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Psychometric Properties of a Self-Report Instrument for the Assessment of Tic Severity in Adults with Tic Disorders

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Abstract

The gold-standard measure of tic severity in Tic Disorders (TD), the Yale Global Tic Severity Scale (YGTSS), is a semi-structured clinician-administered interview that can be time consuming and requires highly trained interviewers. Moreover, the YGTSS does not provide information regarding frequency and intensity of specific tics as all motor, and all vocal tics are rated as a group. The aim of the present study is to describe and test the Adult Tic Questionnaire (ATQ), a measure for the assessment of tic severity in adults, and to report its preliminary psychometric properties. The ATQ is a brief self-report questionnaire that provides information regarding frequency, intensity, and severity of 27 specific tics. In addition, the ATQ produces total frequency, intensity, and severity scores for vocal, and motor tics, as well as a global total tic severity score. Results showed that the ATQ demonstrated very good internal consistency and temporal stability. The total, vocal, and motor tic severity scales of the ATQ showed strong correlation with corresponding subscales of the YGTSS, indicating strong convergent validity. Weak correlations with measures of severity of obsessive-compulsive disorder and attention deficit/hyperactivity disorder, indicated strong discriminant validity. The ATQ is a promising measure for the assessment of tic severity in adults with TD which may be a valuable supplement to the current recommended assessment battery for TD. Furthermore, the ATQ enables clinicians and researchers to track changes in the frequency and intensity of specific tics, which is important given their complex and dynamic nature.

Keywords

Tourette's disorder; Tourette's syndrome; chronic tic disorder; persistent tic disorder; adults; assessment; severity; questionnaire

Introduction

The clinical presentation of tics is complex and dynamic, as tics fluctuate and change in frequency, intensity, and form over time (Lin, et al., 2002; Peterson & Leckman, 1998). In addition, tic severity is influenced by a multitude of situational state-dependent factors (for a review see Conelea & Woods, 2008), such as settings (Goetz, Leurgans, & Chmura, 2001), social interaction (Piacentini, et al., 2006), stress (Eapen, Fox-Hiley, Banerjee, & Robertson, 2004) and anxiety (Silva, Munoz, Barickman, & Friedhoff, 1995), making clinical assessment challenging.

The dynamic, complex, and interactive nature of tics accentuates the need for psychometrically reliable measures for the assessment of tics in adults, tapping the number, type, intensity, and frequency of tics. The most widely used measure for the assessment of tic severity is the Yale Global Tic Severity Scale (YGTSS; Leckman, et al., 1989), a clinician administered semi-structured interview assessing tic severity and impairment over the previous week. The YGTSS includes a symptom checklist for motor and phonic (vocal) tics. As a group, all motor and all vocal tics are then rated for their number, frequency, intensity, complexity, and interference on a 0–5 Likert scale (separately for vocal and motor). Scores can then be summed to reflect motor tic severity (0–25), phonic tic severity (0–25), and combined tic severity (0–50). There is also a separate tic-related impairment scale ranging from 0–50. The YGTSS demonstrates excellent internal consistency ($\alpha = .92 - .94$; Storch, et al., 2005). The measure possesses satisfactory temporal stability and displays adequate convergent and discriminant validity (Leckman, et al., 1989; Storch, et al., 2005). In addition, a confirmatory factor analysis verified a two factor structure for phonic and motor tics with acceptable internal consistency for each factor (Storch, et al., 2007).

Nevertheless, administration of the YGTSS is relatively time consuming (approximately 20–25 minutes) and requires a highly trained, experienced interviewer in order to ensure accurate and reliable use of the measure (Chang, Himle, Tucker, Woods, & Piacentini, 2009). In addition, the YGTSS does not provide information on individual tics. That is, tic scores on the YGTSS pertain to all motor and vocal tics, but do not provide information pertaining to specific tics (e.g., intensity of blinking versus intensity of grunting). Thus, there is a need for a psychometrically sound, brief self-report measure for the assessment of tic severity in adults with TD that would correspond to the need for a rapid clinical assessment. Such a measure would facilitate high resolution measurement of treatment progress allowing clinicians to assess the impact of treatment on specific tics that may improve more than others, including specific information regarding improvement in frequency or intensity. In addition, such an instrument would enable assessment of tics in online studies, an increasingly prevalent methodology (Gosling & Mason, 2015). Notably, self-report methodology is susceptible to a number of biases (Podsakoff, MacKenzie, Lee, &

Podsakoff, 2003), including relying on the level of patient awareness. However, even in clinician administered settings, clinicians rely in part on patient awareness, as not all tics would be presented during the interview and because actual tics may not be observed in, or impacted by interview settings (Conelea & Woods, 2008).

A few self-report measures assessing global tic severity are available. The Tourette Syndrome Symptom List (TSSL; Cohen, Detlor, Young, & Shaywitz, 1980), is a 35-item scale assessing phonic and motor tics and TS-related behaviors over the past week on a 5 point Likert scale. The Tic Symptom Self-Report (TSSR; Scahill, Leckman, Schultz, Katsoyich, & Peterson, 2003) – a revised version of the TSSL – is a 40 item self-report measure, in which 20 items tapping phonic tics and 20 items tapping motor tics are rated on a 0–3 Likert scale. However, psychometric data for these two measures are not available (for a review of assessment measures for TD see McGuire, et al., 2012). Other self-report scales for adults with tic disorders may be either too specific, such as the Premonitory Urge to Tic Scale (PUTS; Reese, et al., 2014) assessing subjective awareness of urges preceding tics; or too general, such as the Motor Tic, Obsessions and Compulsions, Vocal Tics Evaluation Survey (MOVES; Gaffney, Sieg, & Hellings, 1994) which incorporates items tapping OCD symptoms.

