

# The Milwaukee Inventory for Subtypes of Trichotillomania-Adult Version (MIST-A): Development of an Instrument for the Assessment of “Focused” and “Automatic” Hair Pulling

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**Abstract** This article describes the development of the Milwaukee Inventory for Subtypes of Trichotillomania-Adult Version (MIST-A), which was designed to assess “automatic” and “focused” pulling subtypes of trichotillomania (TTM). Participants reporting symptoms of TTM ( $n=1,697$ ) completed an internet survey; participants were later randomly assigned to either Exploratory ( $n=848$ ) or Confirmatory ( $n=849$ ) Analyses. Exploratory Analyses examined the development and psychometric properties of

the MIST-A. Results of an exploratory factor analysis revealed a two-factor solution. Factor 1 (“focused” pulling scale) and 2 (“automatic” pulling scale) consisted of ten and five items respectively, with both scales demonstrating adequate internal consistency and good construct and discriminant validity. Subsequent confirmatory factor analysis demonstrated support for the scale’s underlying factor structure. The MIST-A provides researchers with a reliable and valid assessment of “automatic” and “focused” pulling, although replication using a clinically ascertained sample is necessary.

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Trichotillomania (TTM) is characterized by the recurrent pulling out of one’s hair resulting in noticeable hair loss. Individuals diagnosed with TTM must experience an increasing sense of tension prior to or when attempting to resist pulling, and gratification, relief, or pleasure when pulling. In addition, pulling must result in clinically significant distress or impairment and must not be better accounted for by another mental health or medical condition (American Psychiatric Association 2000, p. 677). TTM occurs in 0.6% of the population and is more prevalent among women (Christenson et al. 1991b).

Research examining the phenomenology of TTM suggests that the disorder may have different subtypes. (Christenson et al. 1991a; Christenson and Mackenzie 1994; du Toit et al. 2001; Diefenbach et al. 2002). In their examination of 60 adults with chronic hair pulling, Christenson et al. (1991a, b) found that 5% of participants reported pulling completely out of awareness, 15% reported pulling in which the focus of

attention was directly on hair pulling, but the majority of participants (80%) reported pulling that ranged from complete to incomplete awareness of the behavior. This research led to the identification of two pulling subtypes referred to as “automatic” and “focused” pulling (Christenson and Mackenzie 1994).

“Automatic” pulling is characterized by pulling episodes that occur primarily out of an individual’s awareness and may include situations in which an individual pulls hair while engaging in sedentary activities (e.g., watching television, reading a book, or listening to the radio) but is unaware of pulling until afterwards (e.g., when seeing hair on lap or clothing). “Focused” pulling is characterized by pulling with an almost compulsive quality and includes situations in which an individual pulls in response to negative emotional states (e.g., anxiety, stress, anger, etc.), an intense thought or urge, or in an attempt to establish symmetry. Research suggests that “focused” pulling may represent an attempt to decrease levels of negative affect or regulate aversive private experiences (e.g., anxiety, stress, specific cognitions, etc.; Begotka et al. 2004; Woods, Wetterneck and Flessner 2006).

Diefenbach et al. (2002) offered preliminary support for the concept of “focused” pulling by examining the affective correlates of TTM in 44 patients diagnosed with the disorder. Self-reported mood states were assessed before, during, and after hair pulling episodes. Results indicated that anxiety and tension served both as stimulus cues and negative reinforcers in TTM, as relief from these states was achieved through pulling. Such findings indicate that at least some pulling (e.g., “focused” pulling) may function to alleviate or regulate negative emotions (e.g., Begotka et al. 2004).

Although there is now growing evidence supporting the presence of “focused” and “automatic” pulling in TTM, ambiguity persists regarding the extent to which individuals experience predominantly one type or the other. Although some research has suggested that 15% of pulling may be entirely “focused” (Christenson et al. 1991a, b), subsequent research has suggested that up to 25% of pulling episodes may be primarily “focused.” (Christenson and Mackenzie 1994). In the most systematic attempt to distinguish between “focused” and “automatic” pulling to date, du Toit et al. (2001) examined pulling in a sample of 47 self-referred patients suffering from either TTM or chronic hair pulling without tension and/or relief after pulling. Patients were asked to rate their pulling from entirely “automatic” (score of 0) to entirely “focused” (score of 4). Results indicated that 34% ( $n=16$ ) of participants characterized their pulling as primarily “focused,” 47% ( $n=22$ ) as primarily “automatic,” and 19% as equally “automatic” and “focused.” Notably, a large percentage of individuals in this study (approximately 81%) reported predominantly “focused” or “automatic” pulling, which contrasts with substantially lower rates

provided from earlier, less systematic studies. Because “focused” and “automatic” pulling may require different interventions (Franklin et al. 2006), more research is needed to clarify the degree to which each is present in those with TTM.

Before any additional work on “focused” and “automatic” subtypes of TTM can continue, there is a compelling need to develop a reliable and valid means of assessing the “focused” and “automatic” constructs. Available measures for the assessment of TTM have focused exclusively on assessing the severity of the disorder (e.g., Winchel et al. 1992; Keuthen et al. 1995), while ignoring the assessment of “focused” and “automatic” pulling subtypes. Unfortunately, recruiting a sample (in excess of 200 participants) of the size necessary to develop such a scale is difficult given the relatively low prevalence rate of the disorder (e.g., 0.6%; Christenson et al. 1991a, b). To date, only Cohen et al. (1995;  $n=123$ ) and Keuthen et al. ( $n=119$ ) have demonstrated the ability to recruit over 100 persons with TTM. As a result, an alternative method of recruitment is necessary.

