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## Systematic Review of Severity Scales and Screening Instruments for Tics: Critique and Recommendations

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### Abstract

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Supporting Data

Additional Supporting Information may be found in the online version of this article at the publisher's web-site.

**Background**—Several clinician, informant, and self-report instruments for tics and associated phenomena have been developed that differ in construct, comprehensiveness, and ease of administration.

**Objective**—A Movement Disorders Society subcommittee aimed to rate psychometric quality of severity and screening instruments for tics and related sensory phenomena.

**Methods**—Following the methodology adopted by previous Movement Disorders Society subcommittee papers, a review of severity and screening instruments for tics was completed, applying a classification as “recommended,” “suggested,” or “listed” to each instrument.

**Results**—A total of 5 severity scales (Yale Global Tic Severity Scale, Tourette Syndrome Clinical Global Impression, Tourette’s Disorder Scale, Shapiro Tourette syndrome Severity Scale, Premonitory Urges for Tics Scale) were “recommended,” and 6 (Rush Video-Based Tic Rating Scale, Motor tic, Obsessions and compulsions, Vocal tic Evaluation Survey, Tourette Syndrome Global Scale, Global Tic Rating Scale, Parent Tic Questionnaire, Tourette Syndrome Symptom List) were “suggested.” A total of 2 screening instruments (Motor tic, Obsession and compulsions, Vocal tic Evaluation Survey and Autism-Tics, Attention Deficit/Hyperactivity Disorder and Other Comorbidities Inventory) were “recommended,” whereas 2 others (Apter 4-questions screening and Proxy Report Questionnaire for Parents and Teachers) were “suggested.”

**Conclusions**—Our review does not support the need for developing new tic severity or screening instruments. Potential objectives of future research include developing a rating instrument targeting the full spectrum of tic-related abnormal behaviors, assessing/screening malignant forms of tic disorders, and developing patient-reported outcome measures.

## Keywords

tics; urges; Tourette’s syndrome; rating scales; screening

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Tics, the cardinal feature of Tourette syndrome (TS) and other primary tic disorders,<sup>1</sup> are rapid, recurrent, nonrhythmic movements or vocalizations differing in complexity, frequency, and interference with normal behavior.<sup>2,3</sup> Individuals with tics report premonitory urges, unpleasant sensations preceding tics, and momentarily relief after tics.<sup>4</sup> They often have additional complex repetitive behaviors (echo-, pali-, copro-phenomena, or nonobscene socially inappropriate behaviors).<sup>2,4</sup> Attention deficit-hyperactivity disorder, obsessive-compulsive disorder, and anxiety/mood disorders are commonly associated with TS, and these behaviors are sometimes more problematic than tics.<sup>5,6</sup>

The population prevalence of TS in children was estimated between 0.3% and 0.9%.<sup>7</sup> A meta-analysis of school-based studies estimated a prevalence of 1.61% for chronic tic disorders and 2.99% for transient tics.<sup>8</sup> Variability in prevalence estimates can be partly explained by differences in screening and ascertainment methods.<sup>8</sup> There is limited guidance on the accuracy and feasibility of screening methods for tics.

Several clinician, informant, and self-report instruments for tics and associated phenomena have been developed that differ in construct, comprehensiveness, and ease of administration. An ideal rating scale for tics should capture the different dimensions of tics (frequency,

intensity, interference, impairment) and demonstrate divergent validity, such that it is not highly correlated with measures of coexisting behavioral disorders.

To provide clinicians and researchers guidance on scale selection, the Committee on Rating Scale Development of the International Parkinson's Disease and Movement Disorder Society organized a subcommittee to systematically review the psychometric properties and use of severity rating and screening instruments for tics and associated sensory phenomena.

## Materials and Methods

A literature search strategy was implemented by 2 subcommittee members (D.M. and T.P.) and reviewed by the other members. All instruments used in studies involving individuals with tics were included. We searched Medline, EMBASE, and PsychInfo for relevant articles from database inception until April 2015. Search terms are listed in Table S1 of the Supplementary Materials. We screened the references of retrieved articles to identify additional references. Finally, we conducted a search in OpenSIGLE and PsycEXTRA and included any additional articles known to subcommittee members. Relevant articles written in any language were included regardless of publication type.

Only data from clinical studies involving rating or screening instruments for tics or premonitory urges were selected. Abstracts were selected that presented data on design, validation, translation, cross-cultural adaptation, and psychometric analysis of instruments. Abstract selection was performed independently by 2 subcommittee members (D.M. and T.P.), who came to consensus on the final list of included articles (see figure in Supplementary Materials).

