>
<td>14.4</td>
<td>9.0</td>
</tr>
<tr>
<td>DASS-21 S</td>
<td>9.5</td>
<td>4.4</td>
<td>8.6</td>
<td>4.0</td>
<td>6.7</td>
<td>4.2</td>
<td>6.7</td>
<td>3.9</td>
</tr>
<tr>
<td>DASS-21 D</td>
<td>5.8</td>
<td>4.3</td>
<td>5.2</td>
<td>4.0</td>
<td>4.6</td>
<td>4.4</td>
<td>4.8</td>
<td>4.3</td>
</tr>
<tr>
<td>DASS-21 A</td>
<td>4.8</td>
<td>3.4</td>
<td>4.3</td>
<td>3.4</td>
<td>2.9</td>
<td>2.8</td>
<td>3.0</td>
<td>2.9</td>
</tr>
</tbody>
</table>

**Note.** AAQ-TTM = Acceptance and Action Questionnaire-Trichotillomania, MGH-HPS = Massachusetts General Hospital- Hair Pulling Scale, MHC-SF= Mental Health Continuum Short Form, DASS-21 = Depression, Anxiety, Stress Scale- 21 Items, DASS-21 S = DASS-21 Stress subscale, DASS-21 D= DASS-21 Depression subscale, DASS-21 A= DASS-21 Anxiety subscale.

¹Higher scores indicate greater severity.
Table 5

Hedges’ g Effect Sizes Within ACT Condition and Between Groups Across Timepoints for Full Sample

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Pre- to post-treatment</th>
<th>Post-treatment to follow-up</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Within-group&lt;sup&gt;1&lt;/sup&gt;</td>
<td>Between-groups</td>
</tr>
<tr>
<td>AAQ-TTM</td>
<td>-1.256</td>
<td>-0.324</td>
</tr>
<tr>
<td>MGH-HPS</td>
<td>-1.375</td>
<td>-0.271</td>
</tr>
<tr>
<td>MHC-SF</td>
<td>0.184</td>
<td>-0.29</td>
</tr>
<tr>
<td>DASS-21</td>
<td>-0.665</td>
<td>-0.233</td>
</tr>
<tr>
<td>DASS-21 Stress</td>
<td>-0.697</td>
<td>-0.122</td>
</tr>
<tr>
<td>DASS-21 Depression</td>
<td>-0.312</td>
<td>-0.578</td>
</tr>
<tr>
<td>DASS-21 Anxiety</td>
<td>-0.593</td>
<td>0.030</td>
</tr>
</tbody>
</table>

Note. AAQ-TTM = Acceptance and Action Questionnaire- Trichotillomania, MGH-HPS = Massachusetts General Hospital- Hair Pulling Scale, MHC-SF= Mental Health Continuum Short Form, DASS-21 = Depression, Anxiety, Stress Scale- 21 Items, DASS-21 Stress = DASS-21 Stress subscale, DASS-21 Depression= DASS-21 Depression subscale, DASS-21 Anxiety= DASS-21 Anxiety subscale.

1 Within treatment group.

Trichotillomania-Related Psychological Inflexibility

For trichotillomania related psychological inflexibility (AAQ-TTM), a significant time and condition interaction was found, indicating a greater decrease in psychological inflexibility in the treatment condition than the waitlist condition over time ($\beta = 0.49$).

See Figure 3 for estimated marginal means of the best fitting model. The within group effect sizes from pre-treatment to post-treatment and pre-treatment to follow-up were large (Hedges’ g = -1.256 to -1.394). The between group effect sizes from pre-treatment to post-treatment and pre-treatment to follow-up were small (Hedges’ g = -0.32 to -0.324).
### Table 6

*Estimated Marginal Means and 95% Confidence Intervals From Best-Fitting Multilevel Models*

