

# Evidence-Based Psychosocial Treatments for Tic Disorders

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**Researchers have questioned the clinical utility of psychosocial treatments to reduce tics in persons with chronic tic disorder or Tourette syndrome. The purpose of this research was to perform an evidence-based analysis on various types of psychosocial treatments to ameliorate tics. The rigorous evidence-based criteria established by the American Psychological Association's Division 12 Task Force on Promotion and Dissemination of Psychological Procedures were used to evaluate the evidence base of psychosocial treatments. Results from this investigation indicate that habit reversal training met criteria as a well-established treatment. In addition, exposure and response prevention was deemed to have met criteria necessary for classification as a probably efficacious treatment. The clinical implications of the results and directions for future research on other promising psychosocial treatments for individuals with tics are discussed.**

**Key words:** evidence-based treatment, psychosocial treatment, tic disorders, Tourette syndrome. [*Clin Psychol Sci Prac* 14: 252–267, 2007]

Although a considerable portion of individuals suffering from tic disorders do not have severe enough symptoms to warrant treatment, there is a substantial portion of individuals who require some form of treatment to experience relief from impaired social, emotional, and behavioral functioning. Rather than focus on the entire array of treatment options for tics, in this review we

were interested in examining psychosocial treatments for tics, specifically. Per the *DSM-IV-TR* (2000), tic disorders consist of Tourette syndrome (TS), chronic motor or vocal tic disorder (CT), transient tic disorder, and tic disorder not otherwise specified. Tic disorders represent a class of interrelated conditions, which include the presence of isolated motor or vocal tics (e.g., CT) or motor and vocal tics that co-occur (e.g., TS). Individuals with CT or TS are at risk for experiencing functional impairment in a variety of domains (Robertson, 2000). In particular, individuals suffering from TS have been documented as experiencing the most negative effects pertaining to social, emotional, and behavioral adjustment (Leckman & Cohen, 1999).

Tics refer to involuntary, repetitive movements of the body or detectable vocalizations that are not typical behaviors for the context in which they occur (Jankovic, 2001). They generally wax and wane across the behavioral dimensions of topography, frequency, intensity, and severity (Coffey & Shader, 2003). Tics are typically classified into those that are *simple* and those that are more *complex*. Simple motor or vocal tics are sudden and brief, and, generally, appear meaningless (Leckman, King, & Cohen, 1999). Complex tics, on the other hand, seem purposeful and typically last longer in duration (Robertson & Baron-Cohen, 1998). Over the years, several studies have been performed to establish the prevalence of tic disorders more broadly and tic typologies specifically in the general population. For example, an epidemiological study performed by Kurlan, Fett, Parry, Boetttrick, and Como (2001) reported that 18.5% of children and adolescents had tics and 3.1% actually met clinical criteria for TS. These findings suggest that tics are more prevalent than previously thought (Caine et al., 1988; Comings, Himes, & Comings, 1990).

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### PREVAILING TREATMENT FOR TICS

