Psychometric Properties of Trichotillomania Severity Measures

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Abstract

**Background**: Trichotillomania (TTM) is a psychiatric disorder that leads to significant hair loss, distress, and impairment. Few validated measures exist to assess TTM, and psychometric research examining these tools is sparse. This study evaluated the psychometric properties of commonly used TTM severity measures and extended prior research by including hair loss severity ratings in our analyses. **Methods**: Participants included 91 adults (92.3% Female; *M* age = 35.0) with TTM who completed baseline assessments as part of a randomized clinical trial of psychotherapy for TTM. TTM measures included the Massachusetts General Hospital Hairpulling Scale (MGH-HS) and National Institute of Mental Health Trichotillomania Severity Scale (NIMH-TSS). Independent evaluators rated photos of participants’ most severely affected pulling sites using a one-item hair loss severity scale. **Results**: Results showed mixed psychometric properties for TTM measures. The MGH-HS showed acceptable internal consistency (alpha = 0.83; omega = 0.89), while the NIMH-TSS had lower internal consistency (alpha = 0.52; omega = 0.73). Both the MGH-HS and NIMH-TSS demonstrated low test-retest reliability. Total scores on the MGH-HS and NIMH-TSS were not associated with hair loss severity. **Conclusions:** Given these findings, it is imperative to develop new, psychometrically-sound TTM measures. These results also emphasize the importance of a multi-method approach to TTM assessment. In addition to self-report and clinician-administered measures, hair loss severity ratings may offer valuable information as part of a comprehensive assessment of TTM.

*Keywords*: trichotillomania, body-focused repetitive behaviors, psychometric, assessment, measurement

Psychometric Properties of Trichotillomania Severity Measures

Trichotillomania (TTM) is a psychiatric disorder characterized by recurrent hair pulling, resulting in hair loss (American Psychiatric Association, 2022). TTM can lead to emotional distress, functional impairment, and medical consequences (e.g., repetitive strain injuries, gastrointestinal obstruction following hair consumption; Christenson et al., 1991; Snorrason et al., 2021; Tung et al., 2015).

Relatively few measures exist to assess TTM, and data on the psychometric properties of these tools are sparse (Diefenbach et al., 2005a). This lack of information on commonly used assessment measures may be a barrier to the advancement of research on TTM (Houghton et al., 2015), With respect to assessing TTM severity, the multiple dimensions of pulling and wide variability found in symptom presentation can complicate measurement (Rothbaum & Ninan, 1994; Winchel et al., 1992b). Hair pulling varies in terms of pulling frequency, duration of pulling episodes, amount of hair pulled, and number and location of pulling sites (du Toit et al., 2001; Woods & Houghton, 2014). Likewise, individuals may or may not use tools or implements to pull or engage in rituals surrounding the behavior (Lochner et al., 2010). There is also variation in the degree to which individuals with TTM engage in different pulling styles (i.e., automatic or focused) and the extent to which pulling negatively affects the person. In addition, the presence, frequency, and intensity of hair-pulling *urges* (apart from the *act* of pulling) may be important to consider (du Toit et al., 2001; Lochner et al., 2011).

TTM is typically assessed via self-report measures and/or clinician ratings. Self-report measures include the Trichotillomania Scale for Children (TSC; Tolin et al., 2008), the Trichotillomania Dimensional Scale (TTM-D; LeBeau et al., 2013), and the Massachusetts General Hospital Hairpulling Scale (MGH-HS; Keuthen et al., 1995). Both adult scales (TTM-D and MGH-HS) were derived from assessments of obsessive-compulsive disorder (OCD) and overlap considerably. The TTM-D was created by the DSM-5 obsessive-compulsive spectrum disorders sub-workgroup (LeBeau et al., 2013) and adapted from the Florida Obsessive Compulsive Inventory (FOCI; Storch et al., 2007). Little research exists on the TTM-D’s psychometric properties in individuals with TTM, but the scale has shown promising reliability and validity in non-clinical populations (Cheyne et al., 2018; Moreno-Amador et al., 2018).

The MGH-HS is currently the most widely used self-report measure of TTM severity (Farhat et al., 2019; Houghton et al., 2015). It assesses the frequency, intensity, and control of hair-pulling urges; the frequency of, resistance to, and control over hair pulling behaviors; and distress associated with pulling (Keuthen et al., 1995; O'Sullivan et al., 1995). Research suggests the scale has a two-factor structure consisting of severity and resistance/control (Keuthen et al., 2007). However, some have criticized the MGH-HS for the lack of assessment of *hair loss* severity specifically (Taillefer & Antony, 2017). Moreover, the MGH-HS may be limited in that many items focus on hair pulling *urges*, which are not a universal experience among individuals with TTM (Lochner et al., 2011).