<table>
<thead>
<tr>
<th>Domain</th>
<th>AAQ-TTM</th>
<th>MGH-HPS</th>
<th>MHC-SF</th>
<th>DASS-21 Total</th>
<th>DASS-21 Stress</th>
<th>DASS-21 Depression</th>
<th>DASS-21 Anxiety</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>95% confidence interval</td>
<td>Mean</td>
<td>95% confidence interval</td>
<td>Mean</td>
<td>95% confidence interval</td>
<td>Mean</td>
</tr>
<tr>
<td>Intercept</td>
<td>43.65</td>
<td>41.44; 45.85*</td>
<td>16.35</td>
<td>14.88; 17.82*</td>
<td>874.98</td>
<td>815.95; 934.02*</td>
<td>19.86</td>
</tr>
<tr>
<td>Week</td>
<td>-0.86</td>
<td>-1.03; -0.69*</td>
<td>-0.50</td>
<td>-0.65; -0.36*</td>
<td>5.34</td>
<td>2.07; 8.60*</td>
<td>-0.50</td>
</tr>
<tr>
<td>Condition</td>
<td>1.04</td>
<td>-2.07; 4.16</td>
<td>1.82</td>
<td>-0.25; 3.89</td>
<td>16.31</td>
<td>-67.11; 99.73</td>
<td>1.35</td>
</tr>
<tr>
<td>Week x condition</td>
<td>0.49</td>
<td>0.25; 0.72*</td>
<td>0.42</td>
<td>0.22; 0.62*</td>
<td>-6.04</td>
<td>-10.56; -1.51*</td>
<td>0.45</td>
</tr>
<tr>
<td>BIC</td>
<td>1999.13</td>
<td>1853.45</td>
<td>3740.67</td>
<td>2149.04</td>
<td>1657.09</td>
<td>1684.50</td>
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<tr>
<td>Number of observations</td>
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<td>306</td>
<td>298</td>
<td>306</td>
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<td>306</td>
<td>306</td>
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<tr>
<td>Number of participants</td>
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<td>80</td>
<td>80</td>
<td>80</td>
<td>80</td>
<td>80</td>
</tr>
</tbody>
</table>

*Null hypothesis value outside the confidence interval.*
Trichotillomania Severity

For trichotillomania severity (MGH-HPS), a significant time and condition interaction was found, indicating a greater decrease in severity in the treatment condition than in the waitlist condition over time ($\beta = 0.42$). See Figure 3 for estimated marginal means of the best fitting model. The within group effect sizes from pre-treatment to post-treatment and pre-treatment to follow-up were large (Hedges’ $g = -1.19$ to -1.38). The between group effect sizes from pre-treatment to post-treatment and pre-treatment to follow-up were small (Hedges’ $g = -0.27$ - -0.34).

On the MGH-HPS, a treatment responder is considered by a 45% or seven-point reduction (Houghton et al., 2015). In the treatment condition, from pre-treatment to post-treatment, 52.78% of participants had clinically significant reduction in symptoms and met responder status criteria. From pre-treatment to follow-up, 30.5% of participants had clinically significant reduction in symptoms or met responder status criteria.

Quality of Life

For quality of life (MHC-SF), a significant time and condition interaction was found which indicates that there was a greater increase in quality of life in the treatment condition than in the waitlist condition over time ($\beta = -6.04$). See Figure 4 for estimated marginal means of the best fitting model. The within group effect size from pre-treatment to post-treatment was negligible (Hedges’ $g = 0.18$). The within group effect size from pre-treatment to follow-up was small (Hedges’ $g = 0.37$). The between group effect sizes from pre-treatment to post-treatment and pre-treatment to follow-up were small (Hedges’ $g = -0.29$ – -0.33).
Figure 3

Estimated Marginal Means and Standard Error Ribbons from Best-Fitting Model for AAQ-TTM and MGH-HPS Scores at $p < .05$
Figure 4

*Estimated Marginal Means and Standard Error Ribbons from Best-Fitting Model for MHC-SF Scores at p < .05*
Distress

For distress (DASS-21), a significant time and condition interaction was found which indicates that there was a greater decrease in distress in the treatment condition than in the waitlist condition over time ($\beta = 0.45$). The within group effect sizes from pre-treatment to post-treatment and pre-treatment to follow-up were medium (Hedges’ $g = -0.61$ to 0.67). The between group effect sizes from pre-treatment to post-treatment and post-treatment to follow-up were small (Hedges’ $g = -0.23$ to -0.27).

Stress

For stress (DASS-21 Stress subscale), a significant time and condition interaction was found which indicates that there was a greater decrease in stress in the treatment condition than in the waitlist condition over time ($\beta = 0.27$). The within group effect sizes from pre-treatment to post-treatment and pre-treatment to follow-up were medium (Hedges’ $g = -0.68$ to -0.70). The between group effect sizes from pre-treatment to post-treatment and pre-treatment to follow-up were negligible (Hedges’ $g = -0.122$ to -0.19).

