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Abstract

Background: Diagnosis of Trichotillomania (TTM) requires meeting several criteria that aim to embody the core pathology of the disorder. These criteria are traditionally interpreted monothetically, in that they are all equally necessary for diagnosis. Alternatively, a dimensional conceptualization of psychopathology allows for examination of the relatedness of each criterion to the TTM latent continuum.

Objectives: First, to examine the ability of recently removed criteria (B and C) to identify the latent dimensions of TTM psychopathology, such that they discriminate between individuals with low and high degrees of hair pulling severity. Second, to determine the impact of removing criteria B and C on the information content of remaining diagnostic criteria. Third, to determine the psychometric properties of remaining TTM diagnostic criteria that remain largely unchanged in DSM-5; that is, whether they measure distinct or overlapping levels of TTM psychopathology. Fourth, to determine whether information content derived from diagnostic criteria aid in the prediction of disease trajectory (i.e., can relapse propensity be predicted from criteria endorsement patterns).

Method: Statistics derived from Item Response Theory were used to examine diagnostic criteria endorsement in 91 adults with TTM who underwent psychotherapy.

Results: The removal of two criteria in DSM-5 and psychometric validity of remaining criteria was supported. Additionally, individual trait parameters were used to predict treatment progress, uncovering predictive power where none previously existed.

Conclusions: Diagnostic criteria for TTM should be examined in dimensional models, which allow for nuanced and sensitive measurement of core symptomology in treatment contexts.

1. Introduction

Trichotillomania (TTM; hair pulling disorder) is classified as an obsessive-compulsive related condition within the Diagnostic and Statistical Manual of Mental Disorders, 5th Edition.¹ Diagnosis of TTM generally focuses on determining the presence/absence of hair pulling, extent of hair loss, and functional impairment, but it also involves ruling out alternative causes (e.g., general medical conditions or alternative mental disorders). The DSM system publishes diagnostic codes and criteria based on an informed review of the extant literature within the context of the views of clinicians and consumers.² Diagnostic criteria for TTM were developed and shaped by expert workgroups and researchers³ that condensed the prevailing scientific advances into the diagnostic criteria, believed to operationalize the core pathology. From DSM-IV-TR to DSM-5, two DSM-IV criteria (B and C) for TTM were removed while the others (A, D, & E) were left mainly unchanged. DSM-5 added one criterion (i.e., Criterion B: repeated attempts to decrease or stop pulling). Although these changes were justified⁴ and incorporated into the diagnostic nomenclature, whether these changes represent improvements remains to be empirically affirmed. These criteria must be assessed psychometrically to fully delineate their diagnostic validity, clinical utility, and scientific merit.

Traditionally, classification of TTM has been approached in a categorical fashion. However, investigators are beginning to discover that, like many other mental disorders,⁵ the TTM construct more accurately can be understood within a dimensional model.⁶ Indeed, the conceptual development of DSM-5 was highly motivated toward a polythetic and dimensional system,⁷ but in many instances retained guidelines for diagnosis that were monothetic and categorical in

nature. Although dimensional and categorical systems may initially appear to be mutually exclusive, they are not.⁸ Some have argued that categorical and dimensional systems represent different ways of describing the same information, yet one or the other is often preferred in certain contexts.⁹ It has been noted that a dimensional approach can be converted to a categorical one, as is done in the DSM, by assigning a cut-point, by counting symptoms, or by assigning minimum time periods for symptom expression.¹⁰ Similarly, a categorical diagnosis can be converted into a dimensional system when one considers the reliability of diagnosis.⁹ For example, if for a single client, we obtained additional opinions regarding diagnosis on a categorical basis, we could convert the number of positive diagnoses into a dimensional system (i.e., 0, 1, or 2). With additional independent opinions, we could progressively add another level to the dimension (i.e., $N + 1$).

Some argue that categorical diagnoses are useful for making clinical and research decisions (i.e., whether to administer treatment or include a participant in a research study), while dimensional systems are useful for hypothesis testing and monitoring treatment response.⁹ Instead, we suggest that “yes/no” decisions are fundamentally hindered by their inability to offer multilayered clinical information that allows for nuanced clinical decision-making and sensitive measurement. We argue that, for researchers and clinicians who wish to maximize the information content of diagnostic criteria endorsement, dimensional systems offer substantial advantages. Concordantly, we also discuss the ways in which a dimensional approach may be useful for examining TTM diagnostic criteria.

1.1. Evaluating TTM

There are several methods for assessing TTM on a dimensional basis, including severity and impairment indices.¹¹⁻¹³ However, diagnostic assessment has often been conducted using the Trichotillomania Diagnostic Inventory,¹⁴ a clinician-rated measure that uses DSM-IV criteria. Each item on the TDI corresponds to a criterion and is rated on a 4-point Likert Scale (e.g., 1 = “inadequate information”, 2 = “absent”, 3 = “subthreshold”, and 4 = “threshold/true”). Despite the fact that psychometric data for the TDI

are limited, the measure has frequently been used in TTM research for obtaining diagnoses.¹⁵⁻¹⁷ Unfortunately, the diagnostic process through which the TDI is interpreted has several shortcomings, most notably the reliance on a summary judgment (or aggregate score) in which all criteria are considered monothetically. On the scale, all items must be endorsed as “threshold/true” for an individual to be diagnosed with TTM (which is consistent with the DSM system). However, this practice neglects critical differences in both the frequency and diagnostic efficiency of individual items. Thus, in practice, TTM is still diagnosed categorically, wherein all criteria must be met and each is considered equally important. Not meeting even one of the criteria would result in the lack of diagnosis.