Additionally, reliability and validity statistics for the MGH-HS have not been widely replicated. The initial development of the MGH-HS showed good internal consistency (α = 0.89) in a large sample of individuals with TTM (Keuthen et al., 1995). In other TTM research, the internal consistency of the MGH-HS has ranged from α = 0.74 to 0.95 (Carlson et al., 2021; Chesivoir & Grant, 2022; Cheyne et al., 2018; Haaga et al., 2015; Haaland et al., 2017; Lee et al., 2018a; Lee et al., 2018b; Rogers et al., 2014; Valle et al., 2022; van Minnen et al., 2003). One study showed that the MGH-HS demonstrated good test-retest reliability, although in a small sample of 26 patients and only over a one-hour timespan (O'Sullivan et al., 1995). Some research supported the convergent validity of the MGH-HS by showing positive correlations with the clinician-administered Clinical Global Impressions – Severity scale (CGI-S; Guy, 1976; O'Sullivan et al., 1995) and Psychiatric Institute Trichotillomania Scale (PITS; Diefenbach et al., 2005a; O'Sullivan et al., 1995; Winchel et al., 1992a). However, other studies have questioned this, finding that the MGH-HS was not significantly correlated with the National Institute of Mental Health Trichotillomania Severity Scale (NIMH-TSS; Swedo et al., 1989), the CGI-S, or a rating of hair loss severity (Diefenbach et al., 2005a). Although the MGH-HS showed weak associations with measures of depression and anxiety in its initial development (O'Sullivan et al., 1995), Diefenbach and colleagues (2005a) found a moderate positive correlation between the MGH-HS and a standard measure of anxiety, which may suggest similarities in the constructs being measured.

Psychometric evaluations of existing clinician-rated TTM severity measures, the PITS and the NIMH-TSS, are also limited. The PITS is a six-item measure that assesses the number of pulling sites, time spent pulling or thinking about pulling, avoidance, resistance, distress, and hair loss severity. Internal consistency of the PITS has been shown to be poor, and interrater reliability results are mixed (Diefenbach et al., 2005a; Stanley et al., 1999; Stanley et al., 1993). Additionally, the hair loss severity item on the PITS has been critiqued, as it rates scalp hair loss as more severe than hair loss in non-scalp sites (Rothbaum & Ninan, 1994; Taillefer & Antony, 2017).

The NIMH-TSS is the most commonly used clinician-rated tool for TTM (Farhat et al., 2019; Houghton et al., 2015). The NIMH-TSS comprises five items assessing frequency (two items), urge resistance, distress, and interference of hair pulling symptoms. Stanley and colleagues (1999) examined the NIMH-TSS in a small sample of TTM patients and described adequate interrater reliability (0.85) but poor internal consistency (α = 0.63). Diefenbach et al. (2005a) reported similar results of acceptable interrater agreement (0.92) but poor internal consistency (α = 0.65) in a sample of 28 TTM patients. The NIMH-TSS also showed low internal consistency in other TTM studies (α = 0.52–0.66; Carlson et al., 2021; Chesivoir & Grant, 2022; Haaland et al., 2017). The NIMH-TSS was shown to be weakly related to the Beck Depression Inventory-II (BDI-II; Beck et al., 1996), but moderately correlated with an anxiety measure (Diefenbach et al., 2005a). The NIMH-TSS has demonstrated sensitivity to symptom changes during treatment (Rothbaum, 1992; Swedo et al., 1989).

Hair loss measures have also been used to assess TTM severity (Friman et al., 1984; Haaga et al., 2015; Rothbaum & Ninan, 1994). Tolin et al. (2002) developed a rating scale for quantifying damage or extent of hair loss, seen during either live observation or photographs. This single-item clinician-rated measure evaluates hair loss severity on a scale ranging from 1 (no evidence of pulling) to 7 (large bald spots that are difficult to conceal). The measure has high interrater reliability (Diefenbach et al., 2005a; Tolin et al., 2002) and shows sensitivity to change in treatment (Rogers et al., 2014). Moreover, Haaga et al. (2015) found that the hair loss rating scale had high acceptability by TTM patients and was generally stable over a ten-week period. Examining a measure of change in hair loss severity, Houghton et al. (2016) found that photographic ratings of improvements in hair loss had adequate psychometric properties and were correlated with quality of life. However, hair loss severity ratings have not been reliably associated with other measures of TTM severity. Diefenbach et al. (2005a) found that hair loss severity in 28 patients was related to clinician-rated global severity but was not associated with total severity scores on the MGH-HS, NIMH-TSS, or PITS. Similarly, Haaga et al. (2015) reported that hair loss ratings were not significantly correlated with MGH-HS or PITS scores.

Concerns have been raised about using hair loss as a measure of TTM severity (Franklin & Tolin, 2007; Haaga et al., 2015; Winchel et al., 1992b), as hair loss resulting from pulling can be highly variable. For example, individuals may pull from localized areas, creating bald patches, or they may distribute their pulling, resulting in less noticeable hair loss (Diefenbach et al., 2005a; Winchel et al., 1992b). Moreover, the time necessary for hair regrowth is often dependent on factors such as gender, age, and hair-pulling site (Cohen, 2010; Haaga et al., 2015; Myers & Hamilton, 1951). Nevertheless, hair loss is a diagnostic criterion of TTM (APA, 2022) and a primary concern of most TTM sufferers (Diefenbach et al., 2005b; Stanley & Mouton, 1996). Thus, hair loss severity may be an important construct to consider in assessing TTM.

