The beliefs in Trichotillomania Scale (BiTS): factor analyses and preliminary validation

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The Beliefs in Trichotillomania Scale (BiTS): Factor Analyses and Preliminary Validation

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Abstract

Objectives: The role of cognitions and beliefs in trichotillomania (TTM; hair pulling disorder) has been the subject of only limited investigation. This study aimed to develop and validate the Beliefs in TTM Scale (BiTS). **Methods**: A pool of 50 items based upon themes identified in previous research was administered online to 841 participants with and without self-reported problematic, non-cosmetic hairpulling behaviours. **Results**: Exploratory and confirmatory factor analyses conducted in randomly split-halves of the sample supported retention of 14 items comprising three factors; negative self-beliefs, low coping efficacy and perfectionism. **Conclusions**: The BiTS demonstrated satisfactory psychometric properties and all three subscales significantly correlated with greater hairpulling severity. Negative self-beliefs predicted hairpulling severity over-and-above mood symptoms, suggesting the importance of addressing self-construals in psychological treatments for TTM. Validation in a clinician diagnosed sample is required.

Practitioner Points

- Research supports cognitive therapies for treating trichotillomania (hair pulling disorder), although studies investigating the nature and role of cognitions and beliefs in this disorder have been lacking
- This study developed and validated a self-report measure of three styles of beliefs most relevant to trichotillomania: negative self-beliefs, low coping efficacy and perfectionism
- Negative self-beliefs predicted the severity of trichotillomania symptoms over-and-above depression and anxiety, suggesting such cognitions may not necessarily be due to comorbidities
- Future research should validate the new measure in a clinician diagnosed sample, and therapies for trichotillomania may be enhanced by targeting shame specifically

Trichotillomania (TTM) is a distressing disorder characterised by repetitive hairpulling, typically from the scalp, eyebrows and eyelashes, causing hair loss (American Psychiatric Association [APA], 2013). Two popular models attempt to explain the development and maintenance of TTM; one, the behavioural perspective suggests that, via classical and operant conditioning processes, internal and external situational factors elicit hair-pulling urges and maintain symptoms over time; especially for unconscious, “automatic” hairpulling (e.g., Azrin & Nunn, 1973; Mansueto, Stemberger, Thomas, & Golomb, 1997). Two, the emotion regulation hypothesis (e.g., Roberts, O’Connor, & Bélanger, 2013; Shusterman, Feld, Baer, & Keuthen, 2009) proposes that individuals with TTM are predisposed to emotion dysregulation. Individuals with TTM therefore engage in hairpulling – especially intentional, “focused” hairpulling – as a method of controlling the intensity and quality of their emotional experience (Arabatzoudis, Rehm, Nedeljkovic, & Moulding, 2017). Support for both models is strengthening, particularly in the form of outcomes from psychological treatments that directly target these behavioural and emotion-regulation processes (McGuire et al., 2014; Slikboer, Nedeljkovic, Bowe, & Moulding, 2017).

Essential to cognitive-behavioural models of psychopathology is the proposition that behaviours and emotions are influenced by one’s interpretations of and beliefs about events. Psychological treatments for most other disorders that are putatively-related to TTM (e.g., obsessive-compulsive disorder, body-dysmorphic disorder, tic disorders) are guided by comprehensive, testable, and evidence-based cognitive-behavioural models of disorder onset and maintenance (O’Connor, 2002; Wilhelm, Phillips, & Steketee, 2015). Arguably, there is currently no equivalent, comprehensive cognitive-behavioural model of TTM, as the role of cognitions and beliefs in eliciting and maintaining hair-pulling episodes has been the subject of limited investigation (Rehm et al., 2016). Candidate beliefs proposed for incorporating into comprehensive cognitive-behavioural models of TTM have included perfectionism, self-control and self-efficacy, permission-giving cognitions, and negative self-evaluations (Franklin & Tolin, 2007; Gluhoski, 1995; Moulding, Mancuso, Rehm, & Nedeljkovic, 2016; Norberg, Wetterneck, Woods, & Conelea, 2007; Pélissier & O'Connor, 2004; Roberts, O'Connor, Aardema, & Bélanger, 2015).

In the absence of strong evidence for the nature and strengths of relationships between dysfunctional beliefs and TTM, cognitive-behavioural treatment (CBT) protocols for TTM have nevertheless been developed and found to significantly reduce TTM severity (e.g., Toledo, De Togni Muniz, Brito, de Abreu, & Tavares, 2014). Most recently, Keijsers, Maas, van Opdorp and van Minnen (2016) developed a cognitive therapy protocol that specifically targeted dysfunctional cognitions about (lack of) self-control in relation to hairpulling urges and behaviour. Their selective focus on self-control cognitions was informed by clinical experience and the development of an associated self-report measure, which was validated in a sample of students with unwanted habits including hairpulling, nail-biting, skin-picking, and smoking (Maas, 2015). In a randomised controlled trial, adults with diagnosed TTM received six weeks of either cognitive therapy (n = 26) or behaviour therapy (n = 22). The behavioural therapy protocol was based upon habit-reversal therapy, which has shown efficacy for TTM in several studies (Falkenstein, Rogers, Malloy, & Haaga, 2014). Both treatments resulted in significant reductions in self-reported TTM severity, increased resistance against hairpulling urges, and reduced maladaptive self-control cognitions. Keijsers et al.'s findings offer the first evidence that a purely cognitive intervention can produce equivalent outcomes to behaviour therapy for TTM.

Conducting semi-structured qualitative interviews with eight women with TTM, [Authors] identified six beliefs that participants associated with their hairpulling episodes: (1) negative self-beliefs; (2) dysfunctional beliefs about control; (3) low self-efficacy regarding coping skills; (4) beliefs that negative emotions are "intolerable" and "unacceptable"; (5)

permission-giving cognitions; and (6) perfectionistic standards. This study provided in-depth descriptions of cognitions that had previously only been speculated to be relevant to TTM (e.g., Franklin & Tolin, 2007; Gluhoski et al., 1995). However, there were several limitations to this study, primarily being that the findings were derived from a small and homogeneous sample of educated, help-seeking females. Additionally, most participants (75%) had a comorbid mood disorder, which challenges the specificity of the identified beliefs to TTM. Quantitative research conducted in a large, diverse sample is required to clarify [Authors'] qualitative findings.