Depression

For depression (DASS-21 Depression subscale), a significant time and condition interaction was found which indicates that there was a greater decrease in depressed mood in the treatment condition than in the waitlist condition over time ($\beta = 0.06$). The within group effect sizes from pre-treatment to post-treatment and pre-treatment to follow-up were small (Hedges’ $g = 0.22$ to -0.31). The between group effect sizes from pre-treatment to post-treatment and pre-treatment to follow-up were medium (Hedges’ $g$
Anxiety

For anxiety (DASS-21 Anxiety subscale), a significant time and condition interaction was not found. A significant fixed effect of time was found which indicates that there was no difference in anxiety based on condition, but over time anxiety symptoms decreased ($\beta = -0.10$). The within group effect sizes from pre-treatment to post-treatment and pre-treatment to follow-up were medium (Hedges’ $g = -0.55$ to $-0.59$). The between group effect sizes from pre-treatment to post-treatment and pre-treatment to follow-up were negligible (Hedges’ $g = 0.03$ to $0.12$). See Figure 5 for the estimated marginal means for distress and subscale outcomes.

Feasibility and Adherence

Treatment feasibility was assessed using the TEI-SF and SUS. Acceptable scores were based on pre-determined benchmarks (21 or higher on the TEI-SF and 72 or higher on the SUS (Bangor et al., 2008; Twohig et al., 2006). In this study, the mean score on the TEI-SF was 26.5 ($SD = 4.6$). This indicates that the treatment was acceptable. In this study, the mean score of the SUS was 84.9 ($SD = 14.9$) indicating a good to excellent score for usability of the website.

Treatment adherence was also assessed. Based on previous trials of trichotillomania, attrition rates range from 0-35%, therefore, good treatment adherence and engagement was indicated if 65% of participants complete all modules. Of the participants in the treatment group, 34 participants (85%) completed all 8 modules, 3
Figure 5

Estimated Marginal Means and Standard Error Ribbons from Best-Fitting Model for DASS-21 and Subscale (Stress, Depression, Anxiety) Scores at \( p < .05 \)
participants (7.5%) completed 3 of the 8 modules, and 3 participants (7.5%) completed one or fewer modules. This indicates good adherence and engagement with the treatment.

Brief qualitative responses from participants indicated that overall, participants found the website to be helpful and easy to use. Several participants reported that they felt understood and validated by the language used in the website. Similarly, participants noted that the website was clear and concise making it more accessible. Several participants also stated that the language felt relatable and accurate to the lived experience of pulling. Additionally, participants reported that scenarios or examples of when urges might show up helped to make the information easily applicable.

Phone check-ins were used to enhance treatment adherence and engagement. Participants in the treatment condition completed 85% of the weekly phone check-ins. All eight weekly check-ins were completed by 47.5% of participants. Seven of the eight check-ins were completed by 25% of participants. Six of eight check-ins were completed by 15% of participants. Finally, 12.5% completed five or fewer check-ins.

Additionally, engagement and adherence to the questionnaires was also assessed. Questionnaire completion was based on the total sample; 100% of participants completed the baseline assessment, 96% of participants completed the mid assessment, 96% completed the post assessment, and 91% of participants completed the follow-up assessment (see Figure 2). Again, this indicates good adherence and engagement in the study.
CHAPTER V
DISCUSSION

The present study aimed to examine the efficacy and feasibility of implementing a fully automated AEBT website for adults with trichotillomania through a randomized waitlist control trial. Results of this study showed significant time and condition interactions on all outcome variables except for anxiety. The research implications of the present study are numerous and contribute to the current literature.

Trichotillomania-Related Psychological Inflexibility and Symptom Severity

Trichotillomania-related psychological inflexibility decreased in the treatment condition significantly more than the waitlist condition. We hypothesized that trichotillomania-related psychological inflexibility would decrease throughout treatment; the results of this study are consistent with this prediction. Trichotillomania specific psychological flexibility is associated with trichotillomania symptom severity, and previous research has suggested that it may also be correlated with higher levels of impairment and symptom severity which makes changes in the AAQ-TTM clinically useful (Houghton et al., 2014). Previous research has mixed findings for the effect of AEBT on psychological inflexibility. For example, in a trial by Woods et al. (2006) examining AEBT for adults in an in-person trial, experiential avoidance, which is the process that prevents an individual from being psychologically flexible by avoiding internal sensations or discomfort, decreased by 13% from pre- to post-treatment (Woods,
Wetterneck, et al., 2006). In the trial by Lee et al. (2018), examining AEBT for adults in a telehealth trial, the effect of treatment on psychological inflexibility throughout treatment was significant which is consistent with the findings in this study. However, in a trial by Twohig et al (2021), examining AEBT for adolescents in a telehealth trial, there was not a significant effect of psychological inflexibility. The variation in results could be due to small sample sizes in the Twohig et al. (2021) study. It could also indicate a difference in response to targeting psychological flexibility based on participant age.