To aid in the examination of behavior problems that may be infrequent in the general population, researchers have begun to utilize internet sampling procedures. Despite trepidation by some as to the appropriateness of using the internet to collect valid data, Gosling et al. (2004) found that data collected from internet samples were not tainted by false data or repeat responders and were consistent with results from traditional methods. In addition, researchers have encouraged the use of large samples to make up for the greater variability found in internet samples and have suggested that procedures be in place to identify and eliminate duplicative data sets sent from the same individual. Researchers have already begun to use internet sampling to examine the social (Wetterneck et al. 2006) and functional impact (Woods et al. 2006) of TTM. Therefore, the internet may be useful for aiding in the development of instruments designed to assess specific phenomenological characteristics of TTM.

The current study was conducted to develop a measure assessing the degree to which individuals engage in “focused” and/or “automatic” pulling and employed internet sampling procedures to obtain a sufficient sample of participants with symptoms of TTM. The current project conducted two separate sets of statistical analyses. The first set of analyses (hereafter referred to as *Exploratory Analyses*) were chosen in order to conduct an exploratory factor analysis (EFA) on, and examine the psychometric properties of the Milwaukee Inventory for Subtypes of Trichotillomania-Adult Version (MIST-A). The second set of analyses (hereafter referred to as *Confirmatory Analyses*) involved a confirmatory factor analysis (CFA) on the newly derived MIST-A to further examine the instrument’s factor structure.

## Methods

### Participants

This study was part of the Trichotillomania Impact Project, a large study examining the functional impact of TTM in adults (Woods et al. 2006), and was approved by the University of Wisconsin-Milwaukee's Institutional Review Board. Participants were recruited through a link established with the Trichotillomania Learning Center's (TLCs) homepage ([www.trich.org](http://www.trich.org)). The TLC is a large patient support organization for persons with TTM. A total of 2,558 responses were received, and all duplicate surveys ( $n=106$ ) were excluded from analyses. Duplicates were defined as surveys containing identical information on all items. Respondents were included in subsequent analyses if they met diagnostic criteria for TTM (APA, 2000, p. 677) as modified for the purposes of the current study. This modified criteria required respondents to indicate that he or she (1) pulled hair resulting in either noticeable hair loss or thinning of the hair, (2) experienced increased physical tension immediately before pulling or when trying to resist pulling, or pulled to relieve an uncomfortable bodily sensation at least "a little of the time" (i.e., 11–29%), (3) experienced pleasure, gratification, or relief after pulling, or he/she pulled to relieve an uncomfortable bodily sensation at least "a little of the time" (i.e., 11–29%), (4) "never/almost never" (0–10%) pulled his/her hair in response to voices others may not be able to hear or due to beliefs that bugs/insects were crawling on their skin, (5) reported experiencing at least "mild to moderate" impairment (a score of 3 or greater on a 9-point Likert scale) in day-to-day, social, interpersonal, occupational, or academic functioning as a result of pulling, and (6) were at least 18 years of age.

A total of 1,697 participants met modified diagnostic criteria for TTM. For the purpose of subsequent analyses, a statistical software package, SPSS, randomly assigned participants to one of two separate groups (e.g., *Exploratory* and *Confirmatory Analyses*). What follows are demographic characteristics for participants assigned to either *Exploratory* or *Confirmatory Analyses*.<sup>1</sup>

*Exploratory Analyses* Exploratory Analyses included data from 848 participants reporting symptoms of TTM. The sample was 6.4% men ( $n=54$ ) and 93.0% women ( $n=789$ ). Five participants failed to report their gender.<sup>2</sup> Participants represented a range of ethnicities, including 87.3% ( $n=740$ ) Caucasian, 3.7% ( $n=31$ ) Hispanic/Latino, 2.9% ( $n=25$ ) African-American, 2.7% ( $n=23$ ) multi-racial, 1.4% ( $n=23$ ) Asian-American, 0.4% ( $n=3$ ) Native-American, and 1.4% ( $n=12$ ) "other." The median income was \$30,000–\$49,999. Participants completed a median of 4 years of education post high school, and the modal degree completed was a "High School or GED equivalent." Participants ranged in age from 18 to 67 ( $M=30.6$ ,  $SD=10.13$ ). Fifty-four percent ( $n=461$ ) were single, 36.6% ( $n=310$ ) married, 8.3% ( $n=70$ ) divorced or separated, 0.1% ( $n=1$ ) widowed, and three participants did not respond to the question. Four-hundred seventy one participants reported having been formally diagnosed with TTM (55.5%), and 373 (44.0%) had not been previously diagnosed. Thirty-four percent ( $n=284$ ) of participants reported seeking help for a psychosocial problem other than TTM with mood (e.g., depression, bipolar disorder, etc.) and anxiety (e.g., obsessive-compulsive disorder, social phobia, agoraphobia, etc.) disorders among the most common concerns.