The aim of the present study was to develop and validate a measure of cognitions and beliefs associated with TTM (the Beliefs in Trichotillomania Scale; BiTS) using the six qualitative themes identified by [Authors] to guide item development. This study employed convenience and purposive internet sampling procedures to maximise participation rates among adults with varying severities of hairpulling behaviours. Participant data were randomly split to create separate datasets for two separate factor analyses; (1) exploratory and (2) confirmatory factor analyses were conducted to respectively derive and replicate the factor structure of the BiTS based on an original, extensive pool of items. Relationships between the BiTS factors and a range of indices were examined to determine the psychometric properties and construct validity of the new scale. We hypothesised that:

i. Exploratory factor analysis would support the extraction of six factors corresponding to the constructs identified in [Authors'] earlier qualitative study.
ii. Should each of the six qualitative constructs identified in [Authors] be represented in the exploratory factor analysis solution, construct validity would be supported by significant correlations between: (1) negative self-beliefs and Rosenberg Self-Esteem Scale (RSE) scores; (2) control beliefs and Anxiety Control Questionnaire-Revised (ACQ-R) scores; (3) low coping-efficacy and

Difficulties in Emotion Regulation Scale (DERS) scores and Distress Tolerance Scale (DTS) scores; (4) beliefs about negative emotions and Anxiety Acceptance Questionnaire-II (AAQ-II) scores; (5) permission-giving cognitions and Impulsive Behaviour Scale scores; and (6) perfectionistic standards and Obsessive Beliefs Questionnaire-44 (OBQ-44) perfectionism/certainty subscale scores.

iii. BiTS scores would differentiate between participants with and without self-reported hairpulling difficulties.

iv. BiTS scores would be significantly correlated with TTM symptoms, as measured by the Massachusetts Hospital Hair Pulling Scales (MGHHPS) and Milwaukee Inventory for Subtypes of Trichotillomania-Adult version (MIST-A), above-and-beyond symptoms of anxiety and depression.

Method

Participants and Procedure

The study protocol was approved by the Human Research Ethics Committee of the host institution. Participants were recruited through undergraduate psychology courses at the host institution in receipt of partial course credit (*N* = 250), and through online advertising to TTM-specific advocacy organisations and social media support forums (e.g., Anxiety Recovery Centre of Victoria; TLC Foundation for Body-Focused Repetitive Behaviors; "Trichotillomania Support Worldwide" Facebook page). Participants were eligible if they were aged 18 years or older. There were no exclusion criteria. After reading and agreeing to an online participant information and consent statement, participants proceeded to complete an online survey that was hosted on the *PsychSurveys* platform. Survey completion time was approximately 40 minutes. The survey was operational from September 2013 to June 2014, during which time, 2,313 participants had accessed it. Of those, 849 participants (36.7%) completed the survey. Six underage participants and two duplicate records were removed, resulting in a final sample of 841 participants.

All participants were asked, “Over the past 12 months, have you experienced difficulties with pulling out your hair or urges to pull out your hair for non-cosmetic purposes?” Participants who responded affirmatively were classified as hairpulling participants, while those who responded negatively were classified as control participants. Similar procedures for sampling participants with and without non-cosmetic hairpulling behaviours in online, student, and community settings have been utilised elsewhere (Bottesi et al., 2016; Duke et al., 2009; Duke, Keeley, Ricketts, et al., 2010; Shusterman et al., 2009). Of the 841 participants, 527 participants (62.7%) were classified as hairpulling participants. The remaining participants did not endorse this criterion and were therefore classified as control participants. Using the Statistical Package for the Social Sciences (SPSS v22), the total sample (N = 841) of hairpulling and control participants was randomly split to form two separate samples to conduct exploratory factor analysis (EFA) and confirmatory factor analysis (CFA). There were no significant demographic or symptom differences between the split EFA and CFA samples. When both samples were separated by group (i.e., hairpulling versus control), hairpulling participants were significantly older than control participants and there were a significantly greater proportion of females than males in the hairpulling groups than in the control groups, in both the EFA and CFA samples. Demographic characteristics of hairpulling and control participants in each sample are shown in Table 1.

Measures

Following questions about demographics and hairpulling characteristics, participants completed measures in the order specified below.

The MGHHPS (Keuthen et al., 1995; O'Sullivan et al., 1995) is 7-item self-report measure of the severity of hairpulling behaviours, urges, and distress in the previous week. Each item is rated on a 5-point Likert scale, where higher total scores indicate greater severity (possible range = 0 – 28, *M* = 14.74, *SD* = 7.02; reported in Keuthen et al., 1995). The MGHHPS has been found to have good internal consistency (α = .80) (Diefenbach, Tolin, Crocetto, et al., 2005). The MGHHPS completion rate among control participants was low (23%) as participants who denied difficulties with non-cosmetic hair-pulling were erroneously directed not to complete the MGHHPS.

The MIST-A (Flessner, Woods, et al., 2008) is a 15-item self-report measure of automatic and focused hairpulling styles. Each item is rated on a 10-point Likert scale. Higher total subscale scores reflect higher levels of focused and automatic hairpulling. Total score means were reported as 45.4 (*SD* = 16.2, possible range = 0 – 90) for the focused subscale, and 25.7 (*SD* = 9.04, possible range = 0 – 45) for the automatic subscale in an internet-surveyed sample of 1,697 participants with self-reported TTM symptoms (Flessner, Woods, et al., 2008). Both scales demonstrated adequate internal consistency (range of α = 0.73 – 0.77), and good construct and discriminant validity (Flessner, Woods, et al., 2008). In the current study, participants who did not endorse non-cosmetic hairpulling behaviours were not required to complete the MIST-A.

The BiTS – validated herein – was initially comprised of 53 items developed to reflect the six superordinate themes identified in [Authors' study]. Between six and eight items per theme were developed with the intention of retaining at least three items per factor in the final scale. Items were developed by the lead author who also conducted the qualitative interviews upon which themes were based. Feedback on item readability and relevance to the construct of each theme being referenced was provided by two experienced researchers familiar with obsessive-compulsive and related disorders (OCRDs). Three items were deleted for their ambiguous relation to the thematic construct in question, leaving 50 BiTS items (Appendix 1). The remaining items were amended as necessary to improve readability and reduce construct overlap. These final items were agreed upon with the input of a third researcher and were measured on a 7-point Likert scale ranging from 1 (*disagree very much*) to 7 (*agree very much*). There were no reverse-scored items.