Given the lack of research on TTM assessment and inconsistent results in published studies, continued examination of psychometric properties for commonly used TTM assessment measures is warranted. Therefore, this study examined the psychometric properties of the MGH-HS and NIMH-TSS in a large clinical sample of treatment-seeking adults with TTM. As small sample sizes and non-clinical samples are often used in TTM research, reevaluating the reliability and validity of TTM measures in a larger clinical sample is important. Moreover, as hair loss severity measures are another assessment tool used in both research and clinical practice, we extended prior research by incorporating hair loss severity ratings in our psychometric analyses. Additionally, previous psychometric evaluations of the MGH-HS and NIMH-TSS have only calculated Cronbach’s alpha (α) coefficients to determine internal consistency. However, Cronbach’s alpha has limitations and can underestimate or overestimate reliability if its assumptions are not met, which is common with psychological test data (Cho & Kim, 2015). Alternatively, coefficient omega (ω; McDonald, 1999) is a composite reliability estimate that is robust to the assumptions of Cronbach’s alpha and can provide a more accurate measure of internal consistency (Dunn et al., 2013; Flora, 2020; Watkins, 2017). Thus, in line with psychometric research on the use of omega and alpha coefficients and recommendations for evaluating and reporting reliability (McNeish, 2018; Revelle & Condon, 2019), we calculated omega coefficients as additional reliability estimates for the MGH-HS and NIMH-TSS.

**Methods**

**Participants**

Data for this study were collected as part of a randomized clinical trial (RCT) examining the efficacy of psychotherapy for adults with TTM (Woods et al., 2022). The RCT was funded by the NIMH (R01MH080966; Woods, PI) and registered with www.clinicaltrials.gov (NCT00872742). The study was approved by Institutional Review Boards (IRBs) at the University of Wisconsin-Milwaukee and Texas A&M University. More information about recruitment practices for the RCT can be found in Neal-Barnett et al. (2019). Participants were included in the study if they met the following criteria at the time of screening: (1) current Diagnostic and Statistical Manual of Mental Disorders (4th ed., text rev.; DSM-IV-TR; APA, 2000) diagnosis of TTM; (2) Massachusetts General Hospital Hairpulling Scale (MGH-HS; Keuthen et al., 1995; O'Sullivan et al., 1995) score of at least 12; (3) a Wechsler Test of Adult Reading (WTAR; Wechsler, 2001) score of at least 85; (4) age between 18 and 65; (5) fluent in the English language; (6) outpatient status; (7) not on psychotropic medication, or on stable psychotropic medication for eight weeks prior to the study and during the course of the study; and (8) not currently receiving therapy for TTM or another disorder. Exclusion criteria included: (1) diagnosis of bipolar disorder, psychotic disorder, current substance dependence, or pervasive developmental disorder; or (2) severe depression or anxiety with potential suicidality as determined by the primary investigator, a licensed clinical psychologist.

A total of 91 adults with TTM (*M* age = 35.0, SD = 12.67, range: 18-61) qualified for the study and completed baseline assessment. Of these participants, 84 identified their gender as female and seven identified as male. The majority (83.5%) of these participants identified their ethnicity as Caucasian, 11 (12.1%) identified as African American, one (1.1%) identified as Asian, and three (3.3%) chose not to respond to this question.

**Measures**

This study utilized the MGH-HS, a self-report TTM scale, and the NIMH-TSS, a clinician-administered TTM measure. Additionally, ratings of participants’ hair loss severity were analyzed. A clinician rating was administered to assess overall TTM severity of each participant. We also examined associations between the MGH-HS and NIMH-TSS with measures of depression, anxiety, and quality of life.

***Massachusetts General Hospital – Hairpulling Scale (MGH-HS)***

The MGH-HS is a 7-item self-report measure of TTM symptom severity over the previous week. Items assess the frequency, intensity, and perceived control of hair-pulling urges, as well as the frequency, resistance, perceived control, and distress related to hair pulling. Each item is scored on a 5-point Likert scale ranging from 0 to 4, with higher scores indicating more severe TTM symptoms. Items are summed to produce an overall severity score ranging from 0-28. In previous research, the MGH-HS has demonstrated good internal consistency (α = .80 – 89; Diefenbach et al., 2005a; Keuthen et al., 1995). The MGH-HS also shows acceptable convergent validity (Diefenbach et al., 2005a; O'Sullivan et al., 1995), is sensitive to change in pulling symptoms (O'Sullivan et al., 1995), and has strong one-hour test-retest reliability (*r* = .97; O'Sullivan et al., 1995)

***National Institute of Mental Health – Trichotillomania Severity Scale (NIMH-TSS)***

The NIMH-TSS comprises five items administered in a semi-structured interview format. It assesses frequency (two items), urge resistance, distress, and interference of pulling. Items are scored on a scale ranging from 0 to 5. Higher scores indicate greater symptom severity. Scores are summed to produce a measure of total severity ranging from 0 – 25. In past studies, the NIMH-TSS has shown low internal consistency (α = .63 – 65; Diefenbach et al., 2005a; Stanley et al., 1999), moderate test-retest reliability (*r* = .70) and good inter-rater reliability (*r* = .88) in a pediatric sample (Franklin et al., 2011). It also had adequate inter-rater reliability in an adult sample (*r* = .85; Stanley et al., 1999) and has shown acceptable convergent validity (Diefenbach et al., 2005a).