The present study presents the first psychometric data on the Adult Tic Questionnaire (ATQ), a brief (10 minutes) self-report measure of tic severity, from 122 individuals aged 16 and older with Tourette Syndrome (TS) or Chronic Tic Disorder (CTD).

Method

DEVELOPMENT AND SCORING OF THE ADULT TIC QUESTIONNAIRE (ATQ)

The ATQ (see appendix) was directly modeled after the Parent Tic Questionnaire (PTQ; Chang, et al., 2009), a self-report inventory administered to parents for the assessment of tic severity in youth. The PTQ demonstrates strong psychometric properties, including construct validity, internal consistency, and test-retest reliability (Chang, et al., 2009). Similar to the PTQ, the ATQ includes a list of 14 common motor tics and 13¹ common vocal tics. Each of those lists includes an open item (i.e., other vocal or other motor tic) allowing individuals to add a type of tic that does not appear in the standard list. For each type of tic, participants are asked to indicate its presence during the past week by selecting ‘yes’ or ‘no’. Subsequently, *for each tic endorsed*, participants indicate its frequency and intensity, both on a 4 point Likert-type scale² For the frequency ratings, scores range from *a few times a week or less* (1), to *constantly, almost all the time during the day* (4). For the intensity ratings, participants are asked to check (1) if the specific tic was *very mild in intensity* in the past week, (2) or higher if the tic was *obviously noticeable to others*; and 3 or higher if the tic was *much more forceful and very noticeable to others* during the past week. A separate score

¹The original version of the ATQ included 14 items assessing vocal tics. However, in the initial version one item assessed “other vocal tics” and the other assessed “other” in general. In the data analysis stage these items were found to result in identical scores. For this reason these two items were collapsed resulting in a total of 13 items assessing vocal tics.

²In the original version of the ATQ, the ‘intensity’ of each tic was ranked on an eight point Likert-type scale. However, in the data analysis stage this scale was transformed to a four point Likert-type scale, similar to the ‘frequency’ scale. The following algorithm was used: 2 = 1; 3, 4 = 2; 5, 6 = 3; 7, 8 = 4. This transformation was performed in order to allow equal weights for both scales comprising the severity score.

of tic severity was calculated by summing the intensity and frequency score resulting in a score between 2 (minimal frequency and intensity) to 8 (maximum frequency and intensity) for each tic endorsed. Subsequently, all severity scores for all vocal and motor tics were summed to produce a total tic severity score. A preliminary version of the ATQ was found to be sensitive to behavior therapy in a randomized controlled trial for comprehensive behavioral intervention for tics (CBIT) versus psychoeducation and supportive therapy in adults with Tourette's disorder (Wilhelm, et al., 2012). The authors reported an effect size of 0.63, exemplifying a reduction on the ATQ total (severity) score following a 10 week (8 sessions) of comprehensive behavioral intervention for tics, and an effect size of 0.28 for a supportive psychotherapy control group. Corresponding effect sizes for thwee total tic score on the YGTSS were 0.96, and 0.39 (Wilhelm, et al., 2012).

PROCEDURE

This study was a part of a multisite randomized controlled trial comparing a comprehensive behavioral intervention to psychoeducation and supportive psychotherapy for individuals 16 years old and older with TS and CTD (see Wilhelm, et al., 2012 for full description). Participants were enrolled at the Massachusetts General Hospital/Harvard Medical School, the University of Texas Health Science Center at San Antonio, and Yale University. Data from clinician-administrated and self-report measures were collected at screening, baseline, mid-treatment, post-treatment and follow-up. For the purpose of the present study, we report data from the screening and baseline time points only. These two administration points took place 7 days apart. Clinician-rated measures were administered by experienced Masters or Doctoral level clinical psychologists who received extensive training including examination of reliability assessed via video-recorded sessions. Detailed information regarding the training and supervision of raters and the interviewers' reliability analysis has been published elsewhere (Wilhelm, et al., 2012). This study was approved by the Institutional Review Boards at each of the participating sites, and all participants signed a written informed consent.

PARTICIPANTS

A total of 122 participants ages 16–69 participated in the present study. Of the entire sample, 103 participants (84%) were diagnosed with primary TS (64% males), and 19 (16%) were diagnosed with primary CTD (63% males). At study entry, 23 participants (18.9%) were on stable doses of medications for tics, together with additional psychiatric medications; 8 participants (6.6%) were on a stable dose of tic medications only; 20 participants (16.4%) were on stable dose of other medications; and 71 participants (58.3%) were unmedicated. (See Table 1 for detailed demographic and clinical data).

MEASURES

Assessment Measures—The present study employed the diagnostic assessment procedure recommended by the Tourette Syndrome Association International Consortium for Genetics (Tourette Syndrome Association International Consortium for Genetics (TSAICG), 2007). The *Structured Clinical Interview for DSM-IV-TR Axis I Disorders, research version, patient edition*, a semistructured clinician administered interview (SCID;

First, Spitzer, Gibbon, & Williams, 2002) was administered in order to establish and screen for DSM-IV diagnoses. Tic Disorder diagnosis was established using a semi-structured interview developed by the TSAICG. Attention Deficit/Hyperactivity Disorder (ADHD) diagnosis was established using a rigorous diagnostic procedure commonly employed in adult ADHD research, including the use of the K-SADS (e.g., Safren, et al., 2010).

Yale Global Tic Severity Scale: (YGTSS; Leckman, et al., 1989). The YGTSS is a clinician-administered structured interview assessing tic severity over the past week. Tic severity is assessed separately for motor and phonic (vocal) tics, by evaluating the number, frequency, intensity, complexity, and interference associated with tics. Psychometric properties of the YGTSS are described above. In the present sample, the YGTSS total score demonstrated good internal consistency ($\alpha = .78$).