A modern understanding of psychopathology strongly suggests that there is an underlying dimension of disorders, including TTM, which should be captured by the diagnostic system. To be specific, various diagnostic criteria often correspond to a place along the latent continuum, such that subclinical or less severe expressions of the condition may be identified by corresponding items (e.g., screening items). In contrast, critical diagnostic items correspond to stronger, more intense expressions of the pathology. For instance, a measure for depression might contain items for sadness and suicidal ideation, whereby the former identifies persons on the low end of the continuum while the latter only captures the higher end. This is likewise true of TTM, wherein the presence of hair pulling in the absence of a dermatological condition indicates merely the possible presence of the disorder, but repeated attempts to quit pulling and either or both distress and impairment indicates relatively strong likelihood of the disorder. A model that elucidates how the criteria for TTM behave in this manner would allow for a fuller understanding of the continuum of pathology and possibly allow for more nuanced measurement and clinical decisions.

The idea that items differ in their ability to identify TTM is supported by the TTM literature. Of particular relevance to the current study, criteria B and C of DSM-IV corresponded respectfully to rising tension prior to hair pulling and subsequent relief during or after pulling, but have been seriously criticized in empirical reports. If B and C truly are poor criteria, they will offer minimal information about hair pulling severity. That is, persons with high levels of TTM pathology

would endorse these criteria at a rate relatively similar to those with lower levels of the pathology. Existing research supports this hypothesis.⁴ Between 4–20% of clinical hair pullers do not endorse symptoms corresponding to either criteria,¹⁸⁻¹⁹ there are few significant clinical differences between TTM patients who do and do not meet criteria B and C,¹⁹⁻²² and individuals who pull hair report varying frequencies of these symptoms, suggesting these experiences are not universal to pulling.¹⁹ Taken together, these findings suggest that DSM-IV criteria B and C have poor diagnostic validity, reliability, and clinical utility.⁴ However, the ability of these criteria to indicate the latent dimension of hair pulling pathology has not been directly investigated.

Another reason to investigate the impact of criteria B and C on identifying the latent continuum is to quantify and analyze the impact of removing these criteria from the DSM system. After the criteria are placed in a dimensional framework, other key relationships between hair pulling and each diagnostic symptom may emerge, enabling us to answer important basic science and practical measurement questions facing the field. For example, when hair pulling reaches a certain frequency or intensity, do affected individuals endorse symptoms at a 100% rate? Or, in contrast, is it that some symptoms are endorsed at a lower level of hair pulling pathology while others identify highly severe hair pullers? A related issue is whether certain items that are endorsed at relatively lower levels of severity of the disorder can be appropriately utilized as “screening” items, whereas other items are more critical and pathognomonic, making them essential to indicate diagnosis.

The added precision of a dimensional approach has other benefits as well, particularly in regards to tracking patients in psychotherapy and treatment trials. Over the course of treatment, patients might no longer meet all criteria but still show symptoms. For example, a patient might no longer endorse one criterion but still endorse all others (e.g., no distress or impairment but still frequently pulling hair), whereas another might no longer endorse any criteria. Although neither would have a diagnosis of TTM, the former patient is probably at much greater risk for relapse than the latter. Assigning a categorical label of “no longer diagnosed” to both patients provides no predictive power for estimating risk of relapse, because individuals not

meeting all diagnostic criteria would be classified as the same (all 0s, or not diagnosed), however, these individuals are a heterogeneous group. The categorical measurement system fails to capture this essential variability in treatment response. Indeed, one study found that persons with TTM who no longer were pulling hair at the conclusion of treatment were more likely to show long-term maintenance of gains, whereas the residual presence of urges to pull did not predict relapse potential.²³ These results could be seen as applicable to DSM-IV-TR criteria A and B, but that study failed to measure the effect of various endorsement patterns of pulling, urges, and other relevant symptoms on relapse.

1.2. Current Study

The current study sought to analyze the behavioral symptoms/diagnostic criteria of the TDI within a dimensional framework. There were four primary aims. The first was to evaluate the ability of criteria B and C from DSM-IV to identify the latent TTM dimension. It was hypothesized that the level of relatedness of DSM-IV criteria B and C to the TTM dimension would be lower than that found with the remaining criteria. Second, the impact of removing criteria B and C from the DSM system was evaluated. We predicted that the other criteria as a set will adequately identify the latent dimension despite these deletions. Third, the study examined how each criterion discriminates between individuals along the diagnostic spectrum. We predicted that the criterion D, which was designed to screen out individuals with alternative medical or psychological conditions, should sit lowest on the latent TTM dimension and be relatively independent of the other items. Fourth, the study attempted to determine whether dimensional information (i.e., how criteria fit along the diagnostic spectrum) could be used to predict relapse in a clinical sample. We hypothesized that by calculating patients' standing along the latent dimension we would uncover meaningful systematic variance, which would improve our ability to predict relapse at follow-up.