***Hair Loss Severity***

Hair loss severity was measured using a one-item alopecia rating scale (Tolin et al., 2002).The degree of hair loss evident in a photograph of the most affected pulling site is rated on a Likert scale of 1 (no evidence of hair pulling) to 7 (large bald spots that are difficult to conceal). This scale has been used in past TTM research and demonstrates good interrater reliability (*r* = .82 – .93; Diefenbach et al., 2005a; Rogers et al., 2014; Tolin et al., 2002). As part of baseline assessments for the RCT, photographs were taken of each participant’s most affected pulling sites using a Canon Powershot A470 digital camera (7.1-megapixel resolution) while the participant was sitting down. Participants’ most affected pulling sites included the scalp, eyebrows, eyelashes, legs, and underarms. Most photos of participants were taken at a distance of between one to two feet from the participant. Photos of the scalp, eyebrows, or eyelashes included the entire face or head in the frame. Some photos were taken closer to the pulling site. One participant who only pulled from the pubic region was not photographed.

Of the 85 participants who were photographed, 82 had usable photos (i.e., photos that were focused, not blurry, and captured the pulling site). For participants who had multiple photos for the same pulling site, the photo with the clearest resolution and that most clearly captured the pulling site was utilized. If photos were taken of multiple pulling sites for a participant, the photo with the most visible hair loss was used. These determinations were made by the first author (K.E.B.). This resulted in only using photos of the scalp, eyebrows, and eyelashes, as these were the sites with the most visible hair loss for all participants. For the present study, photos were rated by independent raters who were masked to participants’ self-report and clinician-administered measures of symptom severity. The primary rater was a licensed psychologist with expertise in the assessment and treatment of trichotillomania. Photos were then evaluated by a second independent rater, also a licensed psychologist.

***Clinical Global Impressions – Severity Scale (CGI-S)***

The CGI-S (Guy, 1976) is a clinician-rated measure that assesses global severity of illness. The CGI-S is rated on a scale of 1 (normal, not at all ill) to 7 (extremely ill). The CGI-S has good psychometric properties (Berk et al., 2008; Leon et al., 1993) and is often used as an outcome measure in TTM treatment studies (Diefenbach et al., 2006; Grant et al., 2009; Woods et al., 2022). A previous TTM trial found inter-rater reliability to be high for the CGI-S (*r* = .87; Haaland et al., 2017).

***Beck Depression Inventory – II (BDI-II)***

The BDI-II (Beck et al., 1996) is a 21-item self-report measure that assesses symptoms of depression experienced in the past two weeks. Each item is scored on a 0-3 summative scale with higher scores indicating more severe symptoms. Items are summed to produce a total score ranging from 0-63. The BDI-II has shown high internal consistency (α = .92) and test-retest reliability (*r* = .96; Sprinkle et al., 2002). Cronbach’s alpha in the present sample was high (α = .92).

***Beck Anxiety Inventory (BAI)***

The BAI (Beck et al., 1988) is a 21-item self-report measure that assesses anxiety symptoms experienced in the past week (e.g. heart pounding or racing, unable to relax). Each item is scored on a 4-point scale, with higher scores indicating more severe anxiety symptoms. Scores are totaled and can range from 0 – 63. The BAI has shown high internal consistency (α = .92) and one-week test–retest reliability (*r* = .75; Beck et al., 1988). In this sample, Cronbach’s alpha for the BAI was high (α = .92).

***Quality Of Life Inventory (QOLI)***

The Quality of Life Inventory (Frisch, 1994; Frisch et al., 1992) is a 32-item self-report questionnaire that assesses satisfaction with 16 domains of life (e.g. health, money, work). Questions are paired asking individuals to rate the importance (rated 0 – 2) and satisfaction (rated -3 to +3; no zero) with each domain. Scores for each domain are then calculated by multiplying the importance by the satisfaction to receive a weighted score. These weighted scores are added together and divided by 16 to receive a total raw score for quality of life. T-scores are identified using the norms table in the manual. Internal consistency for the QOLI is acceptable (α = .79), and it shows acceptable convergent validity (Frisch, 1994; Frisch et al., 1992). Cronbach’s alpha for the QOLI in the present study was α = .82.

**Data Analysis**

To assess internal consistency, alpha (α) coefficients and omega (ω) coefficients were computed for the MGH-HS and NIMH-TSS using the R package *psych* (Revelle, 2023) in RStudio version 4.2.1. Internal consistency coefficients greater than .80 were interpreted as indicating good reliability, for both alpha (Lance et al., 2006; Nunnally, 1978) and omega (McNeish, 2018; Watkins, 2017).

Interrater reliability for the alopecia scale was assessed by calculating an intraclass correlation coefficient (ICC). To evaluate test-retest reliability for the MGH-HS and NIMH-TSS, Spearman’s rank order correlations (*r*s) were conducted between measures completed at screening and baseline. As one of the inclusion criteria for the study was an MGH-HS score of at least 12, all participants who were included in test-retest analyses had an MGH-HS score at screening of greater than or equal to 12. There was no MGH-HS cutoff score at baseline. There was an average of 12.5 days (*SD* = 6.36, range: 3 – 39) between the screen and baseline assessments. We also examined test-retest correlations only including data from measures that were completed within the span of 14 days.