Trichotillomania symptom severity decreased in the treatment condition significantly more than the waitlist condition. Of participants who completed the treatment, 52.78% met treatment responder status from pre- to post-treatment and 30.5% met treatment responder status from pre-treatment to follow-up. We hypothesized that symptom severity would decrease throughout treatment and the results of this study are consistent with this hypothesis. Previous research has similar findings to the present study. For example, Crosby et al. (2012) found significant reduction in pulling from pre- to post-treatment. In the trial by Lee et al. (2018), symptom severity decreased significantly through treatment delivered via telehealth (Lee et al., 2018). Similarly, the trial by Twohig et al (2021) found a significant decrease in symptom severity for adolescents also delivered through telehealth. In both trials, gains were maintained at follow-up (Twohig et al, 2021; Lee et al., 2018). In the present study, gains were maintained at follow-up, however there was an increase in pulling between post-treatment and follow-up. Based on reports from participants, many did not revisit the website between ending treatment and the follow-up assessment which may explain the
increase in pulling symptoms at follow-up. Additionally, several participants contacted the research team requesting access to the treatment again to review and/or complete the program for a second time.

Well-Being

Well-being increased in the treatment condition significantly more than the waitlist condition which is consistent with our prediction. These findings are consistent with theoretical understandings of ACT. ACT supports participants to engage in valued-living even in the presence of uncomfortable or unpleasant thoughts, feelings, or sensations (Hayes et al., 1999). This in turn increases well-being because of engagement with aspects of an individual’s life that are important to them (Lee et al., 2018). In the study by Lee et al., measures of shame (Experience of Shame Scale) and quality of life (Quality of life Scale) were given. Perceived shame significantly decreased through treatment however, quality of life did not increase (Lee et al, 2018). This could be due to sample size and duration of the study. Another factor to consider is the measure that was used to assess quality of life. For example, the Quality of Life Scale (QOLS), used in the study by Lee et al., has mixed results around sensitivity to change in the duration of a treatment study (Buckhardt & Anderson, 2003) Alternatively, the Mental Health Continuum Short Form (MCH-SF) is more sensitive to change and improvements in well-being which is a factor in quality of life and is more commonly used in recent papers (e.g. Twohig et al., 2021). In the present study, well-being improved from pre-treatment to post-treatment and was maintained at follow-up. The effect size was negligible pre- to
post-treatment but was small pre-treatment to follow-up. The duration of the study could explain this change and the discrepancy with previous research on the effect of treatment on well-being.

**Stress, Depression, Anxiety**

Total distress decreased in the treatment condition significantly more than the waitlist condition. Stress decreased in the treatment condition significantly more than the waitlist condition. Depression also decreased in the treatment condition significantly more than the waitlist condition. For anxiety, condition was not a significant predictor of change, however, over time anxiety decreased. The findings for total distress, stress, and depression are consistent with our prediction that distress, depression, and stress would decrease through treatment. The finding for anxiety is not what we expected. However, because of the high comorbidity rates of anxiety disorders with trichotillomania and the targeted nature of this treatment, it is logical that these symptoms were not directly impacted by the treatment. Additionally, it is possible that due to the sample size, there was not enough power to detect the change. Previous research has examined anxiety and depression as comorbid conditions for individuals with trichotillomania (e.g., Grant et al., 2017; Woods et al., 2006) and has suggested that comorbid conditions may have impacts on treatment (Grant et al., 2017). One study by Keuthen et al. (2012) examining DBT combined with HRT, found significant change in anxiety and depression symptoms over the course of treatment. However, previous studies on AEBT for trichotillomania have not examined the effect of treatment on comorbid conditions. The findings from this
study suggest that AEBT helps to benefit symptoms of depression, stress, and overall distress. Perhaps with a longer duration treatment, anxiety symptoms would also be significantly improved.

**Feasibility and Adherence**

Feasibility and usability of the website both were in the good to excellent range indicating good engagement and retention throughout the treatment program. Adherence and engagement were measured through module completion. Most participants completed all modules (85% of participants) and a small portion completed half of the modules or less (15% of participants). This indicates good adherence and engagement.