Yale-Brown Obsessive-Compulsive Scale: (Y-BOCS; Goodman, Price, Rasmussen, Mazure, Delgado, et al., 1989; Goodman, Price, Rasmussen, Mazure, Fleischmann, et al., 1989). The Y-BOCS is a clinician-administered semi-structured measure used for the assessment of OCD symptom severity. The Y-BOCS includes five items assessing obsessions and five assessing compulsions, yielding three scores (i.e., obsessions, compulsions and total score). The Y-BOCS demonstrates good psychometric properties, including convergent and discriminant validity, and internal consistency (Goodman, Price, Rasmussen, Mazure, Delgado, et al., 1989; Goodman, Price, Rasmussen, Mazure, Fleischmann, et al., 1989). In the present study, the Y-BOCS total score was found to have excellent internal consistency ($\alpha = .94$).

Wechsler Test of Adult Reading: (WTAR; The Psychological Corporation, 2001). The WTAR was used to estimate overall intelligence (IQ). Participants are asked to read 50 words aloud and earn one point for each word pronounced correctly. The WTAR has very good psychometric properties, including test-retest reliability, internal consistency, and convergent validity. The test has demonstrated strong correlations ($r = .73$) with the Wechsler Adult Intelligence Scale, third edition (The Psychological Corporation, 2001).

Attention Deficit Hyperactivity Disorder Rating Scale: (ADHD-RS; DuPaul, Power, Anastopoulos, & Reid, 1998). The ADHD-RS is a self-report measure comprised of 18 items that correspond to the 18 ADHD DSM-IV criteria. Items are ranked on a 4-point Likert scale, ranging from 0 (never or rarely) to 3 (very often). Initially developed for pediatric populations, but regularly used in adult studies (e.g., Spencer, et al., 1995), the ADHD-RS demonstrates excellent psychometric properties (Collett, Ohan, & Myers, 2003). In the present study, the ADHD-RS demonstrated excellent internal consistency ($\alpha = .93$).

STATISTICAL ANALYSIS

All psychometric properties apart from test-retest reliability are presented for the baseline time point. Internal consistency of the ATQ subscales was computed using Cronbach's alpha. Test-retest reliability (temporal stability) for the ATQ total severity, motor, and vocal tic severity subscales was assessed by means of Pearson's correlations between administration at screening and baseline. Convergent construct validity was calculated using

Pearson's product-moment correlations between the ATQ and YGTSS subscales. Discriminant construct validity was assessed using Pearson's correlations between the ATQ and the total Y-BOCS scores, as well as the total ADHD-RS inattention, and hyperactivity-impulsivity subscales. Within group differences on tic characteristics were assessed using paired-samples *t* tests.

The structure of the ATQ prevents the implementation of conventional factor analytic methodologies. This is due to the fact that ratings are provided only for tics that are present. Thus most participants did not have data for all tics, which is a prerequisite for factor analysis. The common resolution for missing data (i.e., multiple imputation methodologies) could not be implemented given that these are not conventional missing data (e.g., neglecting to respond to an item) but genuine lack of presentation of specific tics. In addition, the quantity of the 'missing' data points, if imputed, would result in non-reliable data. Thus, in lieu of factor analysis we calculated the motor, vocal and total factors' internal consistency (Cronbach's alpha) as well as between factors Pearson's correlations, and correlations with corresponding YGTSS factors.

Results

Demographic and clinical indices are presented in Table 1. The sample had an average IQ score (106). The mean YGTSS total score indicated a moderate to severe degree of tic severity (according to severity ranges offered by Bloch, Peterson, Scahill, & et al., 2006). Overall severity of OCD symptoms were in the non-clinical range. More than half the sample (54%) was not diagnosed with any comorbid condition. Of those with a co-occurring condition, the most prevalent comorbid conditions were ADHD (28%) and OCD (16%). These rates are commonly reported in adults with tic disorders (e.g., Crossley & Eugenio Cavanna, 2013; Freeman, 2007). Means and standard deviations for frequency, intensity, and severity of each motor and vocal tics included in the ATQ, as well as total scores are presented in Table 2. On average, participants reported the presence of 8.1 tics ($SD=4.5$). Participants reported experiencing significantly more motor tics ($M=5.8$, $SD=2.8$) in the past week compared to vocal tics ($M=2.3$, $SD=2.3$; $t(120)=14.6$, $p<.001$), and had a mean frequency score of 2.6 ($SD=0.6$), mean intensity scores of 2.3 ($SD=0.7$) and a mean severity score of 39.5 ($SD=25$). Compared to vocal tics, motor tics were also ranked as significantly more frequent ($t(92)=3.7$, $p<.001$), and more intense ($t(92)=2.4$, $p=.017$). This effect corresponded to an overall increased severity for motor tics compared to vocal tics ($t(92)=13.1$, $p<.001$).

The two most common motor tics (which were also the most common across all tics) were 'eye blinking' and 'head jerk', presented by 72% and 67% of the sample, respectively. These motor tics were among the most frequent ($M=2.9$), but only 'head jerk' was also among the most intense ($M=2.6$). The least common tic was 'copropraxia' (obscene gestures), presented by only 4% of participants. However, participants reporting this tic, reported relatively increased frequency ($M=3.0$), and intensity ($M=2.6$) ratings. The most common vocal tic, presented in 42% of the sample, was 'sniffing', which was relatively frequent ($M=2.7$). Only 7% of the sample reported the presence of 'coprolalia' (obscene words), which was the least common vocal tic reported (7%). However, similar to 'copropraxia',

participants reporting this type of tic reported it to be the most frequent ($M=3.0$), and intense ($M=2.9$) compared to other vocal tics.