Construct validity was evaluated using Spearman’s rank order correlations between the MGH-HS, NIMH-TSS, hair loss severity rating, and a measure of global severity (CGI-S). Discriminant validity was assessed using Spearman’s rank order correlations between measures of TTM severity (MGH-HS, NIMH-TSS, and hair loss severity) with depression (BDI-II), anxiety (BAI), and quality of life (QOLI). Correlations corrected for attenuation were also calculated and are reported separately to account for reliability differences (Borneman, 2010; Fan, 2003). The Spearman’s rank order correlation for two given variables was divided by the square root of the product of the reliability estimates for the two variables (Borneman, 2010). For these calculations, we used Cronbach’s alpha as the reliability estimate for the MGH-HS, NIMH-TSS, BDI-II, BAI, and QOLI, inter-rater reliability for the CGI-S, and ICC for the hair loss severity rating. Consistent with Cohen (1992), correlations of .10 were considered small, .30 medium, and .50 or greater large.

**Results**

**Descriptive Statistics**

 Demographic data for the sample are presented in Table 1. Descriptive statistics for the measures are outlined inTable 2.

**MGH-HS**

***Reliability***

The MGH-HS showed good internal consistency (α = 0.83; ω = 0.89). Only the deletion of item 5, resistance to pulling, provided a slight increase to Cronbach’s alpha (α = 0.87). The MGH-HS showed low re-test reliability (M = 12.5 days, range: 3 – 39; *r*s(89) = .55, *p* <.001). Including only measures that were completed within the span of 14 days, the test-retest reliability of the MGH-HS increased slightly (*r*s(61) = .60, *p* <.001).

***Construct Validity***

There was a large correlation between the MGH-HS and NIMH-TSS (*r*s(89) = .61, *p* <.001). Scores on the MGH-HS were not significantly correlated with hair loss severity ratings (*r*s(82) = .12, *p* = .288). MGH-HS scores showed a small correlation with CGI-S scores (*r*s(89) = .27, *p* = .010). After correcting for attenuation, the correlation between the MGH-HS and NIMH-TSS was high (*r*s(89) = .93, *p* <.001). MGH-HS scores were moderately correlated with hair loss severity (*r*s(82) = .38, *p* <.001) and CGI-S (*r*s(89) = .31, *p* = .003) after correcting for attenuation. Overall, these results provide moderate support for the convergent validity of the MGH-HS.

 The MGH-HS showed a small correlation with the BDI-II (*r*s(89) = .25, *p* = .017). The MGH-HS was not significantly associated with scores on the BAI (*r*s(89) = .20, *p* = .063) or QOLI (*r*s(89) = -.15, *p* = .144). After correcting for attenuation, the MGH-HS showed moderate correlations with scores on the BDI-II (*r*s(89) = .29, *p* = .006) and BAI (*r*s(89) = .22, *p* = .034), and was not associated with QOLI (*r*s(89) = -.19, *p* = .076). These associations suggest that the MGH-HS has good discriminant validity.

**NIMH-TSS**

***Reliability***

Cronbach’s alpha for the NIMH-TSS was α = 0.52. Only deletion of item 4, resistance to urges, increased Cronbach’s alpha (α = 0.57). Omega coefficient for the NIMH-TSS was ω = 0.73. The NIMH-TSS demonstrated low test-retest stability (*r*s(89) = .61, *p* <.001). A re-examination of test-retest reliability for the NIMH-TSS only including measures completed within the span of 14 days yielded a slightly smaller correlation (*r*s(61) = .56, *p* <.001).

***Construct Validity***

The NIMH-TSS and MGH-HS showed a large correlation that increased after correcting for attenuation. The NIMH-TSS was not significantly associated with hair loss severity ratings (*r*s(82) = .03, *p* = .801). The NIMH-TSS and CGI-S showed a medium correlation (*r*s(89) = .33, *p* = .002). After correcting for attenuation, the NIMH-TSS was not related to hair loss severity ratings (*r*s(82) = .05, *p* = .684) but showed a stronger correlation with CGI-S (*r*s(89) = .49, *p* < .001). On the whole, these results indicate that the NIMH-TSS has adequate convergent validity.

NIMH-TSS scores were weakly correlated with BDI-II (*r*s(89) = .27, *p* = .011) and BAI scores (*r*s(89) = .21, *p* = .048), but were not significantly associated with QOLI (*r*s(89) = -.16, *p* = .121). After correcting for attenuation, the NIMH-TSS was moderately correlated with the BDI-II (*r*s(89) = .39, *p* < .001), BAI (*r*s(89) = .30, *p* = .004), and QOLI (*r*s(89) = -.25, *p* = .016). These associations support the discriminant validity of the NIMH-TSS.

**Hair Loss Severity Ratings**

***Reliability***

Interrater reliability for the alopecia scale was acceptable (ICC = .76, *p* < .001).