2. Method

2.1. Participants

Adults with hair pulling ($N = 91$; 84 females; Mean Age = 35.04)) were recruited for participation in a randomized controlled trial of psychotherapy for TTM (ClinicalTrials.gov #NCT00872742) via newspaper ads, public transportation flyers, advertisements via the Trichotillomania Learning Center (www.trich.org), and clinical referrals at a TTM specialty clinic. Potential participants seeking TTM treatment were given a brief phone screening, and after passing preliminary screening questions (e.g., Do you pull out your hair?) reported to the specialty clinic where inclusion and exclusion criteria were checked and informed consent was obtained by advanced graduate students. Inclusion criteria consisted of (a) current DSM-IV-TR diagnosis of TTM, (b) moderate hair pulling severity as measured by a Massachusetts General Hospital Hairpulling Scale of ≥ 12 , (c) a Wechsler Test of Adult Reading score of ≥ 85 , (d) age 18–65, (e) ability to speak English fluently, (f) judged able to maintain outpatient status for duration of treatment, and (g) no initiation or change in the dosage of any psychotropic medication for up to eight weeks preceding participation or during the course of the study. Exclusion criteria consisted of (a) positive diagnosis of bipolar disorder, psychotic or neurocognitive disorder, substance dependence (with the exception of nicotine dependence), intellectual disability, or pervasive developmental disorder, (b) a primary diagnosis of mood or anxiety disorder with suicide risk, and (c) currently or formerly receiving psychotherapy for TTM. Additionally, each potential participant's ability to participate was reviewed by the research team, including the Principal Investigator, at weekly meetings to determine eligibility and ability to provide consent. Of those recruited, 3 were excluded due to intellectual impairment or another primary mental disorder, 6 were unable to be re-contacted, 13 were below minimum hair pulling severity, and 5 were determined to be subclinical hair pullers (e.g., no functional impairment, pulling conducted primarily for cosmetic reasons, no significant hair loss), resulting in a baseline sample of 91 individuals. 78 participants received treatment until mid-point, 69 were enrolled until post-treatment, and 65 were assessed at 6-month follow-up.

2.2. Materials

The Trichotillomania Diagnostic Inventory is a 7-item clinician-rated measure that assesses the five diagnostic criteria for TTM according to DSM-IV.¹⁴ Items 1, 2, and 3 all correspond to Criterion A, because A is a two-part criterion that requires both inability to resist impulses to pull out hair and noticeable hair loss. Item 1 is meant to screen those who pull hair for non-cosmetic reasons, which is also captured by item 2. Additionally, item 1 is not central to the language of DSM-IV criteria, and thus was not included in our analysis. Item 2 involves ability to resist urges to pull hair, and Item 3 relates to level of hair loss. While items 2 and 3 are subsumed under DSM-IV-TR Criterion A, they were analyzed separately in this study and are referred to henceforth as A1 and A2, respectively. The remaining items (4, 5, 6, and 7) correspond to criteria B, C, D, and E, respectively. As previously mentioned, psychometric data on the TDI do not exist, but the measure is widely used for obtaining TTM diagnosis.¹⁵⁻¹⁷

The Massachusetts General Hospital Hairpulling Scale (MGH-HPS)²⁴ is a 7-item self-report measure of Trichotillomania Severity that has satisfactory psychometric properties.²⁴⁻²⁶ Items are scores on a 5-point Likert scale ranging from 0-4, resulting in total scores that can range from 0-28. Higher scores indicate greater hair pulling severity.

The NIMH Trichotillomania Severity Scale (NIMH-TSS)²⁶ is a 5-item clinician-rated measure of Trichotillomania Severity that has adequate psychometric properties.²⁶⁻²⁹ Items are scored on 6-point Likert scales ranging from 0-5, resulting in total scores that can range from 0-25. Higher scores indicate greater hair pulling severity.

The Clinical Global Impression-Severity Scale (CGI-S)³⁰ is a single-item clinician-rated scale of Trichotillomania severity that ranges from 0-7, with higher scores indicating greater hair pulling severity. The scale has good psychometric properties^{31, 32} and has been used to measure treatment outcome in adults with TTM.^{33, 34}

2.3. Procedure

IRB approval for this project was obtained at the University of Wisconsin-Milwaukee (#09.039) and Texas A&M University (IRB2013-3025). The study is publicly listed on the U.S. National Institutes of Health human subject trials form (ClinicalTrials.gov; #NCT00872742), and was performed in compliance with the latest version of the Code of Ethics of the World Medical Association (Declaration of Helsinki).

Participants were randomly assigned to one of two active psychotherapies for TTM. Both treatments involved 10 sessions of active treatment over 12 weeks, and participants were assessed with the TDI at screening, baseline, mid-treatment (6 weeks), post-treatment (12 weeks), and 6-month follow-up.

2.4. Analysis

Item Response Theory (IRT) is a methodology for modeling how individual test items behave along trait levels.³⁵ Multilog 7 software was employed for IRT analyses.³⁶ Using two-parameter logistic (2PL) analyses for each item, with dichotomous item responses ("threshold/true" vs. "subclinical", "absent", and "inadequate information"), IRT produces two defining characteristics for each item: a slope, or discrimination parameter (a) and a difficulty parameter (b). The a parameter shows how strongly an item relates to a given latent construct (e.g., TTM diagnosis), whereas the b parameter marks the point where identification with the latent construct makes the probability of endorsing that item equal to 50%. Combined, these two parameters offer empirical evidence for how each item functions across the latent continuum.

Confirmatory factor analysis was conducted in order to determine whether the TDI demonstrated sufficient unidimensionality for IRT. There are two basic assumptions of unidimensional IRT: that items correspond to a single underlying construct (e.g., TTM) and that items are locally independent. For the purposes of unidimensional IRT analysis, local independence can be inferred once unidimensionality has been established.³⁷ Evidence for unidimensionality was evaluated using MPLUS²⁷ with two goodness-of-fit indices: the Tucker-Lewis

Index³⁹ and the Comparative Fit Index.⁴⁰ Values for both indices must be greater than .95 in order to provide strong evidence for unidimensionality.⁴¹

3. Results

3.1. Sample Characteristics

Trichotillomania severity indices indicate that the current sample is, on average, moderately impaired by their condition. The mean CGI-S score at baseline was 4.30 (SD = .548), reflecting a moderately ill average.³⁰ The mean scores on the MGH-HPS and NIMH-TSS were 16.98 (SD = 4.65) and 14.41 (SD = 3.72), respectively. These means are comparable to previous studies on adults with a primary diagnosis of TTM.²⁶

3.2. Tests of IRT assumptions

TDI scores in the present sample showed adequate goodness-of-fit indices, indicative of good unidimensionality, with values of both the TLI and CFI at .97. We also found eigenvalues corresponding to 6 factors, but only the first (3.43) was greater than 1, further supporting a solid enough one-factor solution for the IRT analysis.⁴¹