All articles for each instrument were reviewed independently by 2 subcommittee members, who reached consensus on an appraisal document that covered description, versions, availability, use, and clinimetric attributes.

In the final instrument appraisal, the subcommittee adopted terminology of the International Parkinson's and Movement Disorders Society Committee on Rating Scales Development. Final assessment was based on consensus among subcommittee members and the steering committee of the Committee on Rating Scales Development. The official definitions for subcommittee critiques are the following: "recommended" if it has been applied to tic disorders populations, there are studies on its use beyond the group that developed the scale, and it has been found sufficiently valid, reliable, and responsive to change; "suggested" if it has been applied to tic disorders populations, but only one of the other criteria applies; "listed" if the instrument has been applied to tic disorders populations, but does not meet other criteria. Our judgment on psychometric properties on severity scales was based on inter-rater reliability, convergent and divergent validity, internal consistency, and responsiveness; test-retest stability was not considered relevant given the high temporal variability of tics. For screening instruments, we considered sensitivity, specificity, and positive and negative predictive values as well as interrater reliability. As an official International Parkinson's and Movement Disorders Society document, this report was

approved by the Scientific Issues Committee of the International Parkinson's and Movement Disorders Society.

## Results

Our systematic review led to the identification of 16 scales rating the severity of tics or tic-related sensory phenomena. Of these, 5 were “recommended” for use in primary tic disorders by the panel through consensus, 6 were “suggested,” and 5 were “listed.” We also identified 13 screening instruments for tics, 2 of which were “recommended,” 2 were “suggested,” and 9 were “listed.” Detailed information on each instrument identified is available in the Supplementary Materials.

Table 1 summarizes the content, utility, advantages, and limitations on the 11 “recommended” and “suggested” severity scales. Among the “recommended” scales, the Yale Global Tic Severity Scale (YGTSS) is the most extensively deployed worldwide and recommended by TS international guidelines. The YGTSS, developed on the basis of the Tourette Syndrome Global Scale,<sup>9</sup> displayed very good internal consistency,<sup>10</sup> interrater reliability,<sup>11</sup> and convergent and divergent validity.<sup>9–11</sup> An important advantage when compared with other instruments is that its total (motor + phonic) tic severity sub-score can identify clinically meaningful exacerbations of tics.<sup>12</sup> Other “recommended” scales such as the Shapiro TS Severity Scale<sup>13</sup> and the TS-Clinical Global Impression<sup>14</sup> are less comprehensive than the YGTSS and do not assess some tic dimensions such as frequency, complexity, and distribution, but they are quicker and easier to administer. The Tourette's Disorder Scale is the only “recommended” severity scale to measure also comorbid behavioral symptoms (inattention, hyperactivity, obsessions, compulsions, aggression, and emotional symptoms),<sup>15</sup> but has lower internal consistency and interrater reliability than the YGTSS.<sup>15,16</sup> The Premonitory Urge for Tics Scale is the only “recommended” scale specifically designed to assess premonitory urges, but it is psychometrically valid only in patients older than 10 years.<sup>17</sup> Although its convergent validity was not assessed, this is difficult to evaluate because the Premonitory Urge for Tics Scale is, to date, the only scale measuring sensory phenomena specifically related to tics. “Suggested” severity scales did not reach a higher level of recommendation for different reasons, including lack of divergent validity assessment (Rush Video-Based Tic Rating Scale,<sup>18,19</sup> Tourette Syndrome Global Scale,<sup>20</sup> Global Tic Rating Scale,<sup>21</sup> Motor tic, Obsessions and compulsions, Vocal tic Evaluation Survey [MOVES],<sup>22</sup> Tourette Syndrome Symptom List<sup>23</sup>, lack of internal consistency assessment (Tourette Syndrome Global Scale, Global Tic Rating Scale, MOVES, Tourette Syndrome Symptom List), lack of responsiveness assessment (MOVES, Tourette Syndrome Symptom List), and use limited to the developers (Parent Tic Questionnaire<sup>24</sup>). Table S2 in the Supplementary Materials details the psychometric properties of the recommended and suggested severity scales.