***Construct Validity***

As described previously, hair loss severity was not significantly correlated with the MGH-HS or NIMH-TSS. However, after correcting for attenuation, hair loss severity was moderately correlated with the MGH-HS. Hair loss severity ratings showed a medium association with CGI-S scores (*r*s(82) = .30, *p* = .006). After correcting for attenuation, hair loss severity ratings were moderately correlated with CGI-S (*r*s(82) = .37, *p* < .001). Hair loss severity ratings were not significantly correlated with BDI-II, BAI, or QOLI before and after correcting for attenuation (ps > .05).

**Discussion**

The present study evaluated the psychometric properties of commonly used measures of TTM severity. A large sample size from a multi-gated clinical trial allowed for the replication of previous psychometric reports of the MGH-HS and NIMH-TSS, as well as an additional evaluation of test-retest reliability for these measures. This study also extended past research on TTM measures by including a hair loss severity rating in our analyses and calculating omega coefficients in addition to Cronbach’s alpha. Collectively, our findings mirrored past research showing mixed psychometric properties for the MGH-HS and NIMH-TSS, underscoring the importance of a multi-method approach for assessing TTM. Our results also suggest that hair loss severity ratings may offer unique supplemental data in evaluating TTM severity.

**Psychometric Evaluation of the MGH-HS and NIMH-TSS**

The MGH-HS demonstrated good internal consistency (α = 0.83; ω = 0.89), replicating earlier work (Carlson et al., 2021; Chesivoir & Grant, 2022; Cheyne et al., 2018; Diefenbach et al., 2005a; Haaga et al., 2015; Keuthen et al., 2007; Keuthen et al., 1995; Lee et al., 2018a; Lee et al., 2018b) and suggesting the MGH-HS likely assesses a single construct. Cronbach’s alpha for the NIMH-TSS was low (α = 0.52), similar to prior studies (Carlson et al., 2021; Chesivoir & Grant, 2022; Diefenbach et al., 2005a; Haaland et al., 2017; Stanley et al., 1999). However, omega for the NIMH-TSS was 0.73, which may indicate that test data from the NIMH-TSS violated the assumptions of Cronbach’s alpha and resulted in an underestimation of its internal consistency. Nevertheless, the omega coefficient for the NIMH-TSS still falls below optimal levels for psychological measurement (McNeish, 2018; Watkins, 2017).

Previous discussions have noted that diversity in individual presentations of TTM may influence internal consistency (Diefenbach et al., 2005a; Stanley et al., 1999), suggesting that inadequate internal consistency may be the result of attempting to assess an unstable construct, as opposed to being an unreliable measure. This notion aligns with literature underscoring the heterogeneity of hair pulling symptoms seen across individuals with TTM (Duke et al., 2010; Mansueto et al., 1997; Woods et al., 2006; Woods & Houghton, 2014).

The lower internal consistency of the NIMH-TSS might also be related to its origin, as it was derived from the Yale-Brown Obsessive Compulsive Scale (Y-BOCS; Goodman et al., 1989). OCD and TTM are distinct but related disorders (Ferrão et al., 2009; Swedo & Leonard, 1992), and an OCD-based assessment may not capture the key phenomenological and functional factors that are pertinent to TTM. For instance, emotion and sensory-related variables are often involved in the hair pulling cycle (Badenoch et al., 2020; Roberts et al., 2013; Shusterman et al., 2009; Siwiec & McBride, 2016), and these variables are not assessed on the NIMH-TSS. The measure also does not account for hair loss severity caused by TTM symptoms. Despite low internal consistency, however, the NIMH-TSS is one of the only standardized clinician-rated measures of TTM severity. Therefore, it is still important to include as part of a multi-method TTM assessment, rather than solely depending on patient-report data from the MGH-HS.

In this study, the MGH-HS and NIMH-TSS demonstrated low to moderate test-retest reliability. The instability of these measures might be explained by several factors. First, although these measures are intended to be completed weekly, the average time between the first and second assessments was closer to a two-week window. Increasing the amount of time between measurements can inherently diminish test re-test reliability. Thus, a one-week retest window may result in more acceptable test-retest reliability. Second, the assessment of hair pulling itself may have influenced participants’ responses by increasing self-awareness between assessments and increasing variability. Lastly, test-retest reliability assumes that the construct being measured is relatively stable, but hair pulling symptoms are known to vary substantially from day to day and week to week. Nonetheless, the relatively low test-retest reliability of both measures is of concern, as this may bring into question the interpretation of outcome data based on these measures.

**Construct Validity**

The present study also examined correlations between the MGH-HS, NIMH-TSS, and hair loss severity. Results showed a strong correlation between the MGH-HS and NIMH-TSS (*r*s = .61) that increased after correcting for attenuation (*r*s = .93). These results suggest adequate convergent validity and provide support that the MGH-HS and NIMH-TSS are assessing a similar construct. We did not find significant associations between the MGH-HS or NIMH-TSS with hair loss severity ratings, similar to previous studies (Diefenbach et al., 2005a; Haaga et al., 2015). These nonsignificant associations between hair loss severity and the MGH-HS and NIMH-TSS might be attributable to several factors. First, the MGH-HS and NIMH-TSS do not contain items that ask about hair loss resulting from pulling, and hair loss may not have a direct relationship with the variables assessed by the MGH-HS and NIMH-TSS, such as resistance of pulling urges and urge intensity. Second, degree of hair loss might depend more on hair pulling site or idiosyncratic pulling patterns (Myers & Hamilton, 1951). For example, eyebrows and eyelashes have fewer total hairs compared to the scalp, so hair loss might be more apparent in those areas after less pulling. For this reason, pulling from one localized area could result in more severe-appearing hair loss compared to pulling in a more evenly distributed manner. Finally, there can be a latency period between change in hair pulling and change in hair growth (Courtois et al., 1994; Mounsey & Reed, 2009; Winchel et al., 1992b), so current hair loss might not be an accurate reflection of recent pulling symptoms. Considering the MGH-HS and NIMH-TSS assess TTM symptoms over the previous week, this might contribute to the lack of relationship between these measures and hair loss severity ratings.