The Depression Anxiety Stress Scales-21 (DASS-21; Lovibond & Lovibond, 1995) is a popular 21-item self-report scale that measures symptoms of depression, anxiety, and stress in clinical and non-clinical populations. Each subscale (depression, anxiety, stress) is comprised of seven items that are rated on a 4-point Likert scale, where higher total subscale scores reflect greater symptom severity. The DASS-21 subscales have demonstrated good internal consistency (range of $\alpha = 0.82 – 0.94$), divergent validity, and convergent validity in clinical and non-clinical samples (Antony, Bieling, Cox, Enns & Swinson, 1998; Henry & Crawford, 2005).

The OBQ-44 (OCCWG, 2001, 2005) is a self-report scale that measures beliefs associated with OCD rated on a 7-point Likert scale: responsibility/threat, perfectionism/tolerance for uncertainty, and importance/control of thoughts/control of thoughts. Only the 16-item perfectionism/certainty (PC) subscale was utilised in the current study. Higher scores reflect a greater need for PC. The PC subscale (possible range = 16 – 112, $M = 65.7$, $SD = 22.1$) demonstrated high internal consistency ($\alpha = 0.89$) among a sample of individuals with OCD (OCCWG, 2005).

The Urgency, Premeditation, Perseverance, Sensation-Seeking Impulsive Behaviour Scale (UPPS: Whiteside & Lynam, 2001) measures the multidimensional nature of impulsivity. It contains 45 items measured on a 4-point Likert scale ranging from 1 (*strongly agree*) to 4 (*strongly disagree*). The current study utilised three of its four subscales: (1)

negative urgency (M = 3.14), (2) premeditation (lack of) (M = 2.25), and (3) perseverance (lack of) (M = 1.80). Sensation seeking was not deemed relevant to the aims of the current study. Subsccale scores are calculated as means; those reported above are from a sample of participants with alcohol use disorders, borderline personality disorder and pathological gambling (Whiteside, Lynam, Miller, & Reynolds, 2005). The subscales of the UPPS have demonstrated high internal consistency (range of α = 0.82 – 0.91), as established within a large non-clinical sample (Whiteside & Lynam, 2001).

The AAQ-II (Bond et al., 2011) is a 7-item self-report questionnaire designed to measure experiential avoidance. Items are rated on a 7-point Likert scale, where a higher total score reflects greater experiential avoidance (i.e., less psychological flexibility). Mean total scores of 17.34 (SD = 4.37) and 28.34 (SD = 9.92) were respectively reported in a college student sample and outpatient sample undergoing treatment for substance use. The AAQ-II has demonstrated adequate to good internal consistency (range of α = 0.78 – 0.88) in clinical and non-clinical samples (Bond et al., 2011).

The RSE (Rosenberg, 1965) is a popular 10-item self-report instrument for evaluating global self-esteem. Items are scored according to a Likert scale ranging from 1 (*strongly agree*) to 4 (*strongly disagree*). Higher total scores indicate higher self-esteem. The RSE has demonstrated good test-retest reliability (r = .69) and high internal consistency (range of α = 0.88 - 0.90) across a range of community and college student samples (Robins, Hendin & Trzesniewski, 2001).

The ACQ-R (Brown, White, Forsyth, & Barlow, 2004; Rapee, Craske, Brown & Barlow, 1996) is a 15-item self-report measure of one's perceived level of control over anxiety-provoking events and anxiety-based emotional reactions. Items are scored according to a Likert scale ranging from 0 (*strongly disagree*) to 5 (*strongly agree*). Higher total scores reflect greater perceived anxiety control. Total score means of 31.35 (*SD* = 14.73) and 33.58 (*SD* = 15.58) were calculated in two samples of adults with anxiety disorders. The ACQ-R achieved good internal consistency, and convergent and divergent validity within a large clinical sample (Brown et al., 2004).

The DERS (Gratz & Roemer, 2004) is a comprehensive 36-item self-report measure of emotion dysregulation. Items are scored according to a Likert scale, ranging from 1 (*almost never*) to 5 (*almost always*). Higher total scores reflect greater emotion dysregulation; a total score mean of 79.33 (*SD* = 19.76) was calculated in a large non-clinical sample. The DERS has demonstrated high internal consistency ($\alpha = 0.93$) and adequate construct validity (Gratz & Roemer, 2004).

The DTS (Simons & Gaher, 2005) is a 15-item self-report measure of distress tolerance. Participants rate their beliefs about being distressed or upset according to a 5-point Likert scale, ranging from 1 (*strongly agree*) to 5 (*strongly disagree*). Higher scores reflect better distress tolerance. Scale scores are calculated as means; the total mean for a non-clinical sample was 3.43 (*SD* = 0.76). The DTS demonstrated good convergent, discriminant, and criterion-related validity (Simons & Gaher, 2005).

Statistical Analyses

EFA was performed with SPSS (v22) to identify a set of distinct factors represented in the 50-item BiTS. Only the data from hairpulling participants were utilised in the EFA to establish the BiTS factor structure likely to be of greatest relevance to adults with TTM. Inspection of scree plot inflections, Kaiser's criterion (eigenvalues ≥ 1), and Horn's parallel analysis were employed to identify the most parsimonious factor solution. Deletion of items was determined by examining singularity, communalities (excluded if < 0.30), inter-item correlations (excluded if the item shared limited inter-item correlations of ≥ 0.30), factor loadings (excluded if loading was < 0.40), and analysis of internal consistency coefficients (Cronbach's αs) (per Pett et al., 2003). To test the goodness-of-fit of the BiTS factor structure as derived by EFA, CFA using maximum likelihood estimation was performed in a separate hairpulling-only sample, using Analysis of Moment Structures software (v22) for structural equation modelling. Several model fit indices were examined per Hu and Bentler (1998), namely: the comparative fit index (CFI; values ≥ 0.95 desirable); Tucker Lewis index (TLI; values ≥ 0.95 desirable); standardised root mean square residual (SRMR; values ≤ 0.08 desirable); and root mean square error of approximation (RMSEA; values ≤ 0.06 desirable). The χ^2/degrees of freedom ratio (χ^2/df) were also evaluated, with values < 2 indicative of good fit (Ullman, 2007). The CFA model was re-specified until each of these fit indices were within the desirable ranges. Multiple group CFA was performed to examine measurement invariance across hairpulling and control groups.