*Confirmatory Analyses* Confirmatory Analyses included 849 participants reporting symptoms of TTM. The sample was 6.6% men ( $n=56$ ) and 93.3% women ( $n=792$ ). One participant failed to report their gender.<sup>2</sup> Participants represented a range of ethnicities, including 86.9% ( $n=738$ ) Caucasian, 3.7% ( $n=31$ ) Hispanic/Latino, 3.3% ( $n=28$ ) African-American, 1.5% ( $n=13$ ) multi-racial, 2.4% ( $n=20$ ) Asian-American, 0.7% ( $n=6$ ) Native-American, and 1.3% ( $n=11$ ) "other." The median income was \$20,000–\$29,999. Participants completed a median of 4 years of education post high school, and the modal degree completed was a "Bachelor's degree (4 year college)" Participants ranged in age from 18 to 69 ( $M=31.3$ ,  $SD=10.19$ ). Fifty-three percent ( $n=448$ ) were single, 37.0% ( $n=314$ ) married, 9.4% ( $n=78$ ) divorced or separated, 0.6% ( $n=5$ ) widowed, and four participants did not respond to the question. Four-hundred eighty nine participants reported having been formally diagnosed with TTM (57.6%), and 357 (42.0%) had not been previously diagnosed. Thirty-one percent ( $n=260$ ) of participants reported seeking help for a psychosocial problem other than TTM with mood (e.g., depression, bipolar disorder,

<sup>1</sup> Chi-square analyses and independent samples *t* tests were conducted to examine whether significant differences existed between participants randomly assigned to *Exploratory* or *Confirmatory Analyses* with respect to demographic characteristics and MIST-A scores. Results revealed no statistically significant differences between study participants with respect to gender, ethnicity, annual income, marital status, degree obtained, self-reported diagnosis of TTM, comorbid mental health concerns, age, years of education post high school, "focused" scale scores, or "automatic" scale scores.

<sup>2</sup> Given the exceptionally large women to men ratio for individuals diagnosed with TTM cited in previous research (Christenson et al. 1991a, b), the development of gender-based norms for the MIST-A is not planned. As such, participants not specifying gender were included in all subsequent analyses.

etc.) and anxiety (e.g., obsessive–compulsive disorder, social phobia, etc.) disorders among the most common concerns.

For both samples (Exploratory and Confirmatory) statistical analyses were conducted to examine whether significant differences existed between participants who reported having previously been diagnosed with TTM and those who did not. Comparisons were made on demographic characteristics and the various self-report measures used in this study. Due to the number of comparisons ( $n=20$ ), an alpha level of 0.003 was used to determine statistical significance. Chi-square and independent samples  $t$  tests conducted for both Exploratory and Confirmatory data sets revealed statistically significant differences with respect to gender [ $\chi^2(1)=13.67$ ,  $p\leq 0.001$  and  $\chi^2(1)=21.21$ ,  $p\leq 0.001$ , respectively] and “focused” scale scores of the MIST-A [ $t(779)=3.60$ ,  $p<0.001$  and  $t(761)=3.25$ ,  $p=0.001$ ] for both groups indicating that participants receiving a prior TTM diagnosis were more likely to be female and received significantly higher scores on the MIST-A’s “focused” pulling scale. No statistically significant differences were found for either data set with respect to ethnicity, annual income, marital status, degree obtained, anxiety, depression, and stress subscale scores of the DASS-21, and “automatic” scale scores of the MIST-A.

#### Instruments

*Trichotillomania Impact Survey (TIS)* The TIS was developed in stages. In the first stage, the first three authors (CAF, DWW, and MEF) developed a set of questions to assess the domains of interest and chose standard measures to assess a broad range of areas of importance to individuals with TTM (e.g., phenomenology, hair pulling severity, etc.). A number of additional items assessing the psychosocial impact of TTM were included along with a number of additional self-report instruments; the Sheehan Disability Scale (Leon et al. 1997), Depression, Anxiety, and Stress Scale-21 item version (DASS-21; Lovibond and Lovibond 1995), Massachusetts General Hospital Hair-pulling Scale (Keuthen et al. 1995), and the MIST-A. Next, the survey was reviewed by two experts in the field of TTM who provided feedback. After this set of revisions was completed, the survey was reviewed by an expert in survey methodology and epidemiology for feedback on item wording and survey structure. Lastly, the survey was reviewed by members of the TLC-Scientific Advisory Board for comment. A finalized version of the TIS was placed online via a link to the TLC homepage.

To aid in examination of the MIST-A’s construct validity, relevant criterion measures from the TIS were selected. Specifically, the DASS-21 and five individual items from the TIS that assessed TTM phenomenology were selected

for this purpose. What follows is a description of these criterion measures and the rationale for their use.

*MIST-A* The initial version of the MIST-A was a 24-item self-report scale, designed by the first and second authors (CAF, DWW) to assess the degree to which individuals with symptoms of TTM engaged in “automatic” and/or “focused” pulling. Items were developed based upon clinical knowledge of TTM as well as research demonstrating characteristics common to descriptions of these pulling subtypes. In addition, the scale was examined by several experts in the field of TTM as part of the TIS review process (described above). Each item on the MIST-A was rated from 0 (“not true of any of my hair pulling”) to 9 (“true for all of my hair pulling”).