RELIABILITY ANALYSIS

The overall reliability of the ATQ severity scores (including intensity and frequency items), assessed using Cronbach's alpha, indicated very good internal consistency for motor tic severity ($\alpha = .86$), vocal tic severity ($\alpha = .87$), and excellent internal consistency for the total tic severity ($\alpha = .91$). Very good internal consistency was found for the total frequency factor ($\alpha = .83$), and acceptable internal consistency was found for motor frequency ($\alpha = .75$), and vocal frequency ($\alpha = .75$). Very good internal consistency was found for the total intensity factor ($\alpha = .83$), and acceptable internal consistency was found for motor intensity ($\alpha = .73$), and vocal intensity ($\alpha = .75$).

FACTOR INTER-CORRELATIONS

Correlations between motor and vocal intensity and frequency subscales (i.e., factors) are presented in Table 3. Very strong correlations were found between the total frequency and total intensity factors ($r = .89$). Moderate to strong correlations were found between the motor and vocal factors, ($r = .57$ to $.63$). These coefficients were all significant ($<.01$). Intercorrelations between the ATQ and YGTSS subscales are presented in Table 4, demonstrating strong positive correlations amongst corresponding factors. Notably, correlations among total scores appear somewhat stronger than among motor and vocal factors. This is expected due to the scoring methodology where on the YGTSS raters score all motor tics, and all vocal tics together, and in the ATQ motor and vocal factors are produced by amalgamating individual tic scores.

TEMPORAL STABILITY

Test-retest reliability calculated using Pearson's r product moment correlations between the two administrations (screening and baseline) yielded very good temporal stability for the ATQ's motor tic severity ($r = .81$), vocal tic severity ($r = .88$), and total severity ($r = .87$).

CONVERGENT CONSTRUCT VALIDITY

Pearson's product moment correlations between the YGTSS and ATQ subscales revealed strong correlations for motor tic severity ($r = .62$), vocal tic severity ($r = .65$), and total tic severity ($r = .73$).

DISCRIMINANT CONSTRUCT VALIDITY

Discriminant validity was assessed using Pearson's product moment correlations between the ATQ and the Y-BOCS total score, and the ADHD-RS inattention, and hyperactivity-impulsivity scores. As opposed to the strong positive correlation found with the YGTSS total score ($r = .73$, $p < .05$), weaker correlations were found between the ATQ and the Y-BOCS total scores ($r = .23$, $p < .05$), the ADHD-RS inattention score ($r = .21$, $p < .05$) and the ADHD-RS hyperactivity-impulsivity score ($r = .34$, $p < .05$), that were small to medium in magnitude, indicating good discriminant validity.

Discussion

The aim of the present study was to present initial psychometric data on the ATQ, a brief self-report measure for the assessment of tic severity in adults with TD. The ATQ demonstrated very good internal consistency and temporal stability between the screening and baseline assessment. The ATQ subscale scores correlated strongly with the YGTSS, demonstrating strong convergent construct validity. Correlations between the ATQ and Y-BOCS and ADHD-RS subscales were weaker compared to the correlations between the ATQ and YGTSS, indicative of good discriminant validity. In addition, strong interscale correlations were found between the total tic severity score, the motor, and the vocal tic severity scores, as well as between the latter two. The structure of the ATQ prevents computation of confirmatory or exploratory factor analysis. However, the ATQ factors demonstrate good internal consistency, as well as intercorrelations, and strong correlations with corresponding YGTSS factors. Finally, a preliminary version of the ATQ demonstrated sensitivity to change with CBT for adults with TS (Wilhelm, et al., 2012). These results, while not including conventional factor analysis, indicate that the ATQ has very good psychometric properties overall.

The most widely used gold standard measure for the assessment of tic severity, the YGTSS (Leckman, et al., 1989), is a well validated clinician-administered semi-structured interview (Storch, et al., 2007; Storch, et al., 2005). However, the YGTSS is time-consuming (~20–25 minutes), requires administration by highly trained interviewers, and does not provide information regarding frequency, intensity, and severity of specific tics. The ATQ was designed to address these issues by providing a brief (~10 minutes), reliable, self-report measure assessing tic severity in adults. To our knowledge, the ATQ is the only self-report measure for the assessment of tics that has been evaluated psychometrically. This measure provides clinicians and researchers with the opportunity to assess multiple dimensions of tic phenomenology, including presence, frequency, and intensity of specific individual tics as well as overall scores. The need for a comprehensive, multi-method, evidence-based assessment of TD has been repeatedly stated (Cath, et al., 2011; McGuire, et al., 2012; Swain, Scahill, Lombroso, King, & Leckman, 2007). The ATQ contributes to the existing multi-method battery of measures, addressing some of the shortcomings of other measures and may be important in providing accurate tic-specific information.

As a self-report measure, the ATQ enables online administration, facilitating access to different samples, including remote community samples. Furthermore, the ATQ allows participants to choose the time and place to complete the ATQ. In addition, the wealth of specific information provided by the ATQ enables clinicians and researchers to track changes in specific facets of individual tics. Indeed, many behavior therapists target the most frequent and most intense tics early in the treatment. Furthermore, if this measure is completed repeatedly, it allows for the assessment of changes in the severity of specific tics over the course of therapy, which in turn would allow for better treatment planning (e.g., the treatment team would better understand if the targeted tic indeed improved as a result of specific interventions). A potential weakness of the ATQ may be that it requires participants to have a certain degree of insight as to the presence, and other aspects of their tics. However, even in a clinician-administered setting, the interviewer relies heavily on

participants' insight, as interviewees may not present with the full range of tics during the interview. In fact, the interview setting may have an impact on presentation of tics, where some could be more or less pronounced (Conelea & Woods, 2008).