3.3. Item Characteristics

Consistent with hypothesis 1, findings indicated that DSM-IV criteria B and C performed most poorly at identifying the TTM construct. Discrimination parameters (listed in Table 1) were lowest for criteria B and C, whereas all other criteria showed relatively high relatedness to the TTM diagnostic construct (each *a* parameter > 3). These relatively low *a* parameters for criteria B and C are reflected visually in their relatively shallow slopes across the TTM dimension. In further investigating this hypothesis, "information" curves (i.e., derivatives of the item characteristic curves defined by the slope and discrimination parameters) were computed. Figure 2 shows that criteria B and C provided the lowest information peaks as compared to all other criteria. Comparatively, criteria D and E provided the highest

degrees of information, albeit, at different levels of the latent dimension.

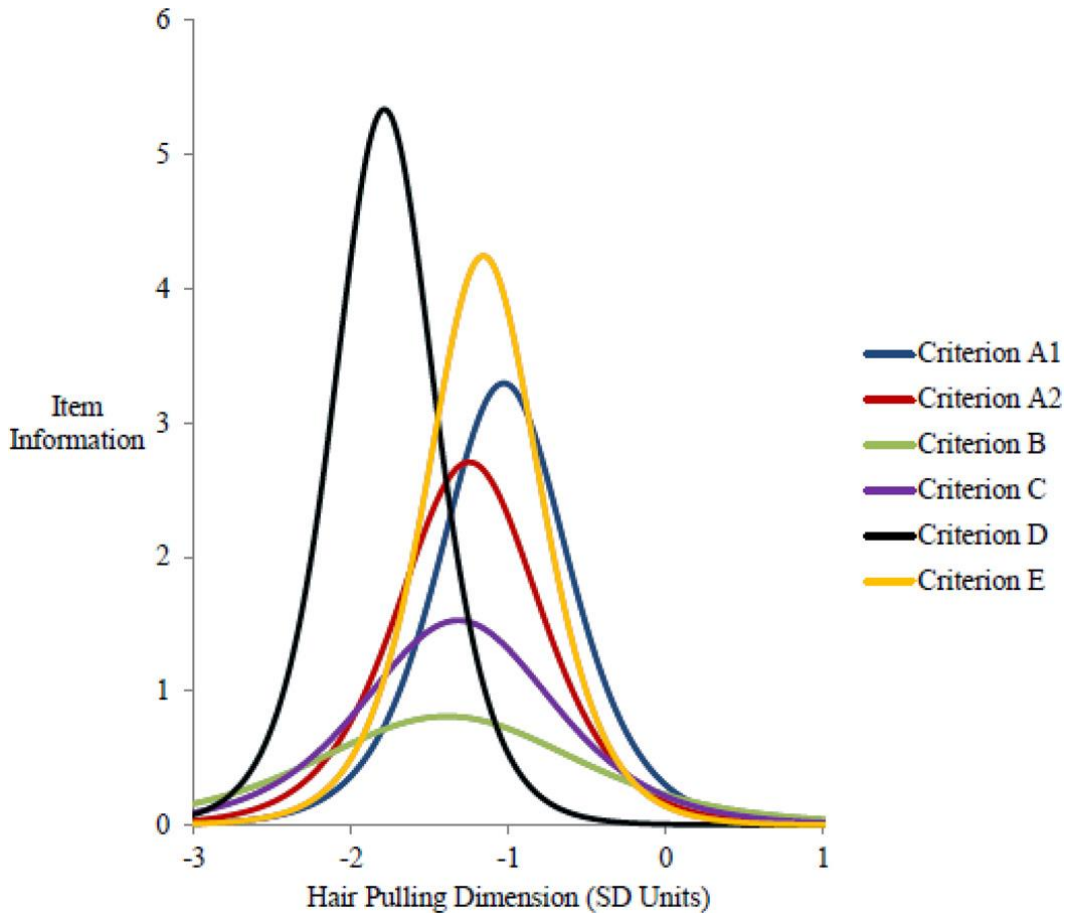


Figure 2. TDI Item Information Functions
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Table 1. IRT Parameters for DSM-IV Diagnostic Criteria for TTM