Table 2 summarizes the content, utility, advantages, and limitations on the 2 “recommended” (Autism-Tics, AD/HD and Other Comorbidities Inventory [A-TAC] and MOVES) and 2 “suggested” (Proxy Report Questionnaire for Parents and Teachers and Apter 4-questions) screening instruments. The A-TAC is a comprehensive instrument addressing different symptoms, each assessed by a specific module within autistic spectrum disorders, attention

deficit-hyperactivity disorder, developmental coordination disorders, tic disorders, and other childhood mental disorders; the tic module, when assessed independently from the other modules, demonstrated adequate psychometric properties and was easy to administer.<sup>25–27</sup> The MOVES screens for a broader array of behavioral symptoms and has also shown adequate sensitivity, specificity, and positive and negative predictive values for diagnosing tic disorders, but it is longer to administer.<sup>22</sup> The Proxy Report Questionnaire for Parents and Teachers and the Apter 4-questions are, respectively, parent/teacher- and self-administered<sup>28,29</sup> and are limited by insufficient field testing and low specificity.<sup>30</sup>

## Discussion

Our systematic review confirmed the YGTSS as the most comprehensive, reliable, and valid instrument rating tic severity related to the past week. The YGTSS is the only scale for which cut-off values of score changes indicate clinically relevant exacerbations and treatment responses,<sup>12,31,32</sup> making it the most suitable instrument for prospective follow-up in clinic observational longitudinal studies and therapeutic trials. Its relatively long administration, however, could constitute a hindrance to its routine use in busy clinical services. In these settings, alternative options such as the TS-Clinical Global Impression and the Shapiro TS Severity Scale can be recommended, especially when it is not necessary to capture all dimensions of tic severity and a more rapid rating is preferable. It seems unlikely that a video-based scale such as the Rush Video-Based Tic Rating Scale will enter routine clinical use, particularly because of its limited temporal window; on the other hand, this instrument could be of great value to capture short-term fluctuations of tic severity, especially those associated with changes in the environmental or social context and to measure the ability to suppress tics.<sup>18,19,33</sup> The main limitation of the Rush Video-Based Tic Rating Scale that influenced our judgment is the lack of data on divergent validity with respect to video-based instruments assessing other hyperkinetic symptoms (eg, chorea, myoclonus, etc.). The fact that the Rush Video-Based Tic Rating Scale relies exclusively on video-based data, thus providing clinicians with direct observation of the movements, partially mitigates this limitation. Interestingly, factor analytic studies that used the YGTSS have shown that this scale yields 2 separate constructs corresponding to motor and phonic tics.<sup>34,35</sup> Nevertheless, clinimetric properties of the “recommended” scales did not significantly differ when these 2 main categories of tics were rated independently.<sup>10</sup> Among instruments not specifically conceived to rate tics, the Tourette’s Disorder Scale appears as the most reliable.<sup>15</sup>

We identified 2 self-report scales rating sensory phenomena associated with tics, which influence quality of life and are critical to behavioral therapies targeting tics.<sup>36</sup> The Premonitory Urges for Tics Scale rates premonitory urges specifically,<sup>17</sup> is rapid to administer, and has shown good psychometric properties, although limited to patients older than 10 years.<sup>17</sup> This limitation may be difficult to overcome in the absence of biological markers related to these phenomena.<sup>37</sup>

Most screening instruments identified were originally developed for epidemiological studies, and only a small minority have entered clinical use. We assigned the “recommended” grade of judgment to the MOVES<sup>22</sup> and to the A-TAC<sup>38</sup> instruments. The MOVES is a

comprehensive instrument capturing a broad array of abnormal behaviors, which displays a quick scoring system and is widespread among clinicians. The A-TAC is a similarly comprehensive, non-tic-specific screening instrument that requires longer administration. The tic module of the A-TAC, however, displayed good psychometric properties,<sup>25,26</sup> and its administration, extrapolated from the larger scale, would be effective as a screening instrument. Among screening instruments specifically designed for tics but did not reach the “recommended” grade of judgment, the Proxy Report Questionnaire for Parents and Teachers yielded high sensitivity and moderate specificity.<sup>28,29</sup>

Our systematic review identified an adequate number of recommended tic severity rating scales, and we therefore conclude that a new scale for rating tic severity is not needed. Nonetheless, a valid and easy-to-administer severity scale capturing the whole spectrum of pathological behaviors in TS (eg, other complex repetitive behaviors, impulsive actions, attention deficit-hyperactivity disorder, and obsessive-compulsive disorder-related symptoms) would be a highly valuable, albeit ambitious, objective. One limitation of available clinimetric instruments is the inadequate ability to rate/identify cases of malignant TS, which manifests with tic-related injuries and self-injurious/aggressive behaviors requiring urgent treatment and hospitalization.<sup>39</sup> Furthermore, scales based on patient-reported outcome measures are currently lacking in tic disorders. Finally, the identification of 2 “recommended” screening tools (MOVES and A-TAC tic module) and 1 highly promising “suggested” tool (Proxy Report Questionnaire for Parents and Teachers) does not support an urgent need for new instruments screening tics in populations of interest.

## Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Summary of recommendations, structure, and clinical utility of recommended and suggested severity rating scales for tics and premonitory urges

**TABLE 1**

Instrument	Panel judgment	Rater	Tic-related dimensions	Features (other than tics) explored	Time of administration	Main advantages of its clinical application		Main limitations	
YGTSS	Recommended	Clinician	<ul style="list-style-type: none"> <li>• Number</li> <li>• Frequency</li> <li>• Intensity</li> <li>• Complexity</li> <li>• Interference</li> <li>• Overall impairment</li> </ul>	None	15–20 minutes	<ul style="list-style-type: none"> <li>• Comprehensiveness</li> <li>• Availability of a joint tic checklist</li> <li>• Availability of thresholds of score change indicating response to clinical treatment</li> </ul>	<ul style="list-style-type: none"> <li>• Training for administration required</li> <li>• Length of administration</li> </ul>		
STSS	Recommended	Clinician	<ul style="list-style-type: none"> <li>• Intensity</li> <li>• Interference</li> </ul>	None	<5 minutes	Brief and easy to administer	<ul style="list-style-type: none"> <li>• Does not assess frequency, complexity, or distribution</li> <li>• Uncertain time frame within which tic severity is measured</li> </ul>		
TSS-CGI	Recommended	Clinician	Overall adverse impact	None	<2 minutes	Brief and easy to administer	Does not assess individual dimensions separately		
TODS	Recommended	Parent or clinician (2 versions)	<ul style="list-style-type: none"> <li>• Overall severity</li> <li>• Inattention</li> <li>• Hyperactivity</li> <li>• Obsessions</li> <li>• Compulsions</li> <li>• Aggression</li> <li>• Emotional symptoms</li> </ul>	<ul style="list-style-type: none"> <li>• Inattention</li> <li>• Hyperactivity</li> <li>• Obsessions</li> <li>• Compulsions</li> <li>• Aggression</li> <li>• Emotional symptoms</li> </ul>	>20 minutes	Joint assessment of tics and main comorbid behavioral features	<ul style="list-style-type: none"> <li>• Does not assess individual dimensions of tics separately</li> <li>• Length of administration</li> </ul>		
PUTS	Recommended in patients older than 10 years	Patient	Premonitory urges	None	5–10 minutes	<ul style="list-style-type: none"> <li>• The only fully validated instrument to measure tic-related premonitory urges specifically</li> <li>• Brief and easy to administer</li> </ul>	<ul style="list-style-type: none"> <li>• Poor psychometric properties in youth younger than 10 years</li> </ul>		
RYBTRS	Suggested	Clinician	<ul style="list-style-type: none"> <li>• Number</li> <li>• Frequency</li> <li>• Complexity</li> </ul>	None	>30 minutes (including set-up, filming, and video rating)	<ul style="list-style-type: none"> <li>• The only validated instrument to measure current tics objectively through a videorecording within a specified time window</li> <li>• The only instrument that allows to measure the ability of patients to actively inhibit tics</li> </ul>	<ul style="list-style-type: none"> <li>• Does not evaluate tics in the time period prior to filming</li> <li>• Does not assess interference and adverse impact of tics</li> <li>• Requires audio-visual equipment</li> <li>• Length of administration</li> </ul>		