This study is not without limitations. The structure of the ATQ does not permit factor analysis. However, the reliability of individual ATQ factors, their intercorrelations, their strong correlations with corresponding YGTSS factors, and especially the similarities between the YGTSS and the ATQ items provides support for the overall very good psychometric properties of the ATQ. In addition, as noted above, in order to obtain equal weights for frequency and intensity of tics when calculating severity, the intensity scale was transformed from an 8 point Likert-type scale, to a 4 point scale, at the data analysis stage. Theoretically it is plausible that participants would have responded slightly different if a 4 point scale was presented to them at time of administration. However, we suspect that given the anchor points, this hypothetical effect would not be of significant impact. With regard to anchor points, as presented in the appendix, instructions for the ATQ Intensity scale outline 3 anchor points for a 4 point scale. However, we do not expect this to have had a meaningful effect on the accuracy of scores, as the instructions do describe the option to rank a fourth anchor point: *"A much more forceful tic that would be very noticeable to others and may even be painful would be rated as a "3" or even higher"*.

Another potential limitation of the present study is that participants were all treatment seeking individuals. Patients who seek treatment may potentially be more aware of their tics, which may have the potential to inflate correlations between the YGTSS, a clinician administered measure, to the ATQ, a self-report measure. However, the vast majority of participants interviewed using the YGTSS would likely be treatment seeking individuals, and thus it would be difficult to assess the hypothetical impact of this issue on psychometric aspect of the ATQ. Notably, the ATQ's total severity score is comprised of the sum of frequency and intensity ratings of all tics, so that the total severity score is influenced by the number of tics presented. This may lead to an instance where an individual with a few highly intense and very frequent tics may obtain the same total severity score as an individual with numerous very mild and infrequent tics. However, the ATQ provides clinicians and researchers with a high resolution clinical picture, including the advantage of looking at per-tic frequency and intensity scores. If desired, clinicians and researchers can calculate an average per-tic severity score (total score divided by number of tics) which would result in an index of severity that is much less sensitive to tic number. Finally, larger samples are required in order to facilitate the development of severity ranges for the ATQ (e.g., mild, moderate, severe).

Conclusion

The ATQ is a promising addition to the current assessment battery of TD. It demonstrates very good psychometric properties, provides valuable multidimensional tic-specific information, and a highly needed option to assess tics online. Furthermore, previous preliminary examination of the ATQ in a randomized clinical trial demonstrated its sensitivity to change with BT for tic disorders, but more research is needed examining the utility and sensitivity of the ATQ in clinical trials.

Appendix: ADULT TIC QUESTIONNAIRE

For each of the tics listed below, please mark “YES” or “NO” as to whether or not you have experienced the tic in the past week.

For each tic you mark as “YES”, please mark how FREQUENTLY the tic occurred over the past week, according to the following:

Constant, almost all the time during the day

Hourly, at least once per hour

Daily, at least several times per day

Weekly, just a few times or less

Under INTENSITY, rate how intense the tic felt to you during the past week. For example, if it was very mild, like a weak twitch, that would be a “1”. A much more forceful tic that would be very noticeable to others and may even be painful would be rated as a “3” or even higher. Any tic that would be obviously noticeable to others should be rated as at least a “2”.

Motor Tics

	Present		Frequency				Intensity (1–4)
	Yes	No	C	H	D	W	
	1	0	4	3	2	1	
Eye Blinking	☐	☐	C	H	D	W	_____
Eye rolling/darting	☐	☐	C	H	D	W	_____
Head Jerk	☐	☐	C	H	D	W	_____
Facial Grimace	☐	☐	C	H	D	W	_____
Mouth/Tongue Movements	☐	☐	C	H	D	W	_____
Shoulder Shrugs	☐	☐	C	H	D	W	_____
Chest/stomach tightening	☐	☐	C	H	D	W	_____
Pelvic Tensing Movements	☐	☐	C	H	D	W	_____
Leg/Feet Movements	☐	☐	C	H	D	W	_____
Arm/Hand Movements	☐	☐	C	H	D	W	_____
Echopraxia (copying another's gestures)	☐	☐	C	H	D	W	_____
Copropaxia (obscene gestures)	☐	☐	C	H	D	W	_____
Other Motor Tics _____	☐	☐	C	H	D	W	_____
Complex Motor Combinations (multiple tics at once)	☐	☐	C	H	D	W	_____

Vocal Tics

	Present		Frequency				Intensity (1–4)
	Yes	No	C	H	D	W	
	1	0	4	3	2	1	
Grunting	☐	☐	C	H	D	W	_____
Sniffing	☐	☐	C	H	D	W	_____
Snorting	☐	☐	C	H	D	W	_____

Motor Tics	Present		Frequency				Intensity (1–4)
	Yes	No	C	H	D	W	
	1	0	4	3	2	1	
Coughing	☐	☐	C	H	D	W	_____
Animal Noises	☐	☐	C	H	D	W	_____
Syllables	☐	☐	C	H	D	W	_____
Words	☐	☐	C	H	D	W	_____
Phrases	☐	☐	C	H	D	W	_____
Echolalia (repeating vocalizations of others)	☐	☐	C	H	D	W	_____
Coprolalia (obscene words)	☐	☐	C	H	D	W	_____
Blocking/stuttering	☐	☐	C	H	D	W	_____
Other Vocal Tics _____	☐	☐	C	H	D	W	_____
Complex Vocal Combinations (multiple tics at once)	☐	☐	C	H	D	W	_____