This study also provides preliminary evidence for the feasibility of AEBT delivered through a website. Technology based research has increased over the last decade across a variety of disorders and has been efficacious for agoraphobia (Alcañiz et al., 2003), smoking cessation (Bricker et al., 2013), trauma (Fiorillo et al., 2017), chronic tinnitus (Jasper et al., 2014), in transdiagnostic settings (Levin et al., 2017), and a website was also tested as part of a stepped care model for trichotillomania (Rogers et al., 2014). The findings from the Rogers et al. trial suggested that the website treatment benefited participants as part of a multi-step treatment (e.g., having both a website and in-person treatment). However, prior to the present study, a website had never been tested as a standalone treatment modality for trichotillomania. The findings of this study provide a strong contribution to technology-based research and preliminary evidence that this is a feasible modality of treatment delivery.
Clinical Implications

The clinical implications of the present study are numerous and significant. Research in other treatment modalities had demonstrated that while engaging in treatment, hair pulling symptoms would decrease but often these gains were not maintained (e.g., Keuthen et al., 2012; Rogers et al. 2014). This study provides preliminary support for a treatment that has demonstrated longer lasting gains following treatment and has greater improvements in quality of life for participants. Based on qualitative reports of participants in this study, evidence-based treatment is difficult to find and often leaves the participant reporting increased self-stigma for engaging in pulling behaviors. Several participants noted that the shame around pulling makes it difficult to seek treatment because of the desire to keep their pulling a secret. Based on the number of people who reported interest in this study within a one-month recruitment period, the need, or desire for treatments delivered in this way appears significant.

Access and Reach

One of the primary limitations of in-person delivered treatment is that these services are only available to individuals who reside in a state with a licensed clinician, have access to transportation, and financial resources to access in-person services. Similarly with telehealth delivered services, individuals must reside in the state of the licensed clinician, have reliable and private internet access, and financial resources to access telehealth services. Alternatively, to access a website requires internet which can be accessed in a public setting like the library, is a significantly smaller fee which occurs
once rather than weekly, and can be accessed by thousands of people at any given time. Previous research has demonstrated that access to clinicians providing evidence-based care for trichotillomania is limited, but this is notably limited for individuals residing in rural areas (Lee et al., 2018; Wood et al., 2006). Rural is defined by the U.S. Census Bureau (2010) as “less than 500 people per square mile and places with fewer than 2,500 people.” In this study, 21% of participants were residing in rural areas at time of enrollment. The present study provides evidence that this treatment is effective and feasible to deliver through this modality and provides a reasonable solution to barriers like financial constraints, travel, continued treatment while moving, or proximity to a providing clinician.

**Clinical Utility**

The clinical utility of web-delivered treatments is significant. First, this treatment could be used as a first step before more intensive treatment. If a client’s willingness to engage in treatment is low, a website may help to increase their willingness by providing a first look at treatment that is less of a financial burden and time commitment. Further, if a client is seeking in-person or telehealth services and the waitlists for providers are long, a website could be recommended in the interim. Finally, this website could be used as a standalone treatment and does not need to be used in conjunction with in-person or telehealth services depending on client need and readiness for change.

**Limitations and Future Directions**

This study had several limitations. First, the sample is primarily female. While
previous literature has suggested that trichotillomania occurs more in females than in males (Christenson et al., 1994). It A recent study suggested that prevalence rates are equal across sex, but more females seek services than males (Grant et al., 2020) Future research should seek to have a more evenly distributed sample. Additionally, this sample was primarily White and future research should focus on obtaining a more heterogenous sample. Of note, in treatment seeking samples, race and ethnic distributions are often predominantly White and this is represented in research samples (Grant et al., 2020). There is currently limited research examining if this is representative of trichotillomania prevalence in the population at large.

Another limitation of this study is that recruitment occurred entirely through trichotillomania specific pages on Reddit and Facebook. While the recruitment occurred quickly and reached a large number of people, the sample was limited to these two platforms which limits the people who may have seen the study advertised and may have contributed to a predominantly female sample. This also limits participants to a help-seeking sample who were already utilizing online support forums and who may have been in a position to easily use a website compared to someone calling into a clinic. Future research should seek to recruit through a variety of forums to ensure more groups are being reached.

**Conclusion**

In sum, this study provides evidence for the efficacy and feasibility of implementing a website delivering AEBT for adults with trichotillomania. Participants in
the treatment condition reported significant improvement in hair pulling symptoms, psychological flexibility, quality of life, total distress, stress, and depression as compared to the waitlist group. Despite the limitations mentioned above, this study adds to the literature supporting AEBT as a potential treatment for trichotillomania and is the first study to provide preliminary evidence supporting its efficacy when delivered through a fully-automated website. These findings have a variety of compelling research and clinical implications which include providing treatment that is accessible across rural and urban areas and is not limited by finances or proximity to a providing clinician. This would increase the number of people who are able to access treatment at a given time and increases the number of people that are able to receive evidence-based care.
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