Several methods of treatment have been devised and administered to reduce tics, including psychopharmacological treatment (Shapiro & Shapiro, 1984), transcranial magnetic stimulation (Ziemann, Paulus, & Rothenberger, 1997), neurosurgical treatment (Rauch, Baer, Cosgrove, & Jenike, 1995), and psychosocial treatment (Azrin & Nunn, 1973). Generally, the first line of treatment proffered to an individual with tics is some form or combination of psychopharmacological treatment (Pauls, 2003; Robertson & Stern, 2000). This is consistent with the prevailing treatment for other conditions, such as challenging behavior among persons with severe intellectual disability, where fewer people receive psychosocial intervention than medication (Robertson et al., 2005). Although psychopharmacological treatments have been repeatedly shown to reduce the various symptoms of CT and TS across a wide range of individuals (Bruun & Budman, 1996; Lipinski, Sallee, Jackson, & Sethuraman, 1997; Shapiro & Shapiro, 1968), there are several aspects of such treatments that limit their use and attendant benefits, including the occurrence of unwanted side effects (Bruun, 1988; Erenberg, Cruse, & Rothner, 1987; Riddle, Hardin, Towbin, Leckman, & Cohen, 1987), poor adherence to treatment regimen (Peterson & Azrin, 1992), inadequate treatment response (Greist, Jefferson, Kobak, Katzelnick, & Serlin, 1995; McDougle, Goodman, & Price, 1993), and failure to teach important behaviors or coping mechanisms. These limitations when considered together suggest that psychopharmacological treatments yield responses that are neither universal nor complete; therefore, there is ample room for psychosocial treatments as alternatives or adjuncts to psychopharmacological ones. It is possible to identify effective psychosocial treatments, because the literature base related to the implementation of psychosocial treatments for tic disorders is quite large and is capable of accommodating a rigorous evaluation of the evidentiary support of psychosocial treatments.

The large literature base notwithstanding, analyses that rigorously synthesize the empirical support of psychosocial treatments for tics are by and large absent from the literature. On the website of the American Psychological Association's Division 12 is *A Guide to Beneficial Psychotherapy* (2006); it is itself devoid of any type of information endorsing methods of practice for tic

disorders. Despite the dearth of attention that has been given to systematically and rigorously evaluating the extent of empirical support for treatments to reduce tics, researchers have recently started to hone in on this shortcoming by attempting to reveal the evidence base for a particular psychosocial treatment to reduce tics—habit reversal training (HRT; Carr & Chong, 2005; Piacentini & Chang, 2005). These recent research efforts are timely because they address an important concern raised by Kazdin and Weisz (2003), who called for the application of evidence-based criteria to treatments for clinical disorders that have not yet been systematically and rigorously assessed, such as tic disorders.

### EVIDENCE-BASED PRACTICE

Evidence-based practice has attracted widespread attention from leading professional, consumer, and institutional governing bodies as the *sine quo non* of clinical practice (Chambless & Ollendick, 2001; Cournoyer & Powers, 2002; Kratochwill, 2005; Task Force on Promotion and Dissemination of Psychological Procedures, 1995). The fundamental idea underlying the notion of evidence-based practice is to ensure that those treatments professionals are implementing with their clientele have been empirically supported for the purposes for which they are used. Evidence-based treatments have been identified by researchers for several psychopathological conditions, including oppositional defiant disorder (Feldman & Kazdin, 1995), attention deficit hyperactivity disorder (Barkely, 1998), anxiety problems (Roth & Fonagy, 1996), eating disorders (Weisz & Hawley, 2002), and enuresis (Chambless & Ollendick, 2001), to name a few. Until recently, though, evidence-based criteria had not been applied to treatments designed to ameliorate tics. The ultimate goal of this article is to enhance the understanding of the evidentiary support of psychosocial treatments for tics. In a recent review of the empirical evidence on the use of HRT to ameliorate tics, Carr and Chong (2005) found that HRT met stringent methodological criteria to be identified as a *probably efficacious* treatment (more on evidence-based criteria later on in the article). This review marked the first time rigorous evidence-based criteria were systematically applied to a psychosocial treatment designed to reduce tics. We acknowledge the importance of this finding; however, we were intrigued to find that the preponderance of attention over the past few decades has

been devoted to the implementation of HRT, with various reviews on its clinical utility to reduce tics (Carr, 1995; Peterson & Azrin, 1992; Piacentini & Chang, 2005; Turpin, 1983; Woods & Miltenberger, 1995). Despite this strong focus on HRT, we were further interested in determining whether alternative psychosocial treatments designed to reduce tics currently meet evidence-based criteria. Moreover, as part of our evaluation of the treatment literature related to tics, we were interested in reanalyzing the studies performed on HRT, in addition to other studies, to see if we would arrive at a similar conclusion to that derived by Carr and Chong (2005).