Past research has characterized “focused” pulling as pulling with a planned or “intentional” quality, including pulling in response to negative emotional states (e.g., anxiety, stress, anger, etc.), an intense thought or urge, or in an attempt to establish symmetry (Begotka et al. 2004; Diefenbach et al. 2002; du Toit et al. 2001; Woods et al. 2006). Because research on “focused” pulling has yet to differentiate between pulling in response to an intense thought, urge, or a negative emotional state, 15 items were developed to assess each of these facets of “focused” pulling. For example, the MIST-A includes items such as “I pull my hair when I am experiencing a negative emotion, such as stress, anger, frustration, or sadness” and “I have thoughts about wanting to pull my hair before I actually pull.” Conversely, “automatic” pulling has been operationally defined as pulling primarily out of one’s awareness (Christenson et al. 1991a, b; Christenson and Mackenzie 1994; du Toit et al. 2001). As a result, nine items were developed to assess “automatic” pulling. For example, the MIST-A includes items such as “I pull my hair when I am concentrating on another activity,” “I don’t notice I have pulled my hair until after it’s happened,” and “I am usually not aware of pulling my hair during a pulling episode.”

*DASS-21* The DASS-21 is a 21-item scale designed to measure symptoms of depression, anxiety, and stress in clinical and non-clinical populations (Lovibond and Lovibond 1995). The measure provides separate scores for the empirically derived factors of depression, anxiety, and stress. Each factor consists of seven items measured on a four-point Likert scale ranging from 0 (“did not apply to me at all”) to 3 (“applied to me very much, or most of the time”). Scores for each scale are calculated by summing the seven items and multiplying by two. Each scale has a minimum score of 0 and a maximum score of 42. Higher scores are indicative of more frequent symptoms in a given domain. The DASS-21 scales have demonstrated good internal consistency and



strong convergent (Antony et al. 1998; Brown et al. 1997) and divergent validity (Brown et al. 1997).

Research suggests that “focused” pulling may represent an attempt to decrease levels of negative affect or regulate aversive private experiences (e.g., anxiety, stress, depression, etc.; Begotka et al. 2004; Woods et al. 2006), and research by Diefenbach et al. (2002) suggests that anxiety and tension may serve as stimulus cues and negative reinforcers for individuals with TTM. Conversely, extant research has failed to report a relationship between “automatic” pulling and negative affect (Diefenbach et al. 2002; du Toit et al. 2001). Therefore, the relationship between participants’ scores on the “automatic” and “focused” pulling scales of the MIST-A and scores from the anxiety, stress, and depression scales of the DASS-21 were examined.

*Specific Items from the TIS* Five TIS items specifically addressed domains pertinent to “automatic” and/or “focused” pulling. Each of these items were rated 0 (0–10%) to 4 (90–100%). Because “automatic” pulling is best characterized by pulling out of one’s awareness (Christenson and Mackenzie 1994), one item was developed to address “percent of time aware of pulling” to provide a criterion measure for “automatic” pulling. Four items were developed to address several facets of “focused” pulling described previously. Specifically, two items assessed “percent of pulling done to achieve a specific bodily sensation” and “percent of pulling initiated in an attempt to establish symmetry.” These items were developed based upon prior research suggesting that one facet of “focused” pulling may include pulling of an almost compulsive nature (Christenson and Mackenzie 1994; Christenson et al. 1991a, b). The other two items assessed “how often do you feel a sense of physical anxiety prior to pulling” and “how often do you feel a sense of mental anxiety prior to pulling.” These were also developed based upon prior research suggesting that “focused” pulling may function to regulate aversive private experiences (Begotka et al. 2004; Woods et al. 2006) and that anxiety may serve as a stimulus cue for “focused” pulling (Diefenbach et al. 2002).

## Procedure

*Data Collection* The link to the TLC website operated for a 2 month period. The TLC directed participants to the link via e-mails sent from the TLC to individuals on its contact list. Prior to completing the TIS, participants were informed about the project’s requirements and that submission of the survey indicated consent to participate in research. The entire survey took approximately 45 min to complete. The first author received all submitted surveys via e-mail as an

“anonymous user,” and an electronic copy of each survey was printed from the first author’s computer. The first author numbered surveys according to when the survey was received (i.e., the first survey received was coded number one, etc.), and a hard copy of the survey was placed in a locked filing cabinet.

*Data Entry and Reliability Checking* To ensure data were entered correctly, an independent rater examined 22 and 18.5% of surveys ( $n=187$  and  $n=157$ ) from the Exploratory and Confirmatory Analyses data sets, respectively. This independent rater compared each variable from each database to the participant’s responses on the hard copy of the survey. Accuracy of data entry was quite high (99.8 and 99.7% accuracy, respectively) and any errors were corrected. Next, frequency checks were conducted on each numeric element for the purposes of this study. Data elements for each set of analyses appearing outside the acceptable range (e.g., a score of 23 on a four-point scale) were identified, checked against the original hard copy of the survey, and corrected if necessary.

## Results

### Exploratory Analyses

*Exploratory Factor Analysis (EFA)* Principal axis factor analysis was conducted on scores from each item of the MIST-A for the 848 respondents meeting inclusion criteria. Based upon a priori theoretical considerations (e.g., two distinct subtypes of TTM) and results from a scree plot, a two-factor solution was used (Bryant and Yarnold 1995). Varimax rotation was performed and the factor matrix was studied. Factor 1 (“focused” pulling scale), with eigenvalue=4.11, accounted for 17.1% of the variance and consisted of ten items constructed to represent pulling of a more “focused” nature (“I pull my hair to get rid of an unpleasant urge, feeling, or thought” and “I pull my hair to control how I feel”). Factor 2 (“automatic” pulling scale), with eigenvalue=3.13, accounted for 13.0% of the variance and consisted of five items constructed to represent pulling typically out of one’s awareness (“I am usually not aware of pulling my hair during an episode” and “I don’t notice that I have pulled my hair until after it’s happened”). Items were selected as representative of either factor 1 or factor 2 if the item displayed a factor structure coefficient of 0.40 or higher (Stevens 2002; Tabachnick and Fidell 2001). Factor structure coefficients are presented in Table 1.