Once the final BiTS model was established, subscale scores were calculated as means and the previously split EFA and CFA samples were merged again to examine the scale's psychometric properties and relationship to TTM symptoms in the original, total sample. A small amount of random missing data (< 1%) from the MGHHPS, MIST-A and DASS-21 were replaced using series mean substitution. Score distributions on the BiTS, MGHHPS, and DASS-21 were negatively skewed among hairpulling participants and positively skewed among control participants, so non-parametric tests were utilised as necessary. Internal consistency coefficients (Cronbach's αs) and inter-correlations were calculated for hairpulling and control participants separately to evaluate reliability. Mann-Whitney U tests were conducted to determine if BiTS scores significantly differed between participants with and without self-reported hairpulling difficulties. Spearman's *rho* correlations between the BiTS scores and selected measures were calculated to test construct validation hypotheses, and to examine the relationships between BiTS scores and TTM symptoms (MGHHPS, MIST-A). Using absolute correlation values, Fisher *r*-to-*z* score transformations (Lenhard & Lenhard, 2014) were applied to establish that differences in the sizes of correlations between the BiTS subscales and their highest measure of construct validity were statistically significant, when compared with the relationship between the BiTS subscales and the other constructs tested. Hierarchical regression was conducted to determine the contribution of BiTS scores to hairpulling severity (MGHHPS) over-and-above depression and anxiety (DASS-21). These correlational and regression analyses were conducted with the pooled data of hairpulling and control participants to maximise variance, as non-cosmetic hairpulling in community and student samples ranges on a continuum from non-clinical to pathological (e.g., Ghisi, Bottesi, Sica, Ouimet, & Sanavio, 2015; Solley & Turner, 2018; Stanley, Borden, Mouton, & Breckenridge, 1995).

Results

Exploratory Factor Analysis

Data screening. Of the 259 hairpulling participants in the EFA sample, 194 (74.9%) completed the 50-item BiTS. Although this number did not reach recommendations of at least 300 participants to conduct EFA (Tabachnick & Fidell, 2007), the Kaiser-Meyer-Olkin (KMO = 0.87) measure verified the sampling adequacy for the analysis (item-level measures of sampling adequacy range = 0.49 – 0.94) and Bartlett's test of sphericity indicated that correlations between items were sufficiently large to conduct EFA [PAF, $\chi^2(1225) = 5213.60$, $p < .001$]. Many BiTS items had high skewness and kurtosis ratios (Appendix 1), so principal axis factoring (PAF) was used as it is a robust EFA method for non-normal data (Tabachnick & Fidell, 2007). Mahalanobis distance values identified nine potential multivariate BiTS outliers. As no suspected outliers exerted excessive influence according to Cook's distance (< 1), and removal of outliers produced no substantive differences to EFA results, all cases were retained.

EFA. Preliminary analyses suggested retention of 12 factors according to Kaiser's criterion, between two and six factors according to scree plot inflexions, and five factors using Horn's parallel analysis. Several factor analyses were therefore performed with three, four, and five specified factors to determine the most parsimonious solution. Following these analyses, and suggestions that Kaiser's criterion and Cattell's scree test typically overestimate the number of factors (Courtney, 2013), three factors were specified. Promax rotation was selected as it maximises simple structure by clarifying the relationships between variables (Tabachnick & Fidell, 2007). One item was excluded due to evidence of singularity, 10 items due to low communalities, 14 items due to limited shared inter-correlations of adequate strength, and four items were excluded due to low factor loadings. Three items with the lowest corrected item-total correlations were also excluded on the basis of internal consistency analysis. The final 3-factor solution comprised 15 items and achieved simple structure. Items featured relatively strong factor loadings (range = 0.42 – 0.89) and accounted for a total of 61.80% of the variance (Table 2). Factor 1 accounted for 38.58% of the variance and comprised five items reflecting shame, low perceived self-worth, and low self-esteem; this subscale was termed Negative Self-Beliefs (BiTS-NSB). Factor 2, termed Low Coping Efficacy (BiTS-LCE), comprised six items reflecting a preference to avoid confronting emotional problems and low confidence in one's emotional coping skills. Factor 3, termed Perfectionism (BiTS-P), comprised four items reflecting a rigid desire to achieve perfectionistic standards.

Confirmatory Factor Analysis

Data screening. Of 268 hairpulling participants, 194 (72.4%) completed the 50-item BiTS. Mardia's coefficient indicated significant multivariate kurtosis across BiTS items. One multivariate outlier was removed. Transformations were applied but normality did not improve. All the remaining 193 cases were found not to exert excessive influence according to Cook's distance (< 1) so their data were used for CFA. The Bollen-Stine bootstrap *p* was used as a post-hoc adjustment to correct standard errors and the chi-square (χ^2) estimator, as these can be inflated when using maximum likelihood (ML) estimation in situations of multivariate non-normality (Cunningham, 2008).

CFA. The model was specified to three inter-correlated factors, with the first indicator of each factor set to unity to scale the latent variables. All other parameters were freely estimated. This model provided a poor fit to the data: χ^2/df = 2.23; CFI = 0.91; TLI = 0.89; SRMR = 0.07; RMSEA = 0.08 [90% confidence interval (CI) = 0.06 – 0.09]; Bollen-Stine $p < .01$. Item 19 shared standardised residuals > 2 with items 10, 40, 25 and 2, suggesting it was failing to account for adequate model variance. Examination of modification indices suggested the model could be improved by allowing error terms to covary between items 22 and 43 (BiTS-LCE). The similar phrasing used in these two items (i.e., avoidance of "problems") justified the correlation of their error terms. The model was re-specified to delete item 19 and allow the error terms of items 22 and 43 to covary (Appendix 2, Figure 1). This 14-item model provided excellent fit to the data: χ^2/df = 1.66; CFI = 0.96; TLI = 0.95; SRMR = 0.05; RMSEA = 0.06 [90% CI = 0.04 – 0.07]; Bollen-Stine $p = .206$. All standardised residual covariances were < 2, suggesting that the model was accounting for sufficient shared variance among all item pairs. Factor inter-correlations ranged from .48 (BiTS-NSB – BiTS-P) to .88 (BiTS-NSB – BiTS-LCE), indicating large inter-correlations between the factors, as expected.