#### **PURPOSE**

The purpose of this research, then, was to perform an evidence-based analysis to evaluate the empirical support for several psychosocial treatments designed to reduce tic symptomology. In so doing, we also chose to reanalyze the studies conducted on the use of HRT included in Carr and Chong, as well as additional studies not included in their review, to determine if a (dis)similar finding indicating HRT as a probably efficacious treatment would be attained. Because the literature does not indicate that the type of tic disorder moderates the effectiveness of psychosocial treatments (e.g., CT versus TS), we chose to analyze the quality of evidence supporting the efficacy of psychosocial treatments to reduce tics globally, regardless of the specific diagnostic label.

The importance of this research for practice is twofold. First, to enhance clinical practice, practitioners should have an understanding of the degree of evidentiary support for various psychosocial treatment options in order to enhance clients' and key stakeholders' participation in the selection of treatments, as well as to increase the probability of attaining clinically significant outcomes. Having only one evidence-based treatment does not allow patients to have the ability to choose the intervention they see most appropriate for their symptoms, nor does it afford clinicians the capability of administering an additional line of treatment in the occasion that their patient fails to respond adequately to the initial treatment. Hence, extending clinicians' repertoires to include additional evidence-based treatments is important for both the patient and the practitioner. This notion is supported by Chambless and Ollendick (2001) as they argue

that "clinicians need summaries of evidence provided by expert reviews" to guide practice (p. 686).

Second, this research is important to highlight treatments that are promising, but that do not quite satisfy the requirements for an evidence-based label at this point in time. Revealing the specific gaps in the research that prevents the determination of a treatment's evidence-based status (i.e., insufficient sample size(s), poor methodology, or lack of replication) will help stimulate additional research to clarify the empirical status of promising treatments for individuals with tics. We briefly describe in further detail the Carr and Chong (2005) study and how the present research contributes to the literature on the treatment of tics beyond that study.

#### **CARR AND CHONG (2005)**

As discussed above, Carr and Chong (2005) co-authored a paper that described the results of an investigation applying the evidence-based criteria created by the Task Force on Promotion and Dissemination of Psychological Procedures from Division 12 of the American Psychological Association. Carr and Chong chose to concentrate solely on the use of HRT to reduce tics. Limiting their review to 12 of 20 identified studies determined to embody acceptable levels of empirical rigor, they concluded that HRT met the Task Force's criteria as a probably efficacious treatment. According to Carr and Chong, although HRT met most of the criteria to be considered a well-established treatment, it did not receive such a classification because they concluded that the authors of the primary studies did not (a) include treatment manuals, (b) consistently monitor the integrity of their interventions, or (c) describe in detail the characteristics of their samples. Hence, Carr and Chong chose to err on the side of caution by concluding that a label of probably efficacious was a more appropriate conclusion at that point in time.

This research extends Carr and Chong's (2005) analysis in two distinct ways. First, rather than focus exclusively on HRT, we chose to take a much broader focus by evaluating several additional types of psychosocial treatments designed to reduce tics. Second, whereas Carr and Chong included only those studies up to 2001, we included studies through the end of 2005, thereby adding five additional methodologically rigorous studies

to the evidence-based review (Carr, Sidener, Sidener, & Cummings, 2005; Verdellen, Keijsers, Cath, & Hoogduin, 2004; Wilhelm et al., 2003; Woods & Twohig, 2002; Woods, Twohig, Flessner, & Roloff, 2003).

## METHOD

### Literature Search

A list of all the potential treatment studies for inclusion into the analysis was generated by searching the Psychological Abstract, Web of Sciences, and MEDLINE databases over the years of 1970 to 2005, as well as conducting ancestral searches on the reference lists from important review articles on CT or TS. The searches within the above databases were performed using a combination of the following descriptors: treatment(s), intervention(s), variants of the term *Tourette syndrome*, tic disorder, and tic(s). In total, 63 studies were identified that met classification as a psychosocial treatment. These 63 studies were then subjected to additional scrutiny to determine whether they met specific methodological criteria to be considered in the establishment of evidence-based treatments for tics.