The MIST-A was designed to assess dimensions of TTM and, as such, empirical evidence supporting or refuting the

**Table 1** Factor structure coefficients from the principal-axis factor analysis with varimax rotation of MIST-A scores

Item	Factor 1 Structure	Factor 2 Structure	Communality
I pull my hair to get rid of an unpleasant urge, feeling, or thought	<i>0.664</i>	0.146	0.532
I pull my hair to control how I feel	<i>0.617</i>	0.157	0.483
I pull my hair because of something that has happened to me during the day	<i>0.548</i>	0.263	0.454
I have thoughts about wanting to pull my hair before I actually pull	<i>0.503</i>	−0.137	0.354
I pull my hair when I am experiencing a negative emotion, such as stress, anger, frustration, or sadness	<i>0.491</i>	0.305	0.539
I pull my hair when I am anxious or upset	<i>0.478</i>	0.325	0.511
I have a “strange” sensation just before I pull my hair	<i>0.467</i>	0.218	0.324
I use tweezers or some other device other than my fingers to pull my hair	<i>0.453</i>	−0.236	0.460
I intentionally start to pull my hair	<i>0.438</i>	−0.226	0.305
I pull my hair while I am looking in the mirror	<i>0.409</i>	−0.200	0.413
I plan a time to pull during the day	0.381	−0.090	0.266
I experience an intense urge before I pull my hair	0.326	0.097	0.221
After I pull my hair, the urge to pull goes away or gets “better” for at least a short time	0.292	−0.028	0.144
I follow specific rule for how I pull my hair	0.284	0.056	0.214
I can resist pulling despite feeling the urge	0.053	−0.011	0.135
I don’t notice that I have pulled my hair until after it’s happened	−0.062	<i>0.701</i>	0.560
I am usually not aware of pulling my hair during a pulling episode	−0.123	<i>0.685</i>	0.567
I pull my hair when I am thinking about something unrelated to hair pulling	−0.079	<i>0.536</i>	0.410
I pull my hair when I am concentrating on another activity	−0.128	<i>0.494</i>	0.398
I am in an almost “trance-like” state when I pull my hair	0.171	<i>0.483</i>	0.299
There seems to be no purpose for my pulling	−0.053	0.367	0.183
I pull my hair when I am bored	0.211	0.364	0.274
It is difficult for me to stop pulling my hair	0.235	0.273	0.252
I pull my hair based on how my hair feels (e.g., dry or course) or how the hair looks (e.g., hair out of place or looks nappy)	0.106	0.153	0.159

Items in italics are those items that loaded onto the respective factor using the selected criteria and thus were retained in the final version of the scale.

utility of the MIST-A’s two distinct scales is of greater importance than empirical evidence supporting or refuting a total score. Therefore, subsequent psychometric analyses pertain only to these distinct scales and do not include discussion as to the psychometric properties of an overall MIST-A score.

**Internal Consistency** Internal consistency coefficients (Cronbach’s alphas) were obtained for scores from both the “focused” and “automatic” scales of the MIST-A. These scores are reported in Table 2. Results indicated that both the “focused” pulling ( $\alpha=0.77$ ) and “automatic” pulling ( $\alpha=0.73$ ) scales demonstrated adequate internal consistency (Nunnally and Bernstein 1994). Further analysis indicated that the deletion of specific items from either scale did not increase either scale’s internal consistency. These results suggest a 15-item version of the MIST-A consisting of a ten-item “focused” pulling scale, with scores ranging from 0 to 90 and a five-item “automatic” pulling scale, with scores ranging from 0 to 45. Higher scores indicate increasingly “focused” or “automatic” pulling, respectively.

**Means and Standard Deviations** The MIST-A does not provide an overall score. Instead, the MIST-A provides two disparate scale scores. The average score on the “automatic”

scale of the MIST-A was 25.7 (SD=9.04), and the average score on the “focused” pulling scale of the MIST-A was 45.4 (SD=16.2).

**Construct Validity** Subsequent analyses were conducted to examine the strength of the relationship between scale scores and scores from both the DASS-21 and several questions administered throughout the TIS (described previously). Spearman rank order correlations were used to examine the construct validity of the “automatic” pulling scale of the MIST-A. Results revealed a moderate, negative correlation between scores on the “automatic” pulling scale and the proportion of time participants reported they were aware of pulling,  $r(796)=-0.46, p\leq 0.001$ , indicating that as scores on the “automatic” pulling scale increased participants reported less awareness of his/her hair pulling. Results also revealed a weak positive correlation between scores on the “focused” pulling scale and the proportion of time participants reported awareness of pulling,  $r(781)=0.16, p\leq 0.001$ , suggesting that as “focused” pulling scores increased, self-reported levels of awareness also increased.