Additionally, we tested the associations between TTM measures and measures of global severity, anxiety, depression, and quality of life. The MGH-HS, NIMH-TSS, and hair loss severity ratings showed moderate correlations with the CGI-S. TTM measures showed small to medium correlations with anxiety, depression, and quality of life, providing support for divergent validity.

**Future Directions**

Given the mixed psychometric properties found for existing TTM measures, researchers and clinicians would benefit from the development of new, psychometrically-sound TTM rating scales. Diefenbach et al. (2005a) proposed the development of a clinician-rated instrument along two dimensions: characteristics of actual pulling behaviors and the impact of pulling. These two facets of TTM are not always strongly associated but are both essential in assessing symptom severity, treatment progress, and treatment outcome. Evaluating actual pulling behaviors can be challenging given the heterogeneity in TTM. For instance, some individuals pull in short but intense episodes that result in marked hair loss and distress. In such a case, duration may not accurately reflect true severity. For a more complete picture of pulling behaviors, a new measure could assess the dimensions of frequency (i.e., number of pulling episodes per unit of time), intensity (i.e., how much force or rapidity is put into the act of pulling), duration (i.e., time spent pulling per episode), amount of hair pulled per episode, and current hair loss. It would also be important to separately assess these dimensions for each affected pulling site. Further, a new TTM measure should assess the different functional areas on which pulling can have a negative impact. It would be important to include items related to the emotional effects of hair pulling (e.g., feeling embarrassed, frustrated, or guilty) as well as functional impairment (e.g., avoidance, interference with everyday activities, social difficulties, work- or school-related consequences, and decreased productivity due to pulling or hair loss).

Additionally, the instability of hair pulling symptoms is another important consideration in developing TTM severity measures. Reliability of a TTM severity scale might be improved by separating items that measure relatively constant variables (e.g., pulling sites and perceived control over pulling) from those that tend to be more inconsistent (e.g., frequency or duration of pulling). The timeframe over which severity is assessed should also be considered. Given the fluctuating nature of TTM, researchers developing a new scale should test if measuring symptoms over the previous two weeks or past month results in a more accurate estimate of severity as compared to the past week.

Subsequent modifications to TTM assessment may also consider including an observable indicator of TTM symptoms, such as observed hair loss severity, as part of a clinician-rated instrument (Winchel et al., 1992b). The present data suggest that degree of hair loss in TTM may occur independently of factors assessed by the MGH-HS and NIMH-TSS. Nevertheless, there are limitations to the use of hair loss ratings, as hair loss and regrowth can vary as a function of pulling site, idiosyncratic pulling behaviors, and individual characteristics like age and gender (Cohen, 2010; Haaga et al., 2015; Myers & Hamilton, 1951). These factors notwithstanding, hair loss is a central component of TTM, and an independent hair loss rating could contribute a piece of observable information to a comprehensive assessment of TTM severity.

On the whole, until new assessment tools for TTM are created, findings support a multi-method approach to assessing TTM. This approach should include existing self-report and clinician-administered measures (e.g., the MGH-HS and NIMH-TSS). A more objective indicator of symptom severity such as a visual analysis of hair loss could also be an important addition. Lastly, as the MGH-HS and NIMH-TSS have limited items assessing the functional and emotional impact of pulling, including a measure of quality of life or wellbeing could be valuable (e.g., the Quality of Life Inventory; Frisch et al., 1992).

**Study Limitations and Strengths**

Results from this study should be interpreted in light of certain limitations. First, inclusion criteria for the study included an MGH-HS score of at least 12 at screening, which restricted the range of scores on the MGH-HS in our sample and may have reduced correlational strength on analyses involving this measure. We were also limited in our measures to assess convergent and divergent validity as we only had the measures used in the RCT. A greater variety of expected positively and negatively correlated measures would teach us more about the constructs assessed with these measures. Additionally, the hair loss severity scale was used to rate a photo of each participant’s worst pulling site. It could be valuable to test alternative approaches to rating hair loss, such as a summative severity score for individuals who have multiple pulling sites. We also did not examine the test-retest reliability of the hair loss severity rating; future research should examine the temporal stability of this measure.

Nevertheless, the present work has notable strengths. We examined the psychometric properties of TTM measures in a large sample of treatment-seeking adults with TTM, which extends past studies on these measures in smaller samples (Diefenbach et al., 2005a; Stanley et al., 1999). We also extended prior research on the MGH-HS and NIMH-TSS by examining test-retest reliability and by calculating omega coefficients as additional measures of internal consistency. Moreover, the present study contributes to the existing literature in this area by including a hair loss severity rating in our psychometric analyses. Overall, our findings underscore the need for more psychometrically-sound TTM measures and highlight the importance of utilizing multiple data sources when assessing TTM.