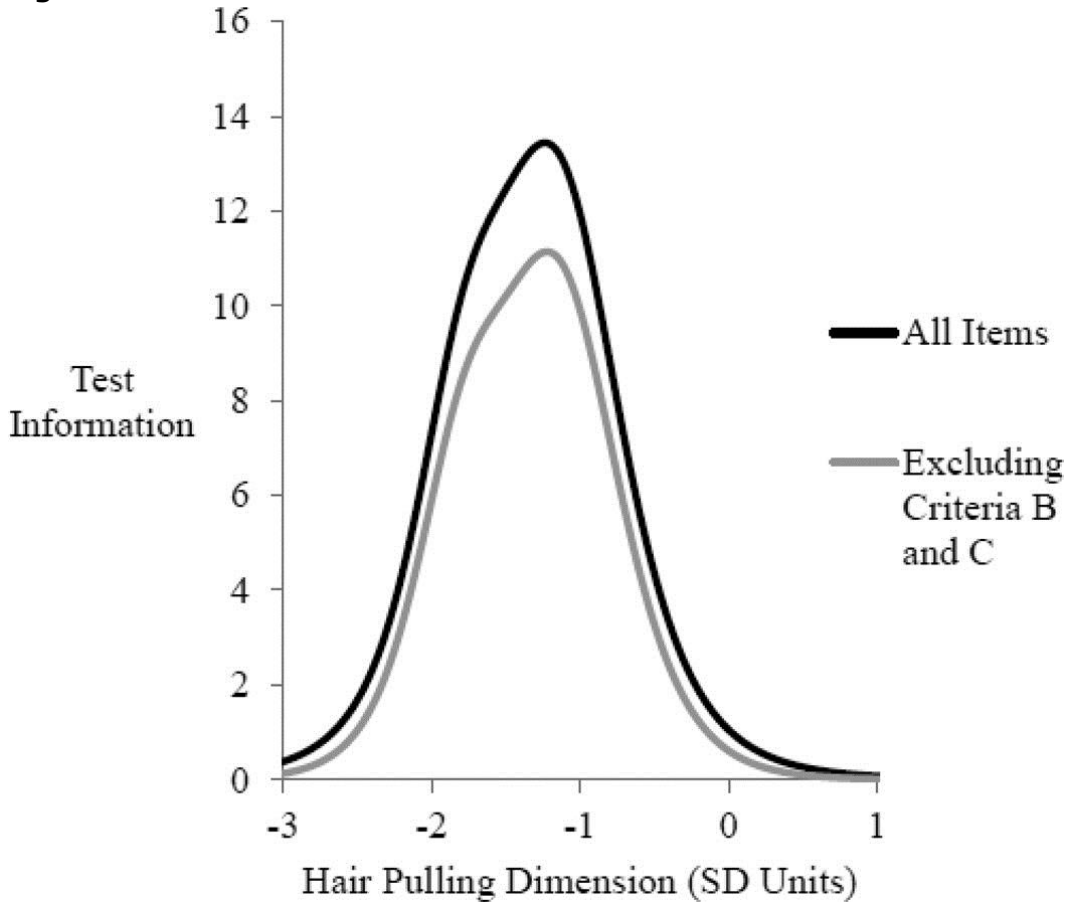
	Criterion A1	Criterion A2	Criterion B	Criterion C	Criterion D	Criterion E
<i>a</i> (SE)	3.63 (.62)	3.29 (.58)	1.80 (.33)	2.47 (.46)	4.62 (1.08)	4.12 (.75)
<i>b</i> (SE)	-1.04 (.08)	-1.25 (.10)	-1.39 (.18)	-1.32 (.14)	-1.79 (.14)	-1.16 (.08)

Note. *a* parameter refers to item discrimination; *b* parameter refers to item difficulty.

Supporting hypothesis 2, removing criteria B and C was not associated with any loss in diagnostic information. Two test information functions were calculated; one including all criteria and one omitting criteria B and C, which are both shown in Figure 3. Results showed no significant difference between these functions, as

areas under the curves were subjected to an independent samples t-test, which was not significant [$t(64) = .52, p = .61$].

Figure 3. TDI Test Information Functions



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In testing hypothesis 3, that criterion D (rule out alternative medical or psychological diagnoses) would serve as an effective screening item, the difficulty parameter for the item evaluating criterion D was found to be considerably lower than other criteria, indicating that the item discriminates between individuals on the lower end of the diagnostic spectrum. Furthermore, confidence intervals ($p < .05$) derived from the standard errors of the b parameters showed that the item measuring criterion D was significantly lower than items measuring all other criteria (CI = -2.06 through -1.52 ; See Table 1). All other difficulty parameters had highly overlapping confidence intervals, highlighting their similar difficulty levels. Moreover, visual analysis of test information metrics (Figure 2) showed that criterion D

provided the highest information content, meaning it functioned well as a screening item near the milder end of the diagnostic spectrum.

3.4. Dimensional Prediction

One can use item parameters to estimate trait levels of individuals using maximum likelihood-based scores called maximum a posteriori (MAP) estimates. Known as theta coefficients, these are calculated by considering an individual's response pattern across all items and simultaneously each item's ability to indicate the latent continuum.⁴² Theta coefficients provide estimates of trait levels for individuals, but they differ from traditional summary scores because items are not weighted equally, but are instead weighted as a function of each item's *a* and *b* parameters.

Results of our analysis supported hypothesis 4, which was that dimensional information would be predictive of relapse. Theta coefficients were calculated for each participant who no longer met diagnosis at their post-treatment TDI assessment (54.3% remission; $n = 38$), and we correlated these coefficients with diagnostic status at 6-month follow-up (30.6% relapse). Results showed a significant correlation ($r = .31, p = .03$), explaining 10% of the variance in relapse status. The higher the trait level, or the closer a participant remains to formal diagnosis along the latent continuum, the more likely that person is to relapse at follow-up. Albeit modest, this correlation could be seen as meaningful given that it reflects predictive variance where none previously existed.

4. Discussion

The aims of the current study were to investigate the psychometric properties and functionality of TTM diagnostic criteria within a dimensional framework. It was hypothesized that recently deleted items (DSM-IV criteria B and C) would demonstrate low relatedness to the underlying TTM construct, and that their removal would not significantly impact overall test functionality. It was also predicted that criterion D would demonstrate characteristics consistent with a screening item. Finally, it was hypothesized that information

gained from a dimensional diagnostic model might predict relapse at follow-up.

Results clearly supported the DSM-5 workgroup's decision to remove the requirement for diagnosed individuals to show urges to pull and subsequent relief after pulling. These criteria showed the lowest relatedness to the underlying TTM construct, confirming results of previous studies indicating that these variables are not central to TTM psychopathology. Additionally, removal of these items did not significantly impact the ability of the measure (i.e., the remaining diagnostic criteria) to identify clinical levels of hair pulling. It appears that urges to pull and subsequent relief are present in many individuals with TTM, but the ability of these criteria to effectively screen those with and without hair pulling, as compared to other criteria, is limited.