Multiple group CFA. Group comparisons of unstandardised coefficients suggested that items 14 (BiTS-NSB), 47 (BiTS-P), and 10 (BiTS-LCE) be constrained to equality for multiple group CFA. The re-specified 14-item model was tested for invariance between hairpulling participants ($n = 193$) and control participants ($n = 136$) following a stepwise procedure (per Cunningham, 2008). Model fit and nested model comparisons are summarised in Appendix 3. The simultaneously tested, unconstrained configural model (test 1) fit the data adequately. This model acted as the baseline model to which increasingly constrained models were compared. Assuming this model to be correct, the model in which measurement weights were constrained to be equal across groups (test 5) was also supported as model fit did not significantly deteriorate (p = .515). In other words, factor loadings were found to be equivalent between hairpulling and control participants, which supported the measurement invariance of the BiTS. Due to an insufficient number of male participants with BiTS data (n = 34), invariance testing between males and females was not possible.

Internal Consistency, Construct Validity and Symptom Correlations.

Cronbach's alpha coefficients for the BiTS subscales and total scale ranged from acceptable to excellent in hairpulling and control participants, separately (Table 3). In further support of the internal consistency of the BiTS, subscales were significantly correlated with each other and the full scale score in hairpulling and control participants, separately (Table 4). The moderate-to-large strength BiTS subscale inter-correlations in both groups suggest that they measure related but sufficiently distinct domains of dysfunctional beliefs.

Correlations between the BiTS subscales and measures of construct validity are shown in Table 5. The BiTS-NSB subscale shared moderate-to-large correlations with most other scales; its strongest correlation was with RSE scores (r_s = -.80). The correlation between the BiTS-NSB and the RSE was significantly stronger than the correlation between the BiTS-NSB and all other measures (p's < .001), thus supporting its convergent validity as a measure of negative self-evaluations, as hypothesised. The BiTS-P shared moderate strength correlations with several other constructs that are suggestive of the role of perfectionism in self-regulation. As hypothesised, its strongest correlation (r_s = .74) was with the OBQ-PC, which similarly measures perfectionism and need for certainty relevant to obsessive-compulsive phenomena. The correlation between the BiTS-P and the OBQ-PC was significantly stronger than the correlation between the BiTS-P and all other measures (p's < .001). The BiTS-LCE shared moderate-to-large correlations with most scales, but particularly with those reflecting perceived difficulties in accepting (AAQ-II; r_s = .75), controlling (ACQ-R; r_s = .73), and regulating (DERS; r_s = .71) negative emotions. The correlation between the BiTS-LCE and the AAQ-II was significantly stronger than the correlation between the BiTS-LCE and all other measures (range of p < .05 to p < .001) besides the correlation with the ACQ-R (p = .254). Further, the correlation between the BiTS-LCE and ACQ-R was not significantly greater than the BiTS-LCE correlation with the DERS (p = .155), however, the latter correlation was still significantly stronger than for all other measures (range of p < .05 to p < .001).

Spearman's *rho* correlations were calculated between the BiTS subscales and TTM symptom measures (Table 6). As expected, hairpulling severity, as measured by the MGHHPS, was positively and moderately correlated with all three of the BiTS subscales (p < .001). Focused hairpulling (MIST-A-Fo) was positively correlated with all of the BiTS subscales. BiTS subscales also shared significant, moderate-to-large strength correlations with depression and anxiety, as measured by the DASS-21 (range of r_s = .43-.70, p < .01); and there were moderate strength relationships between hairpulling severity and depression (r_s = .43, p < .01) and anxiety (r_s = .35, p < .01). Using non-parametric partial correlations to control for negative affect, the relationships between all three BiTS subscales and hairpulling severity remained significant but was attenuated. Correlations between the BiTS and hairpulling styles (MIST-A) were no longer significant after controlling for negative affect.

Hierarchical regression was performed to determine if BiTS subscale scores could predict hairpulling severity over-and-above negative affect (Table 7). Controlling for negative affect at step 1 (DASS-21), results of the hierarchical regression indicated a significant R^2 change after the addition of the BiTS subscales in the prediction of hairpulling severity, as measured by the MGHHPS [$F(3, 435) = 17.85$, $p < .001$]. Specifically, TTM-relevant beliefs accounted for an additional 9% of the variance in hairpulling severity beyond that explained by depression and anxiety. The BiTS-NSB was the only significant predictor of hairpulling severity when all other variables were held constant, accounting for half (4.6%) of the unique variance explained by TTM-relevant beliefs. Combined, all variables accounted for 26.6% of the variance in hairpulling severity.

Due to violated assumptions, analysis of covariance controlling for DASS-21 scores could not be performed to determine if BiTS scores differentiated between participants with and without self-reported TTM symptoms. Mann-Whitney U tests were therefore conducted as the non-parametric alternative to independent samples *t*-tests. As shown in Table 3, hairpulling participants reported significantly higher scores on all BiTS subscales (i.e., greater endorsement of maladaptive beliefs) than did control participants. Effect sizes were moderate.

Discussion

This study presented the development and psychometric evaluation of the Beliefs in Trichotillomania Scale (BiTS), a new 14-item measure reduced from an initial pool of 50 items designed to reflect the six domains of TTM-relevant beliefs identified in an earlier qualitative investigation conducted by [Authors]. Three, instead of the six hypothesised domains of dysfunctional beliefs (i.e., subscales), were represented in the emergent scale, which was found to have a replicable factor structure across two separate samples using EFA and CFA. The subscales demonstrated good convergent and divergent validity with related constructs; demonstrated strong configural and measurement invariance, which supports the use of the BiTS with both clinical and non-clinical samples; predicted TTM symptoms over-and-above depression and anxiety, as hypothesised; and differentiated between participants with and without self-reported TTM symptoms, also as expected.