Additional analyses were conducted to examine the construct validity of the “focused” pulling scale of the

**Table 2** Internal consistency coefficients (Cronbach's Alphas) for both the "Focused" and "Automatic" pulling scales of the MIST-A

Scale	Corrected-item correlation	$\alpha$ with item deleted
<b>"Focused" pulling scale, <math>\alpha=0.771</math></b>		
1. I pull my hair to get rid of an unpleasant urge, feeling, or thought	0.612	0.727
2. I pull my hair to control how I feel.	0.545	0.737
3. I pull my hair because of something that has happened to me during the day	0.513	0.742
4. I have thoughts about wanting to pull my hair before I actually pull.	0.397	0.757
5. I pull my hair when I am anxious or upset.	0.441	0.754
6. I have a "strange" sensation just before I pull my hair.	0.403	0.757
7. I pull my hair when I am experiencing a negative emotion, such as stress, anger, frustration, or sadness	0.463	0.749
8. I use tweezers or some other device other than my fingers to pull my hair.	0.363	0.764
9. I intentionally start to pull my hair.	0.319	0.768
10. I pull my hair while I am looking in the mirror	0.355	0.763
<b>"Automatic" pulling scale, <math>\alpha=0.734</math></b>		
1. I don't notice that I have pulled my hair until after it's happened	0.596	0.648
2. I am usually not aware of pulling my hair during a pulling episode.	0.599	0.646
3. I pull my hair when I am concentrating on another activity.	0.434	0.712
4. I pull my hair when I am thinking about something unrelated to hair pulling.	0.474	0.697
5. I am in an almost "trance-like" state when I pull my hair.	0.382	0.730

MIST-A. Results revealed a weak but significant correlation between scores on the "focused" pulling scale and the proportion of pulling episodes initiated in an attempt to establish symmetry,  $r(780)=0.20$ ,  $p\leq 0.001$ . Results also revealed weak to moderate correlations between scores on the "focused" pulling scale and the frequency with which participants reported a sense of physical anxiety prior to pulling,  $r(783)=0.25$ ,  $p\leq 0.001$ . Additional analyses revealed a moderate correlation between scores on the "focused" pulling scale and proportion of pulling done to achieve a specific bodily sensation,  $r(776)=0.35$ ,  $p<0.001$  and the frequency with which participants experienced a sense of mental anxiety prior to pulling,  $r(780)=0.32$ ,  $p<0.001$ . No statistically significant relationships were found between "automatic" pulling scale scores and pulling episodes initiated to establish symmetry,  $r(795)=-0.003$ ,  $p=0.92$ , the frequency with which participants experienced mental,  $r(795)=-0.012$ ,  $p=0.74$ ) or physical anxiety,  $r(798)=-0.007$ ,  $p=0.85$ , or the proportion of pulling done to achieve a specific bodily sensation,  $r(788)=-0.004$ ,  $p=0.910$ .

A final set of analyses were conducted to examine the relationship between the "focused" and "automatic" scales of the MIST-A and participant's scores on the depression, anxiety, and stress scales of the DASS-21. Results revealed moderate correlations between scores on the "focused" pulling scale and the depression, anxiety, and stress scales of the DASS-21 [ $r(767)=0.32$ ,  $p\leq 0.001$ ,  $r(763)=0.32$ ,  $p\leq 0.001$ , and  $r(767)=0.36$ ,  $p\leq 0.001$ , respectively]. Results revealed only weak correlations between scores on the "automatic" scale and the stress and anxiety scales [ $r(783)=0.15$ ,  $p\leq 0.001$  and  $r(775)=0.12$ ,  $p=0.001$ , respectively] and

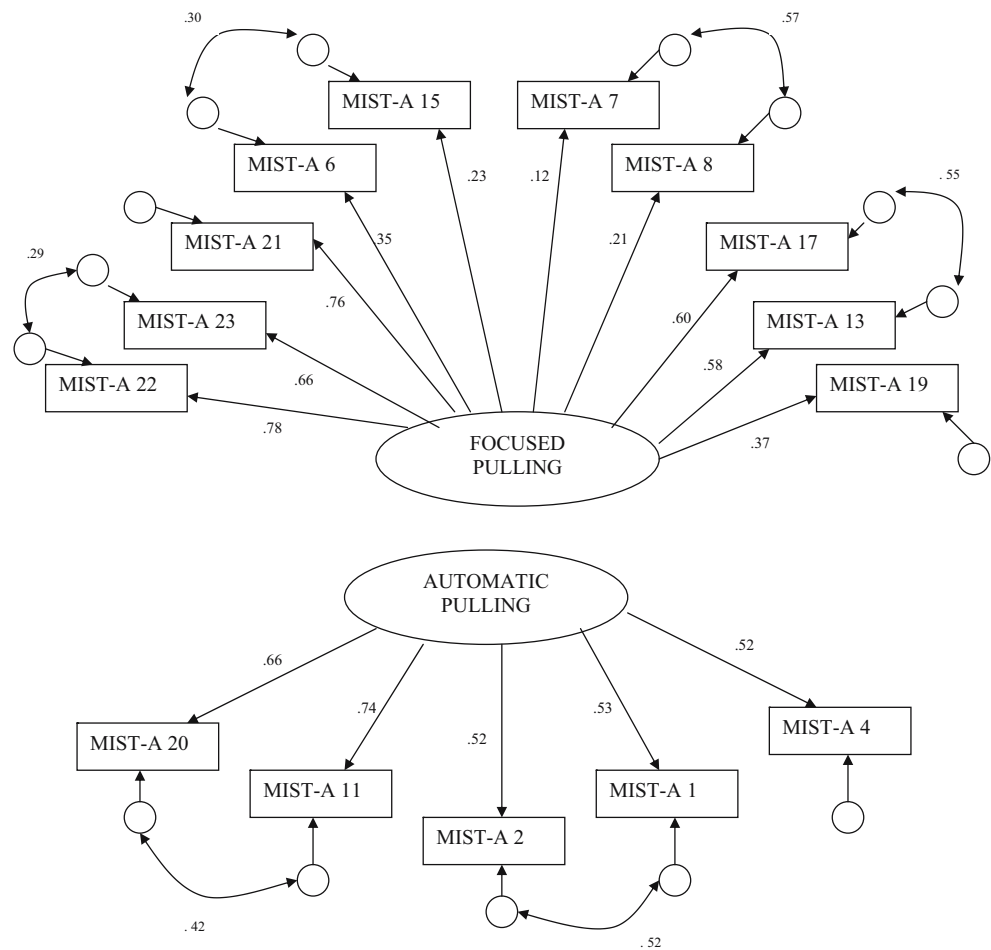
no statistically significant correlation with the depression scale of the DASS-21,  $r(783)=0.05$ ,  $p=0.206$ .