In examining the item characteristics of all other criteria, each item showed high relatedness to the TTM construct, but also displayed varying difficulty parameters. Although confidence intervals showed that most criteria discriminate between hair pullers at similar levels of the construct, the *b* parameter of criterion D was significantly lower than all others, confirming that it functions well as a screening item. Thus, clinicians, particularly those who work in brief and time-intensive clinical contexts, should consider first asking whether clients who are suspected of having TTM have a pre-existing inflammatory/dermatological condition that precludes psychosomatic hair pulling. Once this exclusion item has been confirmed, the diagnostician can subsequently administer items that more effectively screen individuals at higher ends of the diagnostic spectrum. This progression would reduce false positives (i.e., incorrectly identifying persons as having TTM) while enhancing identification of true positives.

These results further indicated that criterion E (i.e., clinically significant distress and/or impairment) provides important information at a higher point on the latent continuum, consistent with the notion that the item discriminates between subclinical and clinical levels of the disorder. While some have debated the merit of clinical significance thresholds in psychiatric disorders,⁴³ our results indicate that this

criterion provides high information content and is a useful component of TTM nosology.

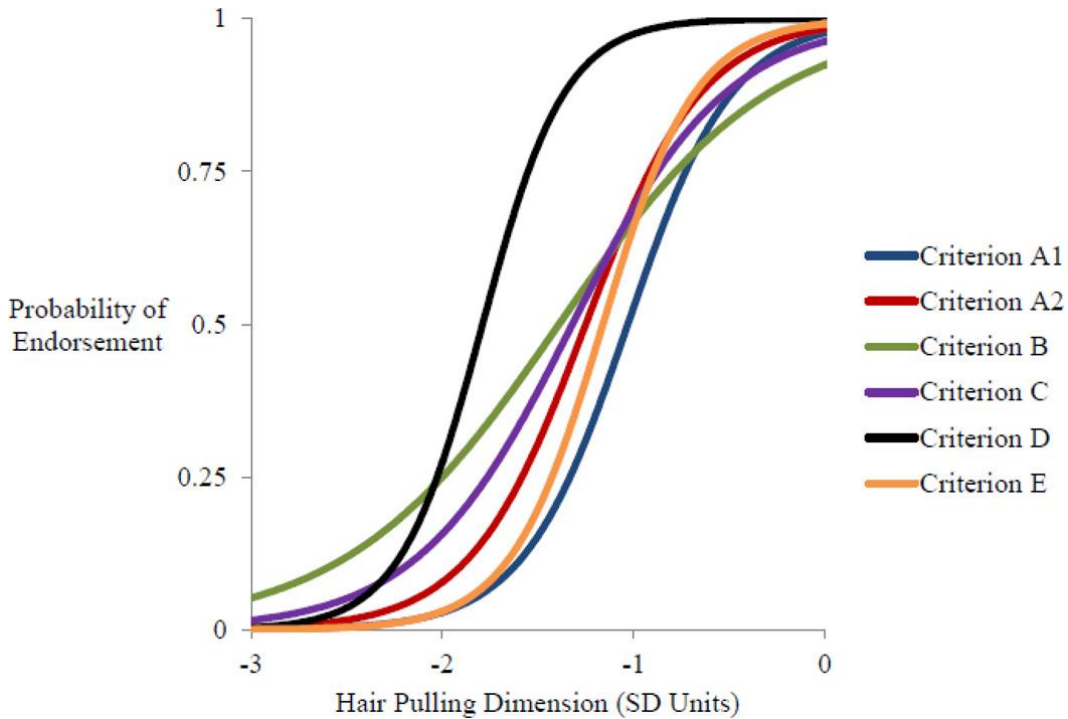
The final hypothesis was that by characterizing remission status in TTM along the latent dimension, predictive power above that provided by a categorical system could be obtained. Previous approaches typically report the percentage of individuals at post-treatment who no longer meet full criteria for diagnosis, but fail to acknowledge patterns of subclinical criteria endorsement. Although informative, these individuals cannot be considered "recovered" and are not a homogeneous group. Not having dimensional information, previous approaches have thus not attempted to predict relapse status at follow-up from diagnostic criteria endorsement alone. For most disorders, a key indicator of the stability of treatment gains is the dimensional effects of treatment on key facets of the targeted pathology, namely, diagnostic criteria. In support of the hypothesis, the dimensional method used in the present study was able to differentiate some patients with different degrees of residual TTM, and, importantly, allowed for prediction of a modest percentage of variance in relapse status 6 months later. Our results could be seen as consistent with that of Falkenstein et al.,²³ who showed that abstinence from pulling but not urges at post-treatment predicted long-term maintenance of gains. Criterion A1 was found to have the highest difficulty parameter and a high discrimination parameter, meaning that it contributes largely to higher trait parameters and that failure to meet this criterion would signify lower trait levels and make that individual less likely to relapse. Criterion B showed a low discrimination parameter, meaning that it does not provide meaningful information to the latent dimension of TTM and did not contribute largely to trait parameters. However, the predictive validity of our results could be seen as modest. Given that the modal size of correlations in psychological research is between .10 and .40,^{44, 45} the magnitude of association between trait parameters and relapse could be considered meaningful but limited. Clinicians who consider patterns of diagnostic criteria endorsement in patients no longer meeting formal diagnosis should consider the impact of such information alongside other relevant clinical variables. Nevertheless, the ability to explain 10% of variance in relapse likelihood makes this information relevant for clinicians who are considering termination or other alterations in

treatment, despite the fact that many other variables affect long-term outcomes.

The immediate implications for clinicians are that although all DSM criteria are required to meet TTM diagnosis, they are not all equally representative of TTM psychopathology. When clinical judgment is used to make important treatment decisions that involve diagnostic criteria endorsement, results of the current study should be considered. Those who cannot resist urges to pull and have associated distress and impairment fall at the higher end of the diagnostic spectrum, while those who may occasionally pull and still have hair loss likely fall at the lower end. Tension prior to pulling and/or subsequent relief do not appear to provide much information about TTM severity, and might only be useful in a phenomenological context.