References

- Bloch MH, Peterson BS, Scahill L, et al. Adulthood outcome of tic and obsessive-compulsive symptom severity in children with tourette syndrome. *Archives of Pediatrics and Adolescent Medicine*. 2006; 160:65–69. [PubMed: 16389213]
- Cath D, Hedderly T, Ludolph A, Stern J, Murphy T, Hartmann A, Czernecki V, Robertson M, Martino D, Munchau A, Rizzo R. European clinical guidelines for Tourette Syndrome and other tic disorders. Part I: assessment. *European Child & Adolescent Psychiatry*. 2011; 20:155–171. [PubMed: 21445723]
- Chang S, Himle MB, Tucker BTP, Woods DW, Piacentini J. Initial Psychometric Properties of a Brief Parent-Report Instrument for Assessing Tic Severity in Children with Chronic Tic Disorders. *Child & Family Behavior Therapy*. 2009; 31:181–191.
- Cohen DJ, Detlor J, Young J, Shaywitz BA. CLonidine ameliorates gilles de la tourette syndrome. *Archives of General Psychiatry*. 1980; 37:1350–1357. [PubMed: 6255888]
- Collett BR, Ohan JL, Myers KM. Ten-Year Review of Rating Scales. V: Scales Assessing Attention-Deficit/Hyperactivity Disorder. *Journal of the American Academy of Child & Adolescent Psychiatry*. 2003; 42:1015–1037. [PubMed: 12960702]
- Conelea CA, Woods DW. The influence of contextual factors on tic expression in Tourette's syndrome: A review. *Journal of Psychosomatic Research*. 2008; 65:487–496. [PubMed: 18940379]
- Crossley E, Eugenio Cavanna A. Sensory phenomena: Clinical correlates and impact on quality of life in adult patients with Tourette syndrome. *Psychiatry Research*. 2013; 209:705–710. [PubMed: 23684051]
- DuPaul, GJ., Power, TJ., Anastopoulos, AD., Reid, R. ADHD rating scale - IV: Checklists, norms, and clinical interpretation. New York, NY: Guilford Press; 1998.
- Eapen V, Fox-Hiley P, Banerjee S, Robertson M. Clinical features and associated psychopathology in a Tourette syndrome cohort. *Acta Neurologica Scandinavica*. 2004; 109:255–260. [PubMed: 15016007]
- First, MB., Spitzer, RL., Gibbon, M., Williams, JWB. Structured Clinical Interview for DSM-IV-TR Axis I Disorders, Research Version, Patient Edition (SCID-I/P). New York: Biometrics Research, New York State Psychiatric Institute; 2002.
- Freeman RD. Tic disorders and ADHD: answers from a world-wide clinical dataset on Tourette syndrome. *European Child & Adolescent Psychiatry*. 2007; 16:15–23. [PubMed: 17665279]
- Gaffney GR, Sieg K, Hellings J. The MOVES: A self-rating scale for Tourette's syndrome. *Journal of Child and Adolescent Psychopharmacology*. 1994; 4:269–280.

- Goetz CG, Leurgans S, Chmura TA. Home alone: methods to maximize tic expression for objective videotape assessments in Gilles de la Tourette syndrome. *Movement Disorders*. 2001; 16:693–697. [PubMed: 11481693]
- Goodman WK, Price LH, Rasmussen SA, Mazure C, Delgado P, Heninger GR, Charney DS. The Yale-Brown Obsessive Compulsive Scale. II. Validity. *Archives of General Psychiatry*. 1989; 46:1012–1016. [PubMed: 2510699]
- Goodman WK, Price LH, Rasmussen SA, Mazure C, Fleischmann RL, Hill CL, Heninger GR, Charney DS. The Yale-Brown Obsessive Compulsive Scale. I. Development, use, and reliability. *Archives of General Psychiatry*. 1989; 46:1006–1011. [PubMed: 2684084]
- Gosling SD, Mason W. Internet Research in Psychology. *Annual Review of Psychology*. 2015; 66:877–902.
- Leckman JF, Riddle MA, Hardin MT, Ort SI, Swartz KL, Stevenson J, Cohen DJ. The Yale Global Tic Severity Scale: initial testing of a clinician-rated scale of tic severity. *Journal of the American Academy of Child and Adolescent Psychiatry*. 1989; 28:566–573. [PubMed: 2768151]
- Lin H, Yeh CB, Peterson BS, Scahill L, Grantz H, Findley DB, Katsoyich L, Otko J, Lombroso PJ, King RA, Leckman JF. Assessment of symptom exacerbations in a longitudinal study of children with Tourette's syndrome or obsessive-compulsive disorder. *Journal of the American Academy of Child and Adolescent Psychiatry*. 2002; 41:1070–1077. [PubMed: 12218428]
- McGuire J, Kugler B, Park J, Horng B, Lewin A, Murphy T, Storch E. Evidence-Based Assessment of Compulsive Skin Picking, Chronic Tic Disorders and Trichotillomania in Children. *Child Psychiatry & Human Development*. 2012; 43:855–883. [PubMed: 22488574]
- Peterson BS, Leckman JF. The temporal dynamics of tics in Gilles de la Tourette syndrome. *Biological Psychiatry*. 1998; 44:1337–1348. [PubMed: 9861477]
- Piacentini J, Himle M, Chang S, Baruch D, Buzzella B, Pearlman A, Woods D. Reactivity of Tic Observation Procedures to Situation and Setting. *Journal of Abnormal Child Psychology*. 2006; 34:647–656.
- Podsakoff PM, MacKenzie SB, Lee JY, Podsakoff NP. Common method biases in behavioral research: a critical review of the literature and recommended remedies. *J Appl Psychol*. 2003; 88:879–903. [PubMed: 14516251]
- Reese HE, Scahill L, Peterson AL, Crowe K, Woods DW, Piacentini J, Walkup JT, Wilhelm S. The Premonitory Urge to Tic: Measurement, Characteristics, and Correlates in Older Adolescents and Adults. *Behavior Therapy*. 2014; 45:177–186. [PubMed: 24491193]
- Safren SA, Sprich S, Mimiaga MJ, Surman C, Knouse L, Groves M, Otto MW. Cognitive behavioral therapy vs relaxation with educational support for medication-treated adults with ADHD and persistent symptoms: a randomized controlled trial. *JAMA*. 2010; 304:875–880. [PubMed: 20736471]
- Scahill L, Leckman JF, Schultz RT, Katsoyich L, Peterson BS. A placebo-controlled trial of risperidone in Tourette syndrome. *Neurology*. 2003; 60:1130–1135. [PubMed: 12682319]
- Silva RR, Munoz DM, Barickman J, Friedhoff AJ. Environmental factors and related fluctuation of symptoms in children and adolescents with Tourette's disorder. *Journal of Child Psychology and Psychiatry*. 1995; 36:305–312. [PubMed: 7759592]
- Spencer T, Wilens T, Biederman J, Faraone SV, Ablon J, Lapey K. A double-blind, crossover comparison of methylphenidate and placebo in adults with childhood-onset attention-deficit hyperactivity disorder. *Archives of General Psychiatry*. 1995; 52:434–443. [PubMed: 7771913]
- Storch EA, Murphy TK, Fernandez M, Krishnan M, Geffken GR, Kellgren AR, Goodman WK. Factor-analytic study of the Yale Global Tic Severity Scale. *Psychiatry Research*. 2007; 149:231–237. [PubMed: 17150256]
- Storch EA, Murphy TK, Geffken GR, Sajid M, Allen P, Roberti JW, Goodman WK. Reliability and validity of the Yale Global Tic Severity Scale. *Psychological assessment*. 2005; 17:486–491. [PubMed: 16393016]
- Swain JE, Scahill L, Lombroso PJ, King RA, Leckman JF. Tourette Syndrome and Tic Disorders: A Decade of Progress. *Journal of the American Academy of Child & Adolescent Psychiatry*. 2007; 46:947–968. [PubMed: 17667475]