These results provide preliminary evidence suggesting that both the "automatic" and "focused" pulling scales of the MIST-A are accurate measures of their respective constructs. In an attempt to further examine whether each scale truly examined different "focused" and "automatic" subtypes of TTM, a Pearson product moment correlation was calculated to examine the relationship between "focused" and "automatic" pulling scale scores. Results demonstrated no statistically significant relationship between the "focused" and "automatic" pulling scales,  $r(774)=0.01$ ,  $p=0.742$  providing support for the notion that these two scales measure disparate dimensions of TTM.

#### Confirmatory Analyses

*Confirmatory Factor Analysis (CFA)* CFA was performed on items identified in the EFA described previously. Ten and five items demonstrating the strongest and most clear structure coefficients for Factor 1 ("focused" pulling scale) and factor 2 ("automatic" pulling scale), respectively, were used to confirm the MIST-A's underlying factor structure. Factor 1 and factor 2 were constrained to be uncorrelated with each other as the items constituting these respective scale domains are theoretically related to each other, each measuring a specific dimension of pulling. As a result, it is understandable that the error terms for some of these items are related. Therefore, several error terms for these items were allowed to correlate to account for this variability in the model. Six correlation paths among error terms were

**Fig. 1** Standardized path coefficients for the model. Latent constructs are shown in *ellipses*, and observed variables (scale items) are shown in *rectangles*, and error terms from manifest variables are shown in *circles*



entered in the model. The correlation of error terms does not change the basic factor structure, but accounts for the correlation among item response patterns for those items that may be similar in nature. Figure 1 displays the current model which demonstrates a moderately good fit with the data ( $\chi^2(84)=638.65$ ,  $p<0.001$ ,  $TLI=0.81$ ,  $CFI=0.87$ ,  $RMSEA=0.09$ ), and the significant chi-square statistic is not surprising given this study’s large sample size. Fit indices approach generally accepted standards (Hu and Bentler 1999), but these cut-offs have been argued to be arbitrary (Bollen 1989). All regression coefficients in this model were statistically significant. Therefore, this CFA supports the underlying factor structure emerging from the EFA conducted previously.

*Internal Consistency* To provide a comparison between the samples utilized as part of the Exploratory and Confirmatory Analyses, internal consistency coefficients (Cronbach’s alphas) for scores from both the “focused” and “automatic” scales of the MIST-A were obtained from this cross-validation sample. Results indicated that both the “focused” and “automatic” pulling scales ( $\alpha=0.77$  and  $\alpha=0.78$ , respectively) demonstrated adequate internal consistency

(Nunnally and Bernstein 1994). These findings are similar to results from the Exploratory Analyses.

**Discussion**

The current study investigated the development, factor analysis, and psychometric properties of a measure designed to assess “focused” and “automatic” pulling subtypes in participants reporting symptoms of TTM. Results of an EFA revealed a 15-item measure, the MIST-A, consisting of two distinct scales. Both the “focused” and “automatic” scales demonstrated adequate internal consistency and good construct validity. In addition, the “focused” and “automatic” scales demonstrated no significant relationship to one another, providing empirical support for the notion that these scales indeed measure disparate dimensions of pulling and support findings from previous research (Christenson and Mackenzie 1994; Christenson et al. 1991a, b). In addition, CFA confirmed the scale’s underlying factor structure.

The MIST-A provides the first opportunity for researchers to reliably and accurately assess “focused” and



“automatic” pulling in a time sensitive manner. The use of information obtained via a standard assessment battery (e.g., self-report, clinical interview, functional assessment, etc.) in conjunction with information obtained via administration of the MIST-A may elucidate the appropriateness of specific therapeutic interventions for a client. Previous research has suggested that tailoring treatment to the function of an individual’s hair pulling may enhance treatment outcome (Christenson and Mackenzie 1994; Diefenbach et al. 2002; Franklin et al. 2006). For example, it may be the case that individuals engaging in predominantly “automatic” pulling may be best served by therapeutic techniques aimed at increasing one’s awareness of pulling and disrupting the chain of habitual responding (e.g., habit reversal training; Azrin and Nunn 1973). Conversely, individuals engaging in predominantly “focused” pulling may be best served by interventions addressing negative private experiences exacerbating a pulling episode, such as Cognitive Behavior Therapy, Dialectical Behavior Therapy (Linehan 1993), or Acceptance and Commitment Therapy (Hayes et al. 2001). Still others with TTM experiencing a combination of both “automatic” and “focused” pulling may be best served by a combined treatment approach, such as acceptance-enhanced habit reversal training (e.g., Woods et al. 2006).