The fact that data for this study were drawn from a recent randomized controlled trial, where all participants were screened for TTM diagnostic status and lack of comorbidities which might have interfered with treatment or required immediate clinical attention, represents a limitation to the current study. The current study also examined a sample of persons with TTM undergoing psychotherapy, and results might be different with medication treatments. Furthermore, as TTM onset typically occurs during childhood,⁴⁶ future analyses should conduct similar examinations of diagnostic criteria in children with subclinical hair pulling who are at risk for developing TTM and children with recent onset. The current study did not possess data on age of onset or duration of illness, variables which could potentially alter the manner in which individuals endorse diagnostic criteria at different severity levels. Perhaps those with longer disorder duration might be more inclined to endorse more noticeable hair loss and greater distress or impairment. Another limitation is that when data were collected for this trial, it was not possible to incorporate recently adopted DSM-5 diagnostic criteria into the procedure. Perhaps future trials might undertake the same analytic strategy using the refined criteria, examining whether or not the few language changes have made significant impact. Nevertheless, the results of the current study add considerable information to the TTM diagnostic literature and suggest possible methodological changes for the psychological/psychiatric treatment field as a whole.

Figure 1. TDI Item Characteristic Curves



Note. Criterion A1 = "Are you unable to resist impulses to pull out your hair?"; Criterion A2 = "Is the hair loss or thinning noticeable or would it be noticeable without using make up, wigs, or something else to cover it up?"; Criterion B = "Do you experience an increasing sense of tension before pulling out the hair?"; Criterion C = "Do you experience a sense of pleasure, gratification, or relief when pulling out the hair?"; Criterion D = "Why do you pull out your hair? Do you have a pre-existing inflammation of the skin?"; Criterion E = "Does the pulling bother you a lot? Does it get in the way of your life? Interfere with social or occupational functioning?" [Please reproduce in color on the Web and black and white in print]

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Footnotes

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References

1. American Psychiatric Association. Diagnostic and Statistical Manual of Mental Disorders. 5th ed. Washington, DC: American Psychiatric Association; 2013.
2. Stein DJ, Phillips KA. Patient advocacy and DSM-5. *BMC Med.* 2013;11(1):133.
3. Lochner C, Grant JE, Odaug BL, Woods DW, Keuthen NJ, Stein DJ. DSM-5 field survey: hair-pulling disorder (trichotillomania) *Depress Anxiety.* 2012;29(12):1025–1031.
4. Stein DJ, Grant JE, Franklin ME, et al. Trichotillomania (hair pulling disorder), skin picking disorder, and stereotypic movement disorder: toward DSM-V. *Depress Anxiety.* 2010;27(6):611–626.
5. Biondi M, Picardi A, Pasquini M, Gaetano P, Pancheri P. Dimensional psychopathology of depression: detection of an "activation" dimension in unipolar depressed outpatients. *J Affect Disord.* 2005;84(2–3):133–139.
6. O'Sullivan RL, Keuthen NJ, Christenson GA, Mansueto CS, Stein DJ, Swedo SE. Trichotillomania: behavioral symptom or clinical syndrome? *Am J Psychiatry.* 1997;154(10):1442–1449.
7. Regier DA, Narrow WE, Kuhl EA, Kupfer DJ. The conceptual development of DSM-V. *Am J Psychiatry.* 2009;166(6):645–650.
8. Kessler RC. The categorical versus dimensional assessment controversy in the sociology of mental illness. *J Health Soc Behav.* 2002;43(2):171–188.
9. Kraemer HC, Noda A, O'Hara R. Categorical versus dimensional approaches to diagnosis: methodological challenges. *J Psychiatr Res.* 2004;38(1):17–25.
10. American Psychiatric Association. Diagnostic and Statistical Manual of Mental Disorders. 4th ed. Arlington: American Psychiatric Association; 2000. text revision.
11. Guy W. The Clinical Global Impression Scale. the ECDEU Assessment Manual for Psychopharmacology Revised. Public Health Service; 1976.

12. Rabiei M, Nikfarjam M, Khoramdel K, Movassagh MT. Factor Structure, Validity and Reliability of the Massachusetts General Hospital Hair Pulling Scale. *PBS*. 2014;3(1):12–16.
13. Swedo SE, Leonard HL, Rapoport JL, Lenane MC, Goldberger EL, Cheslow DL. A double-blind comparison of clomipramine and desipramine in the treatment of trichotillomania (hair pulling) *N Engl J Med*. 1989;321(8):497–501.
14. Rothbaum BO, Ninan PT. The assessment of trichotillomania. *Behaviour Research and Therapy*. 1994;32(6):651–662.
15. Diefenbach GJ, Tolin DF, Meunier S, Worhunsky P. Emotion regulation and trichotillomania: a comparison of clinical and nonclinical hair pulling. *Journal of Behavior Therapy and Experimental Psychiatry*. 2008;39(1):32–41.
16. Grant JE, Odlaug BL, Kim SW. N-Acetylcysteine, a Glutamate Modulator, in the Treatment of Trichotillomania. *Arch Gen Psychiatry*. 2009;66(7):756–763.
17. Tolin DF, Franklin ME, Diefenbach GJ, Anderson E, Meunier SA. Pediatric Trichotillomania: Descriptive Psychopathology and an Open Trial of Cognitive Behavioral Therapy. *Cognitive Behaviour Therapy*. 2007;36(3):129–144.
18. Christenson GA, Mansueto CS. Trichotillomania: descriptive characteristics and phenomenology. In: Stein DJ, Christenson GA, Hollander E, editors. *Trichotillomania*. Arlington: American Psychiatric Publishing; 1999.
19. Woods DW, Flessner CA, Franklin ME, Keuthen NJ, Goodwin RD, Stein DJ, et al. The Trichotillomania Impact Project (TIP): Exploring Phenomenology, Functional Impairment, and Treatment Utilization. *J Clin Psychiatry*. 2006;67:1877–1888.
20. Conelea CA, Walther MR, Flessner CA. The incremental validity of criteria B and C for diagnosis of Trichotillomania in children and adults. *Journal of Obsessive-Compulsive and Related Disorders*. 2012;1(2):98–103.
21. du Toit PL, van Kradenburg J, Niehaus DJ, Stein DJ. Characteristics and phenomenology of hair-pulling: an exploration of subtypes. *Comp Psychiatry*. 2001;42(3):247–256.
22. Lochner C, Seedat S, Stein DJ. Chronic hair-pulling: Phenomenology-based subtypes. *J Anx Dis*. 2010;24(2):196–202.
23. Falkenstein MJ, Rogers K, Malloy EJ, Haaga DAF. Predictors of relapse following treatment of trichotillomania. *Journal of Obsessive-Compulsive and Related Disorders*. 2014;3(4):345–353.
24. Keuthen NJ, O'Sullivan RL, Ricciardi JN, Shera D, Savage CR, Borgmann AS, et al. The massachusetts general hospital (MGH) hairpulling scale: 1. Development and factor analysis. *Psychother Psychosom*. 1995;64:141–145.