**Declarations**

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**Conflicts of interest**: Ms. Barber, Mr. Bauer, and Dr. Saunders, Dr. Compton, and Dr. Franklin declare that they have no conflict of interest. Dr. Woods receives book royalties from Oxford University Press and Guilford Press. Dr. Twohig has books on trichotillomania and ACT with New Harbinger and Oxford University Press, has received honorarium for talks on ACT and trichotillomania, and has received donations from the Huntsman Foundation for his research on trichotillomania.

**Ethics approval**: Data analyzed in this study were collected as part of a randomized clinical trial examining the efficacy of psychotherapy for adults with TTM. All procedures performed in studies involving human participants were in accordance with the ethical standards of the Institutional and/or National Research Committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. The data collection procedures for the trial were approved by Institutional Review Boards at both the University of Wisconsin-Milwaukee and Texas A&M University.

**Animal Rights**

No animal studies were carried out by the authors for this article.

**Consent to participate**: Informed consent was obtained from all individual participants included in the study.

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**Table 1**

*Sample Demographics*

|  |  |  |
| --- | --- | --- |
|  | Full Sample | Hair Loss Severity Subsample |
|  | M or n | SD or % | M or n | SD or % |
| Age | 34.93 | 12.65 | 35.63 | 12.88 |
| Gender |  |  |  |  |
|  Female | 84 | 92.3% | 78 | 92.9% |
|  Male | 7 | 7.7% | 6 | 7.1% |
| Ethnicity |  |  |  |  |
|  Caucasian | 76 | 83.5% | 70 | 83.3% |
|  African American | 11 | 12.1% | 11 | 13.1% |
|  Asian/Pacific Islander | 1 | 1.1% | 0 | 0 |
|  Not Reported  | 3 | 3.3% | 3 | 3.6% |

**Table 2**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | N | Mean | SD | Min | Max | Cronbach's Alpha Coefficient (α) | Cronbach'sAlpha if Item Deleted | OmegaCoefficient (ω) |
| NIMH-TSS Total | 91 | 14.53 | 3.66 | 6.00 | 21.00 | 0.52 |  | 0.73 |
|  Item 1: Duration, past week | 91 | 2.87 | 1.43 |  |  |  | 0.31 |  |
|  Item 2: Duration, past day | 91 | 2.47 | 1.64 |  |  |  | 0.31 |  |
|  Item 3: Resistance | 91 | 3.44 | 1.13 |  |  |  | 0.57 |  |
|  Item 4: Distress | 91 | 3.36 | 0.96 |  |  |  | 0.46 |  |
|  Item 5: Interference | 91 | 2.38 | 0.96 |  |  |  | 0.54 |  |
| MGH-HS Total | 91 | 16.99 | 4.65 | 8.00 | 26.00 | 0.83 |  | 0.89 |
|  Item 1: Frequency of urges | 91 | 2.23 | 1.01 |  |  |  | 0.79 |  |
|  Item 2: Intensity of urges | 91 | 2.37 | 0.86 |  |  |  | 0.79 |  |
|  Item 3: Control of urges | 91 | 2.54 | 0.95 |  |  |  | 0.80 |  |
|  Item 4: Frequency of pulling | 91 | 2.11 | 0.94 |  |  |  | 0.80 |  |
|  Item 5: Resistance of pulling | 91 | 2.22 | 0.89 |  |  |  | 0.87 |  |
|  Item 6: Control of pulling | 91 | 3.21 | 0.78 |  |  |  | 0.80 |  |
|  Item 7: Distress | 91 | 2.31 | 1.11 |  |  |  | 0.82 |  |
| Hair Loss Severity Rating | 84 | 4.51 | 1.67 | 1.00 | 7.00 |  |  |  |
| CGI-S | 91 | 4.29 | 0.55 | 3.00 | 6.00 |  |  |  |
| BDI-II | 91 | 12.64 | 9.97 | 0.00 | 41.00 |  |  |  |
| BAI | 91 | 12.62 | 10.68 | 0.00 | 56.00 |  |  |  |
| QOL | 91 | 1.52 | 1.67 | -3.13 | 4.44 |  |  |  |

*Descriptive Statistics*

**Table 3**

*Correlation Matrix of Study Variables*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | MGH-HS | NIMH-TSS | Hair Loss Severity | CGI-S | BDI-II | BAI |
| MGH-HS | - |  |  |  |  |  |
| NIMH-TSS | .61\*\*\* | - |  |  |  |  |
| Hair Loss Severity | .12  | .03 | - |  |  |  |
| CGI-S | .27\*\* | .33\*\* | .30\*\* | - | . |  |
| BDI-II | .25\* | .27\* | .11 | .28\*\* | - |  |
| BAI | .20 | .21\* | -.02 | .16 | .66\*\*\* | - |
| QOL | -.15 | -.16 | -.11 | -.10 | -.50\*\*\* | -.28\*\* |

*Note*. \*\*\* p < .001; \*\* p < .01; \* p < .05.