Instrument	Panel judgment	Rater	Tic-related dimensions	Features (other than tics) explored	Time of administration	Main advantages of its clinical application	Main limitations
TSGS	Suggested	Clinician	<ul style="list-style-type: none"> <li>• Frequency</li> <li>• Disruption level</li> </ul>	<ul style="list-style-type: none"> <li>• Behavioral problems</li> <li>• Motor restlessness</li> <li>• School or occupational functioning</li> </ul>	15–20 minutes	Joint assessment of tics, comorbid behavioral features and functioning	<ul style="list-style-type: none"> <li>• Divergent validity with instruments measuring other types of involuntary movements has not been assessed</li> <li>• Length of administration</li> <li>• Does not assess complexity or distribution</li> <li>• Internal consistency and divergent validity have not been assessed</li> </ul>
GTRS	Suggested	Clinician or caregiver (parents or teachers)	<ul style="list-style-type: none"> <li>• Frequency</li> <li>• Overall severity (without assessing individual dimensions)</li> </ul>	None	<2 minutes	Brief and easy to administer	<ul style="list-style-type: none"> <li>• Does not assess individual tic dimensions</li> <li>• Internal consistency and divergent validity have not been assessed</li> </ul>
MOVES	Suggested	Patient	<ul style="list-style-type: none"> <li>• Frequency</li> </ul>	<ul style="list-style-type: none"> <li>• Obsessions and compulsions</li> <li>• Echo- and copro-phenomena</li> </ul>	<5 minutes	<ul style="list-style-type: none"> <li>• Joint assessment of tics and some comorbid behavioral features</li> <li>• Brief and easy to administer</li> </ul>	<ul style="list-style-type: none"> <li>• Does not assess individual tic dimensions other than frequency (measured using generic anchor points)</li> <li>• Internal consistency and divergent validity have not been assessed</li> </ul>
PTQ	Suggested	Parents	<ul style="list-style-type: none"> <li>• Number</li> <li>• Frequency</li> <li>• Intensity</li> </ul>	None	10–20 minutes	<ul style="list-style-type: none"> <li>• The first tic severity rating instrument specifically designed for parent-report</li> <li>• Easy to administer</li> </ul>	<ul style="list-style-type: none"> <li>• Its scoring refers to a limited list of 14 common motor tics and 14 common vocal tics</li> <li>• Field testing is limited (used only by developers)</li> </ul>
TSSL	Suggested	Parents	<ul style="list-style-type: none"> <li>• Frequency</li> </ul>	Nontic repetitive behaviors (5 of 41 items)	10–20 minutes	<ul style="list-style-type: none"> <li>• Useful to assist parents in daily or weekly ratings of tics</li> <li>• Easy to administer</li> </ul>	<ul style="list-style-type: none"> <li>• Does not assess individual tic dimensions other than frequency</li> <li>• Psychometric properties not formally evaluated</li> </ul>

YG/TSS, Yale Global Tic Severity Scale; STSS, Shapiro TS Severity Scale; TS-CGI, Tourette Syndrome-Clinical Global Impression; TODS, Tourette's Disorder Scale; PUTS, Premonitory Urges for Tics Scale; RVBTRS, Rush Video-Based Tic Rating Scale; TSGS, Tourette Syndrome Global Scale; GTRS, Global Tic Rating Scale; MOVES, Motor tic, Obsessions and compulsions, Vocal tic Evaluation Survey; PTQ, Parent Tic Questionnaire; TSSL, Tourette Syndrome Symptom List.

Summary of recommendations, structure, and clinical utility of recommended and suggested screening instruments for tics

**TABLE 2**

Instrument	Panel judgment	Rater	Features (other than tics) explored	Time of administration	Main advantages of its clinical application	Main limitations
A-TAC	Recommended	Clinician	The full inventory screens different behavioral symptoms across developmental disorders; the tic module can be administered independently	<2 minutes for the tic module	Brief and easy to administer, even by nonexperts	Lacks good examples of common tics in the screening questions
MOVES	Recommended	Clinician	<ul style="list-style-type: none"> <li>• Obsessions and compulsions</li> <li>• Echo- and copro-phenomena</li> </ul>	<5 minutes	<ul style="list-style-type: none"> <li>• Joint screening of tics and some comorbid behavioral features</li> <li>• Brief and easy to administer</li> </ul>	Items include very generic examples or descriptions of common tics
PRQPT	Suggested	Parent or teacher	None	<2 minutes	<ul style="list-style-type: none"> <li>• Brief and easy to administer</li> <li>• Designed for parent or teacher administration</li> </ul>	<ul style="list-style-type: none"> <li>• Field testing is limited (used only by developers)</li> <li>• High negative predictive value but low positive predictive value</li> </ul>
Apter 4-q	Suggested	Subject	None	<2 minutes	Brief and easy to administer	<ul style="list-style-type: none"> <li>• High sensitivity but low specificity</li> </ul>

A-TAC, Autism-Tics, AD/HD and Other Comorbidities Inventory; MOVES, Motor tic, Obsessions and compulsions, Vocal tic Evaluation Survey; PRQPT, Proxy Report Questionnaire for Parents and Teachers; Apter 4-q, Apter 4-questions.