Past research has noted similarities between TTM and a variety of other psychiatric disorders, including body dysmorphic disorder, bulimia nervosa, hypochondriasis, impulse-control disorders, obsessive-compulsive disorder, skin picking, and tic disorders (Jaisoorya et al. 2003; Lochner et al. 2002; Mackenzie et al. 1995). Therefore, the use of the MIST-A or measures similar to the MIST-A may answer important questions as to the course of not only TTM but other psychiatric conditions as well. For example, a client diagnosed with bulimia nervosa may be unaware of the trigger(s) for binge-eating in some circumstances (e.g., watching television, listening to music, etc.) but may be quite aware and cognizant of other triggers (e.g., stressful day at work, negative emotions such as anxiety or depression, etc.).

Despite these encouraging findings, several methodological shortcomings should be noted. First, data from this study were collected from a non-referred sample of hair pullers, the diagnostic status and preexisting medical conditions for whom may not be indicative of “focused” and “automatic” pulling in a clinical population. Nevertheless, recent research suggests that data collected from internet samples are seldom limited by false data or repeat responders, provide results consistent with traditional methods, and have been used recently to examine the impact of both TTM and chronic skin picking (Gosling et al. 2004; Flessner and Woods 2006; Woods et al. 2006) with research by Wetterneck et al. (2006) demonstrating

that internet-derived samples are similar to those obtained via face-to-face clinical interviews. In addition, this study included only participants 18 years of age or older, and the median level of education for participant’s in this study was 4 years post high school. As such the use of the MIST-A is only appropriate for those 18 years of age or older. Related to this issue, there are questions as to the applicability of the “focused”/“automatic” distinction in children. When Reeve et al. (1992) examined the clinical characteristics of ten children with TTM none described hair pulling occurring in a compulsive manner. Although this description was meant to highlight potential differences between TTM and obsessive-compulsive disorder and did not include a direct assessment of pulling subtypes, literature has used similar terminology to describe at least one facet of “focused” pulling (e.g., pulling with an almost compulsive quality; Christenson and Mackenzie 1994). Although additional research is necessary, these findings may indicate that children do not experience or are unable to identify “focused” pulling and indicate that the emergence of “focused” pulling may follow a developmental trend. To that end, research is already underway to develop a child version of the instrument. As a second limitation to generalizability, the differences in gender and “focused” pulling scores between persons previously diagnosed with TTM and those not previously diagnosed should make clinicians cautious in their differential use of the scale with those who have not previously been diagnosed with the disorder.

As a third limitation, the final 15-item MIST-A was not administered to participants separately from the original 24 items. As a result, it is possible that the elimination of “distracter” items may change the psychometric properties of the instrument. Fourth, the “focused” and “automatic” pulling scales accounted for only 30% of the total variance, which suggests that a variety of additional environmental (e.g., family conflict) and/or biological factors (e.g., genetics) or additional undiscovered subtypes likely influence an individual’s hair pulling. Finally, it is important to note that the current study demonstrated weak to moderate correlations between “focused” pulling scale scores and several criterion measures of “focused” pulling. As one plausible explanation for these weaker correlations, previous research has suggested an increased prevalence of predominantly “automatic” and “mixed” pulling in persons diagnosed with TTM (Christenson et al. 1991a, b; Christenson and Mackenzie 1994; du Toit et al. 2001). Therefore, it is possible that these increased rates of predominantly “automatic” or “mixed” pulling in the current sample may have contributed to the weak to moderate relationships between “focused” pulling scale scores and some criterion measures. In addition, because there may exist a number of different facets to “focused” pulling (e.g., pulling to decrease a

negative emotion (e.g., anxiety, depression, etc.) or relieve some physical sensation, pulling in response to an urge or impulse, and pulling in an attempt to establish symmetry), it is not entirely surprising that scores on the “focused” pulling scale do not correlate stronger with certain criterion measures of “focused” pulling.

Despite these limitations, the current study provides the largest samples of individuals with symptoms of TTM ever collected ( $n=1,697$ ). Consequently, this study’s increased sample size provides substantial statistical power and empirical support for the factor structure of the MIST-A. Unfortunately, current measures available for use in the assessment of individuals with TTM focus primarily on the assessment of symptom severity and not on phenomenological characteristics of the disorder. Therefore, the creation and validation of the MIST-A provide an adjunct to current measures used in the assessment of TTM. It is imperative that subsequent research replicates the current findings using clinical samples of individuals diagnosed with TTM. Future research should also reexamine the psychometric properties (e.g., internal consistency, test–retest reliability, construct validity, etc.) of the MIST-A using a clinical sample. The development of the MIST-A and the subsequent development of a similar measure designed for children and adolescents may allow researchers to examine important empirical questions, such as whether pulling begins as “automatic” during childhood and becomes more “focused” throughout adolescence and into adulthood.

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