The three constructs represented in the BiTS subscales (Negative Self-beliefs, Perfectionism, and Low Coping Efficacy) have repeatedly been speculated as being relevant to TTM (e.g., Franklin & Tolin, 2007; Gluhoski, 1995; Moulding et al., 2016; Pélissier & O'Connor, 2004) and were found to significantly correlate with hairpulling severity in the current study, as hypothesised. Focused hairpulling was significantly correlated with TTM-relevant beliefs with a small effect size, which is consistent with theorising that this intentional hairpulling style helps regulate unpleasant cognitions, emotions, and sensations (Houghton et al., 2014). Unexpectedly, small but significant correlations between higher levels of automatic hairpulling, low coping efficacy (BiTS-LCE) and perfectionism (BiTS-P) were identified. To the authors' knowledge, this is the first report of significant relationships between automatic hairpulling and any cognitive-affective process. However, after controlling for negative affect, no correlations between TTM-relevant beliefs and hairpulling styles were significant. It is possible that the BiTS subscales are simply referencing the cognitions implicated in commonly co-occurring depression and anxiety. Indeed, negative self-beliefs, perfectionism, and low coping efficacy are transdiagnostic processes (e.g., Beck, 1979; Egan et al., 2011). Regardless of their specificity, if these styles of beliefs are contributing to the maintenance of TTM symptoms, they are still relevant to theoretical models and psychological treatments for the disorder. Disentangling the contributions of depression and anxiety to the presentation of TTM has recently become a research focus (Grant et al., 2017). It should be noted that the correlations between all BiTS subscales and hairpulling severity were attenuated but remained statistically significant even after controlling for negative affect.

Hierarchical regression analysis demonstrated the importance of negative self-beliefs, with BiTS-NSB scores acting as the only significant predictor of hairpulling severity over-and-above depression and anxiety symptoms. Combined, negative affect and TTM-relevant beliefs accounted for almost 27% of the variance in hairpulling severity; TTM-relevant beliefs accounted for one-third (9%) of that variance and negative-self beliefs uniquely contributed 4% of the variance. This finding provides support for theorising that negative self-beliefs may play a role in eliciting and maintaining hairpulling episodes (Rehm et al., 2015; Moulding et al., 2016) and supports past quantitative research that has found relationships between TTM, self-esteem, and shame (Diefenbach, Tolin, Hannan, Crocetto, & Workunsky, 2005; Noble, 2012; Norberg et al., 2007; Stemberger et al., 2000; Weingarden & Renshaw, 2014). The finding that negative self-beliefs predicted hairpulling severity over-and-above depression and anxiety challenges propositions that such cognitions may only be associated with TTM due to comorbid affective disorders (e.g., Franklin & Tolin, 2007). Although negative-self beliefs contributed only a small percentage of unique variance, it is noteworthy that one of the first investigations into the role of emotion regulation in TTM found that difficulties with regulating emotions of specific relevance to hair-pulling (e.g., boredom, frustration) accounted for less than 1% of the variance in TTM severity (Shusterman et al., 2009). This finding nevertheless prompted important research into the role of emotion dysregulation in TTM, and has since contributed to the development of effective treatments (e.g., DBT-enhanced BT; Keuthen et al., 2012) and identification of potential behaviour change mechanisms (Roberts et al., 2013, 2015).

It is intuitively appealing that negative self-beliefs would be especially relevant to TTM, given that hair loss has an adverse impact upon the self-esteem of both men and women (Cash, 1999; Hilton et al., 2008; Münstedt, Manthey, Sachsse, & Vahrson, 1997). The relationships between TTM, hair loss, and self-construals has not been investigated, which is surprising considering that TTM onset typically occurs during the identity-formative years of adolescence; and further, that self-construals are considered relevant to the development and maintenance of other OCRDs (Bhar & Kyrios, 2007; Doron, Kyrios, & Moulding, 2007; García-Soriano, Clark, Belloch, del Palacio, & Castañeiras, 2012; Phillips, Moulding, Kyrios, Nedeljkovic, & Mancuso, 2011). Despite the limited research, it appears that clinicians have recognised that the relationship between TTM and self-construals is a pertinent consideration in case formulation and treatment planning (e.g., Novak, 2014). The role of self-construals is a potentially fruitful area for investigation as an aetioloigical and/or maintaining mechanism in TTM that, if addressed, could have the potential to improve the efficacy of psychological treatments.

The findings of this study ought to be interpreted with caution due to methodological limitations. The BiTS items were not pilot tested by a sub-sample of participants with TTM; reviewing item content and phrasing among people with lived experience will be an important task for future validation studies of the BiTS. Order effects were uncontrolled for, as the presentation of surveys was not randomised. Invariance testing between males and females who reported non-cosmetic hairpulling behaviours was not possible due to sample size restrictions. No information pertinent to determining the presence of *DSM-5* criteria for TTM was gathered, and the only clinical characteristics inquired about were the number and type of hairpulling sites targeted. Hence, it cannot be verified that the symptoms of participants who self-identified difficulties with non-cosmetic hairpulling would warrant a diagnosis of TTM. Given that the MIST-A “focused” and “automatic” subscales were initially developed from an internet-surveyed sample of self-identified TTM but a different factor structure emerged when analyses were repeated with a clinically diagnosed sample (Alexander et al., 2016), similar research ought to be conducted to validate and replicate the BiTS factor structure using a clinical sample. Nevertheless, the mean MGHHPS score for hairpulling participants pooled from the EFA and CFA samples (*M* = 17.51, *SD* = 5.60, *n* = 481) was comparable with those typically reported in treatment-seeking TTM samples (e.g., Keuthen et al., 2012). By contrast, control participants reported minimal TTM symptoms (*M* = 0.40, *SD* = 1.21, *n* = 71), which provides confidence that all participants correctly interpreted the question as inquiring about non-cosmetic hairpulling *unrelated* to personal grooming or hygiene purposes.

The cross-sectional methodology means that the directionality and causality of relationships identified between TTM-relevant beliefs and symptoms cannot be established. Referring to theorising by Moulding et al. (2016), it was suggested that the relationships between negative self-beliefs and TTM symptoms may reflect shame proneness as a vulnerability factor, such that individuals engage in hairpulling behaviours to deflect threats to self-worth. Alternatively, negative self-beliefs – and relatedly, low coping efficacy – may be consequences of the disorder in relation to its adverse psychosocial impacts and/or due to the disempowering lack of self-control one feels for their own unwanted behaviour. Similarly, while perfectionism can be conceptualised as a predisposing personality trait (e.g., Egan, Wade, & Shafran, 2011), it is also possible that, as TTM symptoms become more severe, the individual engages in increasingly perfectionistic ideation to retain a sense of control over their dysregulated hairpulling behaviour and associated affect. Both self-esteem and perfectionism are correlated with cognitions and beliefs related to boredom in OCRD samples – including participants with hairpulling behaviours (O'Connor et al., 2015; Roberts et al., 2015) – so future research using the BiTS in TTM-specific samples may benefit from evaluating how the relationships between boredom-related beliefs correlate with or predict those represented in the BiTS. Tracking changes to BiTS subscale scores, TTM severity, and negative affect over the course of psychological treatment may help determine the role these beliefs have in the maintenance of the disorder, which could facilitate novel developments in its cognitive-behavioural conceptualisation and treatment.