- The Psychological Corporation. Wechsler Test of Adult Reading Manual. San Antonio, Texas: The Psychological Corporation; 2001.
- Tourette Syndrome Association International Consortium for Genetics (TSAICG). Genome scan for Tourette disorder in affected-sibling-pair and multigenerational families. *American Journal of Human Genetics*. 2007; 80:265–272. [PubMed: 17304708]
- Wilhelm S, Peterson AL, Piacentini J, Woods DW, Deckersbach T, Sukhodolsky DG, Chang S, Liu H, Dziura J, Walkup JT, Scahill L. Randomized trial of behavior therapy for adults with Tourette syndrome. *Archives of General Psychiatry*. 2012; 69:795–803. [PubMed: 22868933]

Table 1

Demographic and clinical indices.

Variable	N(%) / M(SD)
Mean Age	31.6 (13.7)
Gender	
Male	78 (63.9%)
Female	44 (36.1%)
Ethnicity	
Caucasian	98 (80.3%)
Hispanic	17 (13.9%)
African-American	1 (0.8%)
Asian-American	4 (3.3%)
Pacific Islander	1 (0.8%)
Other	1 (0.8%)
IQ	106.0 (9.6)
YGTSS Baseline	
Motor Total	15.2 (3.2)
Vocal Total	7.8 (5.2)
Overall Total	22.9 (6.6)
Y-BOCS Baseline	
Obsessions	1.9 (3.8)
Compulsions	3.3 (4.7)
Total	5.2 (7.8)
ADHD Inattention Baseline	6.9 (6.2)
Tic Diagnosis	
TS	103 (84.4%)
CTD	19 (15.6%)
Comorbidity Status	
ADHD	34 (27.9%)
Major Depressive Episode	3 (2.5%)
Dysthymic Episode	4 (3.3%)
Bipolar Disorder	1 (0.8%)
Panic Disorder	1 (0.8%)
Obsessive-Compulsive Disorder	19 (15.6%)
Social Phobia	3 (2.5%)
Specific Phobia	12 (9.8%)
Generalized Anxiety Disorder	8 (6.6%)
Hair Pulling Disorder	1 (0.8%)
No Comorbid Disorder	66 (54.1%)

Note. Values represent means (SD) and frequency (%); IQ = Intelligence Quantity; YGTSS = Yale Global Tic Severity Scale; Y-BOCS = Yale-Brown Obsessive-Compulsive Scale; ADHD = Attention Deficit/Hyperactivity Disorder; TS = Tourette's Syndrome; CTD = Chronic Tic Disorder.

Table 2

Descriptive statistics of presence, frequency, intensity, and severity of individual tics.