25. O'Sullivan RL, Keuthen NJ, Hayday CF, Ricciardi JN, Buttolph ML, Jenike MA, et al. The massachusetts general hospital (MGH) hairpulling scale: 2. Reliability and validity. *Psychother Psychosom.* 1995;64:146–148.
26. Diefenbach GJ, Tolin DF, Crocetto JS, Maltby N, Hannan SE. Assessment of trichotillomania: a psychometric evaluation of hair pulling scales. *J Psychopathol Behav Assess.* 2005;27:169–178.
27. Swedo SE, Leonard HL, Rapoport JL, Lenane MC, Goldberger EL, Cheslow D. A double-blind comparison of clomipramine and desipramine in the treatment of trichotillomania (hair pulling) *New Engl J Med.* 1989;321:497–501.
28. Franklin ME, Edson AL, Ledley DA, Cahill SP. Behavior therapy for pediatric trichotillomania: a randomized controlled trial. *J Am Acad Child Psy.* 2011;50:763–771.
29. Stanley MA, Breckenridge JK, Snyder AG, Novy DM. Clinician-rated measures of hair pulling: a preliminary psychometric evaluation. *J Psychopathol Behav Assess.* 1999;21:157–170.
30. Guy W. Clinical global impression scale. *The ECDEU Assessment Manual for Psychopharmacology.* 1976;76(338):218–222.
31. Dahlke F, Lohaus A, Gutzmann H. Reliability and clinical concepts underlying global judgments in dementia: implications for clinical research. *Psychopharmacol Bull.* 1992;28:425–432.
32. Leon AC, Shear MK, Klerman GL, Portera L, Rosenbaum JF, Goldenberg I. A comparison of symptom determinants of patient and clinician ratings in patients with panic disorder and depression. *J Clin Psychopharm.* 1993;13:327–331.
33. Ninan PT, Rothbaum BO, Marsteller FA, Knight BT, Eccard MB. A placebo-controlled trial of cognitive-behavioral therapy and clomipramine in trichotillomania. *J Clin Psychiatry.* 2000;61:47–50.
34. Diefenbach GJ, Tolin DF, Hannan S, Maltby N, Crocetto J. Group treatment for trichotillomania: behavior therapy versus supportive therapy. *Behav Ther.* 2006;37:353–363.
35. Embretson SE, Reise SP. *Item Response Theory for Psychologists.* New York: Psychology Press; 2000.
36. Thissen D, Chen WH, Bock RD. *MULTILOG 7 for Windows: Multiple-Category Item Analysis and Test Scoring Using Item Response Theory[Computer Software]* Lincolnwood, IL: Scientific Software International; 2003.
37. Hambleton RK, Swaminathan H, Rogers HJ. *Fundamentals of Item Response Theory (Measurement Methods for the Social Sciences Series, Vol. 2)* Newbury Park: Sage; 1991.
38. Muthén LK, Muthén BO. *Mplus (Version 5.1)* Los Angeles: 2008.
39. Tucker LR, Lewis C. A reliability coefficient for maximum likelihood factor analysis. *Psychometrika.* 1973;38(1):1–10.

40. Bentler PM. Comparative fit indexes in structural models. *Psych Bull.* 1990;107(2):238–246.
41. Hu L, Bentler PM. Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal.* 1999;6(1):1–55.
42. Thissen D, Orlando M. Item response theory for items scored in two categories. Mahwah: Lawrence Erlbaum Associates; 2001.
43. Wakefield JC, Schmitz MF, Baer JC. Does the DSM-IV clinical significance criterion for major depression reduce false positives? Evidence from the National Comorbidity Survey Replication. *Am J Psychiatry.* 2010;167(3):298–304.
44. Hemphill JF. Interpreting the magnitudes of correlation coefficients. *Am Psychol.* 2003;58(1):78–79.
45. Roberts BW, Kuncel NR, Shiner R, Caspi A, Goldberg LR. The power of personality: the comparative validity of personality traits, socioeconomic status, and cognitive ability for predicting important life outcomes. *Perspect Psychol Sci.* 2007;2(1):313–345.
46. Snorrason I, Belleau EL, Woods DW. How related are hair pulling disorder (trichotillomania) and skin picking disorder? A review of evidence for comorbidity, similarities and shared etiology. *Clin Psychol Rev.* 2012;32(7):618–629.