Unlike the meta-analytic procedure, which allows one the capability of correlating treatment outcome with research quality, research reviews do not permit such comparisons. Thus, as Mansfield and Busse (1977) point out, in such syntheses researchers should “eliminate from consideration studies with severe methodological inadequacies” (p. 3). Therefore, to ensure that only the most scientifically rigorous individual studies were included in the analysis, studies had to satisfy three methodological criteria in order to merit further investigation: (a) randomization, (b) control group, and (c) adequate outcome measures. These criteria were predicated on recommendations by Wortman (1983) and Cook and Campbell (1979) on judging research quality. Furthermore, studies employing sophisticated single-case experimental designs (i.e., multiple baseline, alternating treatment, and withdrawal designs) that demonstrated intraindividual control were considered for further analysis. As a result, simple AB case study designs, which do not allow for adequate experimental control, were not admitted into the next step of analysis. In total, 30 studies met the inclusion criteria for analysis. Of the studies that were excluded, the majority of studies (82%;  $n = 27$ ) were excluded on the basis of using simple case study designs. The remaining

six studies were excluded due to insufficient information on the independent and dependent variables, sample, and/or experimental design.

### Evidence-Based Criteria

The criteria set forth by the American Psychological Association Task Force for Promotion and Dissemination of Psychological Procedures (1995) and further elaborated upon by Chambless et al. (1998) were used to determine whether particular treatments met the criteria to be deemed an evidence-based treatment for the symptoms of tics. In essence, the criteria determine the degree of evidentiary support for a given treatment. The Task Force’s criteria differentiate treatments according to those that are *well established* and those that are *probably efficacious*.

*Well Established.* Well-established treatments are supported by higher standards of scientific evidence than probably efficacious treatments. Well-established treatments have been demonstrated to be superior to alternative treatments or placebo conditions. In addition, the efficacy of a well-established treatment must be demonstrated in studies with adequate samples sizes and/or a series of studies employing rigorous single-subject designs ( $n = 9$ ). Moreover, well-established treatments must be explicitly detailed or manualized and replicated by a different investigator or team of researchers. In light of the outcomes principle, well-established treatments should be considered the first line of treatment, as they are more sufficiently supported by empirical evidence to produce positive outcomes than probably efficacious treatments.

*Probably Efficacious.* Probably efficacious treatments are a rung down from well-established treatments on the ladder of evidentiary support. Probably efficacious treatment is reserved for treatments that are promising and meet a certain threshold in terms of empirical support, but are in need of independent replication with a larger sample size or a sufficient control group. A treatment can be identified as probably efficacious if it demonstrates comparable results to a well-established treatment and the treatment protocol is sufficiently described so as to allow for replication. One should keep in mind, though, that just because a treatment is labeled probably efficacious does not mean that it cannot or will never be

considered a well-established treatment. Indeed, there may not be good enough research, of sufficient quality or quantity, to deem a particular treatment “well established” at this juncture. The same argument can be applied to treatments that do not quite meet criteria for probably efficacious treatment.