Tic	Present (%; n/N)	Frequency M(SD)	Intensity M(SD)	Severity M(SD)
Motor				
Eye Blinking	72% (87/121)	2.9 (1.1)	2.2 (1.0)	5.0 (1.8)
Eye rolling/darting	31% (38/121)	2.8(1.2)	2.2 (1.1)	5.0 (2.0)
Head Jerk	67% (81/121)	2.9 (0.9)	2.6 (1.0)	5.5 (1.8)
Facial Grimace	55% (66/120)	2.6 (0.9)	2.3 (0.9)	4.9 (1.4)
Mouth/Tongue Movements	55% (58/120)	2.8 (1.0)	2.1 (1.0)	4.8 (1.8)
Shoulder Shrugs	56% (68/121)	2.6 (0.9)	2.3 (0.9)	4.9 (1.4)
Chest/stomach tightening	37% (45/121)	2.3 (0.9)	2.3 (1.2)	4.6 (1.8)
Pelvic Tensing Movements	17% (20/121)	2.4 (0.9)	1.9 (0.9)	4.2 (1.5)
Leg/Feet Movements	50% (60/121)	2.5 (0.9)	2.0 (1.0)	4.5 (1.7)
Arm/Hand Movements	61% (74/121)	2.8 (1.0)	2.3 (1.0)	5.1 (1.7)
Echopraxia (copying another's gestures)	8% (10/121)	2.1 (1.0)	2.0 (1.0)	4.1 (1.7)
Copropaxia (obscene gestures)	4% (5/121)	2.8 (0.8)	2.4 (1.1)	5.2 (1.1)
Other Motor Tics	32% (36/112)	3.0 (0.9)	2.6 (0.9)	5.5 (1.7)
Complex Motor Combinations (multiple tics at once)	47% (54/114)	2.7 (0.9)	2.8 (0.9)	5.4 (1.7)
Total Motor Tics M(SD)	5.8 (2.8) ¹	2.7 (0.7)	2.3 (0.7)	29.6 (15.6)
Vocal				
Grunting	31% (38/121)	2.3 (0.9)	2.0 (1.0)	4.3 (1.6)
Sniffing	42% (50/120)	2.7 (1.0)	2.0 (1.0)	4.6 (1.8)
Snorting	12% (14/120)	2.6 (1.1)	2.2 (1.0)	4.8 (1.7)
Coughing	23% (27/120)	2.4 (0.9)	2.0 (0.9)	4.4 (1.6)
Animal Noises	8% (10/120)	2.4 (1.0)	2.5 (1.1)	4.9 (1.9)
Syllables	10% (12/120)	2.5 (0.8)	2.2 (0.7)	4.7 (1.2)
Words	15% (18/119)	2.3 (0.9)	2.3 (0.9)	4.6 (1.5)
Phrases	11% (13/119)	2.5 (1.1)	2.2 (0.8)	4.7 (1.4)
Echolalia (repeating vocalizations of others)	12% (14/120)	2.0 (0.8)	2.2 (1.0)	4.2 (1.4)
Coprolalia (obscene words)	7% (8/120)	3.0 (0.8)	2.9 (1.2)	5.9 (1.8)
Blocking/stuttering	19% (23/120)	2.4 (1.0)	2.5 (0.9)	4.8 (1.8)
Other Vocal Tics	29% (34/117)	2.5 (1.0)	2.5 (0.9)	4.9 (1.6)
Complex Vocal Combinations (multiple tics at once)	14% (16/117)	2.3 (0.8)	2.5 (0.7)	4.6 (1.6)
Total Vocal Tics M(SD)	2.3 (2.3) ²	2.4 (0.9)	2.1 (0.8)	13.4 (12.1)
Total Scores	8.1 (4.5)	2.6 (0.6)	2.3 (0.7)	39.5 (25.0)

Note. Present = number of different types of tics presented in the last week; Frequency = frequency of tics in the past week (1–4 Likert-type scale); Intensity = intensity of tics in the past week (1–4 Likert-type scale); Severity = severity of presented tics;

¹
n = 121;

²
n = 96.

Table 3

ATQ interscale correlations.

	Motor Frequency	Vocal Frequency	Total Frequency	Motor Intensity	Vocal Intensity
Vocal Frequency	.63**				
Total Frequency	.92**	.85**			
Motor Intensity	.83**	.52**	.77**		
Vocal Intensity	.57**	.92**	.78**	.60**	
Total Intensity	.78**	.76**	.89**	.92**	.85**

** Note. Significant on 0.01 level (2-tailed); ATQ = Adult Tic Questionnaire

Table 4

Correlations between the ATQ and YGTSS factors.

	YGTSS Total Score	YGTSS Motor Total	YGTSS Phonic Total	YGTSS Motor Intensity	YGTSS Phonic Intensity	YGTSS Total Intensity	YGTSS Motor Frequency	YGTSS Vocal Frequency	YGTSS Total Frequency
ATQ Total Severity	.73**	.57	.57**	.41**	.47**	.57**	.35**	.46**	.57**
ATQ Motor Severity	.61**	.62**	.41**	.43**	.35**	.48**	.40**	.32**	.44**
ATQ Vocal Severity	.68**	.32**	.65**	.26*	.45**	.48**	.24*	.47**	.51**
ATQ Motor Intensity	.60**	.61**	.39**	.46**	.35**	.50**	.31**	.29**	.38**
ATQ Vocal Intensity	.66**	.33**	.62**	.29**	.45**	.50**	.20	.40**	.43**
ATQ Total Intensity	.71**	.57**	.55**	.44**	.47**	.59**	.28**	.41**	.50**
ATQ Motor Frequency	.58**	.57**	.39**	.36**	.32**	.43**	.45**	.33**	.46**
ATQ Vocal Frequency	.68**	.30**	.66**	.22*	.43**	.44**	.28**	.51**	.57**
ATQ Total Frequency	.70**	.54**	.55**	.36**	.44**	.53**	.40**	.45**	.58**

**
Note. = significant at the 0.01 level (2-tailed);

*
= significant at the 0.05 level (2-tailed); YGTSS = Yale Global Tic Severity Scale; ATQ = Adult Tic Questionnaire.