Ongoing validation of the BiTS may present important opportunities to investigate how unhelpful cognitions and beliefs come to elicit and maintain hairpulling urges and behaviour, including whether such beliefs are largely associated with commonly co-occurring affective disorders. It is imperative to validate the BiTS in a larger, clinical sample of participants with TTM diagnosed according to *DSM-5* criteria and whose comorbidity profile is known. There is potential for the BiTS to advance understanding of the cognitive-affective behaviour change mechanisms implicated in TTM, beyond emotion dysregulation and experiential avoidance. Use of the BiTS as a process measure may help researchers decipher which CBT components elicit and maintain the greatest symptom improvements, such that empirically-supported and testable cognitive models of TTM may be developed to specifically guide the development of more effective, evidence-based iterations of CBT for this disorder.

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Table 1.

Frequencies (%) for Participant Demographic and Hairpulling Characteristics

Variable	EFA Sample			CFA Sample		
	Hairpulling group *n* = 259	**Control group *n* = 162**	**Test statistic**	**Hairpulling group *n* = 268**	**Control group *n* = 152**	**Test statistic**
Age	*M* = 27.00 *SD* = 8.75	*M* = 21.90 *SD* = 6.05	*t*(413.34)= 7.03*	*M* = 28.74 *SD* = 10.75	*M* = 22.79 *SD* = 7.68	*t*(394.19)= 6.56*
Gender						
Female	252 (97.3)	124(76.5)	χ^2(1)=44.97*	254 (94.8)	124(81.6)	χ^2(1)=18.77*
Male	7 (2.7)	38 (23.5)		14 (5.2)	28 (18.4)	
Employment						
Full-time	89 (34.5)	11 (6.8)		98 (36.6)	23 (15.1)	
Part-time/casual	73 (28.1)	96 (59.3)	χ^2(2)=55.72*†	78 (29.1)	78 (51.3)	χ^2(2)=28.36*†
Unemployed	91 (35.2)	54 (33.3)		90 (33.6)	50 (32.9)	
Retired	4 (1.5)	0 (0.0)		2 (0.7)	1 (0.7)	
Not reported	2 (0.7)	1 (0.6)		0 (0.0)	0 (0.0)	
Education						
Secondary	107 (41.3)	116 (71.6)		107 (39.9)	103 (67.8)	
Vocational	32 (12.4)	17 (10.5)	χ^2(2)=41.62*	28 (10.4)	17 (11.2)	χ^2(2)=35.42*
Tertiary	120 (46.3)	29 (17.9)		133 (49.6)	32 (21.1)	
Relationship						
Single	167 (64.5)	134 (82.7)		167 (62.3)	111 (73.0)	
Married	61 (23.6)	11 (6.8)	χ^2(3)=27.00*	75 (28.0)	14 (9.2)	χ^2(3)=48.65*
De facto	19 (7.3)	16 (9.9)		7 (2.6)	25 (16.4)	
Divorced	12 (4.6)	1 (0.6)		19 (7.1)	2 (1.3)	
Nationality						
Australia & NZ	55 (21.2)	149 (92.0)		54 (20.1)	134 (88.2)	
UK	30 (11.6)	4 (2.5)		26 (9.7)	7 (4.6)	
USA	145 (56.0)	7 (4.3)	χ^2(4)=201.62*	149 (55.6)	9 (5.9)	χ^2(4)=182.71*
Canada	7 (2.7)	2 (1.2)		20 (7.5)	0 (0)	
Other	22 (8.5)	0 (0.0)		19 (7.1)	2 (1.3)	
Hairpulling sites						
Scalp	158 (61.7)	-	-	153 (58.2)	-	-
Eyelashes	69 (29.0)	-	-	70 (26.6)	-	-
Eyebrows	104 (32.4)	-	-	89 (33.8)	-	-
Pubic, limbs, torso or face	169 (64.3)	-	-	134 (51.1)	-	-
Not reported	55 (21.3)	-	-	68 (25.9)	-	-
MGHHPS	*M* = 17.60 *SD* = 5.44 *n* = 240	*M* = 0.18 *SD* = 0.72 *n* = 34	*t*(271.63)= 46.89*	*M* = 17.37 *SD* = 5.81 *n* = 246	*M* = 0.32 *SD* = 1.09 *n* = 34	*t*(259.85)= 41.09*

Note. NZ = New Zealand; UK = United Kingdom; USA = United States of America; MGHHPS = Massachusetts Hospital Hair Pulling Scale. Percentages for hairpulling sites do not add up to 100 as multiple sites were recorded per participant.

*p<.001

†Excludes "retired" and "not reported" categories.

Table 2.

Final Factor Pattern Matrix for 15-item BiTS: Principal Axis Factoring with Promax Rotation

Item	**BiTS-NSB**	**BiTS-LCE**	**BiTS-P**
13. I have much to feel embarrassed or ashamed about	**.89**	-.07	-.03
14. I do not like to think about my self-worth	**.84**	.06	-.09
1. I do not feel comfortable with who I am	**.80**	-.02	.03
2. I do not think I am normal, like everyone else	**.71**	-.02	.06
25. I think I am lacking or deficient in many positive qualities	**.49**	.26	.10
43. Trying to resolve my problems will only cause me more stress and hurt	-.06	**.82**	-.06
22. I do not want to deal with my problems	.06	**.72**	-.18
27. Everything in my life should be predictable	-.11	**.60**	.23
28. I do not have any choice but to act upon my urges or impulses when they occur	-.01	**.60**	.08
40. I think I experience negative emotions more intensely than others do	.14	**.48**	.03
10. I cannot cope with stress	.24	**.42**	-.03
4. If I am unable to fix something so that it's perfect, I won't be able to stop thinking or feeling uncomfortable about it	-.03	.08	**.80**
19. I strive for perfection in everything that I do	-.09	-.05	**.79**
47. I experience strong urges to fix anything that I perceive to be wrong, imperfect or not-quite-right	.03	-.07	**.78**
50. I am never satisfied with "good enough"	.23	.02	**.51**
Eigenvalue	5.79	2.17	1.31
% of variance	38.58	14.46	8.76

Note. BiTS = Beliefs in Trichotillomania Scale; NSB = Negative Self-Beliefs; LCE = Low Coping Efficacy; P = Perfectionism. Item 19 was removed following confirmatory factor analysis, resulting in a final 14-item scale.

Table 3.

Means, Cronbach's Alpha Coefficients and Group Comparisons for the 14-item BiTS

Subscale	**Hairpulling participants** ***n*** **= 388**		**Control participants** ***n*** **= 285**		**Test statistic**	**Effect size**
	M (*SD*)	α	*M* (*SD*)	α		
BiTS-NSB	4.60 (1.59)	0.88	3.02 (1.49)	0.87	*U* = 26,154.50*	*r* = .45
BiTS-P	4.67 (1.53)	0.76	3.71 (1.45)	0.75	*U* = 35,416.00*	*r* = .31
BiTS-LCE	4.01 (1.32)	0.78	2.99 (1.23)	0.83	*U* = 30,947.50*	*r* = .38
BiTS total	4.36 (1.22)	0.89	3.16 (1.20)	0.91	*U* = 26,148.50*	*r* = .45

Note. SD = Standard deviation; BiTS = Beliefs in Trichotillomania Scale; NSB = Negative Self-Beliefs; P = Perfectionism; LCE = Low Coping Efficacy.
* $p < .001$.

Table 4.

BiTS Subscale Inter-Correlations for Hairpulling Participants versus Control Participants

Variable	**1.**	**2.**	**3.**	**4.**
1. BiTS-NSB	-	.50	.74	.89
2. BiTS-P	.34	-	.60	.75
3. BiTS-LCE	.62	.45	-	.92
4. BiTS total	.86	.63	.88	-

Note. Correlations for hairpulling participants are below the diagonal. All correlations significant at $p < .01$. BiTS = Beliefs in Trichotillomania Scale; NSB = Negative Self-Beliefs; P = Perfectionism; LCE = Low Coping Efficacy.

Table 5.

Spearman's Rho *Correlations between BiTS Subscales, Symptoms and Other Constructs*

Variable	**BiTS-NSB**	**BiTS-P**	**BiTS-LCE**	***M***	***SD***	***N***
RSE	**-.80***	-.43*	-.69*	17.74	7.29	585
OBQ-PC	.56*	**.74***	.57*	64.00	21.34	620
AAQ-II	.74*	.48*	**.75***	26.66	10.54	592
ACQ	-.67*	-.51*	**-.73***	38.12	13.21	582
DERS	.68*	.44*	**.71***	97.03	27.09	571
DTS	-.59*	-.46*	-.67*	2.94	0.94	567
UPPS-URG	.48*	.33*	.51*	2.69	0.63	599
UPPS-PREM	-.03	-.18*	-.05	2.04	0.53	599
UPPS-PERS	.32*	-.03	.33*	2.27	0.53	599

Note. MGHHPS = Massachusetts General Hospital Hair Pulling Scale; MIST-A = Milwaukee Inventory for Subtypes of Trichotillomania-Adult version; DASS-A = Depression Anxiety Stress Scales-Anxiety; DASS-D = Depression; BiTS = Beliefs in Trichotillomania Scale; NSB = Negative Self-Beliefs; P = Perfectionism, LCE = Low Coping Efficacy; RSE = Rosenberg Self-Esteem scale; OBQ-PC = Obsessive Beliefs Questionnaire-Perfectionism/Certainty subscale; AAQ-II = Acceptance and Action Questionnaire-II; ACQ = Anxiety Control Questionnaire; DERS = Difficulties in Emotion Regulation Scale; DTS = Distress Tolerance Scale; UPPS-URG = Urgency, Premeditation, Perseverance, Sensation-Seeking Impulsive Behaviour Scale-Urgency; UPPS-PREM = Premeditation (lack of); UPPS-PERS = Perseverance (lack of).
Emboldened correlations indicate the construct validity measures that correlated the strongest with each of the BiTS subscales, with these correlations significantly higher than for other measures as determined by Fisher *r*-to-*z* transformations, *p*'s < .05.
* $p < .01$.

Table 6.

Spearman's Rho *Correlations between the BiTS, MGHHPS, MIST-A, and DASS-21 Scores*

Variable	BiTS-NSB	BiTS-P	BiTS-LCE	*M*	*SD*	*N*
Symptoms						
MGHHPS	.48**	.29**	.41**	15.24	16.58	560
MIST-A Au	.09	.14**	.13**	27.23	8.81	457
MIST-A Fo	.26**	.20**	.24**	45.50	16.58	457
DASS-21-D	.70**	.43**	.65**	6.89	5.80	652
DASS-21-A	.55**	.50**	.56**	5.29	4.74	652
Controlling for Negative Affect						
MGHHPS	.28**	.11*	.18**			
MIST-A Au	.05	.10	.10			
MIST-A Fo	.09	.07	.05			

Note. BiTS = Beliefs in Trichotillomania Scale; BiTS-NSB = Negative Self-Beliefs; BiTS-P = Perfectionism; BiTS-LCE = Low Coping Efficacy; DASS-21-A = Depression Anxiety Stress Scales-Anxiety; DASS-21-D = Depression; MGHHPS = Massachusetts General Hospital Hair Pulling Scale; MIST-A = Milwaukee Inventory for Subtypes of Trichotillomania-Adult version.

*$p < .05$, **$p < .01$.

Table 7.

Hierarchical Regression Analysis Predicting TTM Symptoms (MGHHPS) with TTM-relevant Cognitions (BiTS), Controlling for Depression and Anxiety (DASS-21)

Step	**Predictors**	***B***	**S.E *B***	**β**
1				
	Constant	11.24	0.54	
	DASS-21-A	0.10	0.10	.06
	DASS-21-D	0.50	0.08	.37*
2				
	Constant	5.59	1.07	
	DASS-21-A	0.02	0.10	.02
	DASS-21-D	0.13	0.10	.10
	BiTS-NSB	1.58	0.30	.35*
	BiTS-P	0.24	0.26	.05
	BiTS-LCE	0.38	0.38	.07

Note. DASS-21-A = Depression Anxiety Stress Scales-Anxiety subscale; DASS-21-D = Depression subscale; BiTS = Beliefs in Trichotillomania Scale; BiTS-NSB = Negative Self-Beliefs; BiTS-P = Perfectionism; BiTS-LCE = Low Coping Efficacy.
R^{2} = .18 for Step 1, ΔR^2 = .09 for Step 2 (p = .000).
*p < .001.