## RESULTS

Overall, six different psychosocial treatments for tics were identified in the literature base reflecting methodologically rigorous studies: (a) habit reversal training, (b) massed negative practice, (c) self-monitoring, (d) contingency management, (e) exposure and response prevention, and (f) cognitive-behavioral treatment (Tables 1 and 2). Of the 63 studies reporting on psychosocial treatments, 30 met criteria for inclusion into the analysis. One study of Varni, Boyd, and Cataldo (1978) met all inclusion criteria, but it was impossible to categorize given the unique multicomponent nature of the intervention program. Nevertheless, out of the 30 studies, six employed group-based methodology with random assignment to treatment conditions; the remaining 24 utilized sophisticated single-case experimental designs. Fifteen of these used a multiple baseline design, and the remaining used either a withdrawal or an alternating treatments design. In total, treatments were administered to 221 participants ranging in age from 7 to 66 years old. Of the 221 participants, 153 (69%) were male and 68 (31%) were female. Moreover, diagnoses of CT and TS were nearly equally distributed across the participants included in the studies. As was able to be discerned from the primary studies, the majority of participants were treated for motor tics. This is consistent with Carr and Chong's (2005) conclusion, as much less attention has been paid to evaluating the efficacy of psychosocial treatments to reduce vocal tics. Additional information on whether (a) participants were taking concomitant medication during the course of the study, (b) follow-up data were collected, and (c) procedures were used to handle missing data in group-based studies are reported in Table 1. Furthermore, we recorded information on the measurement strategies used to evaluate the efficacy of the intervention. Eighty-one percent of the studies included the use of direct observation procedures to measure the frequency of tics, 10% included the use of the Yale Global Tic Severity Scale (YGTSS), and 13%

relied on self-report measures of tic frequency. Thirteen percent of the studies incorporated a multimethod approach to intervention evaluation. A recent investigation of the psychometric properties of the YGTSS by Storch et al. (2005) revealed that it is a reliable and valid instrument for the assessment of tics, and direct observation of tic frequency has been shown to produce adequate interobserver agreement indices (Kompolti & Goetz, 1997). The following are the results of the application of the Task Force's evidence-based criteria to the six psychosocial treatments, beginning first with the psychosocial treatments deemed to have met the Task Force's evidence-based criteria.

### Treatments Satisfying Evidence-Based Criteria

*Habit Reversal Treatment.* Habit reversal treatment is a multicomponent treatment introduced by Azrin and Nunn (1973) that combines the following techniques: (a) recording, (b) awareness training, (c) competing response practice, (d) habit control motivation, and (e) generalization training. Our evaluation of the literature on the use of HRT to decrease tics revealed 20 studies that met the abovementioned criteria for inclusion into the analysis (Table 2). We were able to retrieve an additional five studies (two groups and three single cases) that were not included in the Carr and Chong (2005) study. In some studies, only a few components of the HRT program were implemented. In these instances, we classified the treatment into the HRT category if it included competing response training, arguably the most critical HRT component (Carr, 1995). The following are the results of our systematic review of the studies administering HRT to reduce tics.

Out of the 20 studies, six utilized a group-based randomized control framework and 14 employed rigorous single-case experimental designs to assess the efficacy of HRT. In all but one of the studies (Carr, Bailey, Carr, and Coggin, 1996), the majority of participants demonstrated significant reductions in tic frequency. And, in the Carr et al. study, the authors reported that the interventions were not implemented as planned and, therefore, the results should *not* be interpreted as demonstrative of the lack of efficacy of HRT to reduce tics. In applying the Task Force's criteria for a well-established treatment, we concluded that HRT satisfied the necessary criteria to meet classification as a *well-established* treatment:

(a) randomized clinical trials with adequate control group, (b) replication with different researchers, (c) manualized treatment protocol, (d) numerous single-case studies ( $n > 9$ ), and (e) adequate outcome measures.

*Exposure and Response Prevention.* Exposure and response prevention (ERP) entails first exposing individuals to the sensations and urges that precede the occurrence of their tics followed by the response prevention of the tics. An analysis of the single study by Verdellen, Keijsers, Cath, and Hoogduin (2004) evaluating the use of ERP to reduce tics in patients with TS revealed that it merits classification as a probably efficacious treatment. Although only one study was identified, this conclusion was reached based on the fact that ERP was able to produce comparable results to the well-established treatment of HRT under a randomized clinical design. Moreover, the investigators sufficiently described the treatment protocol, such that different researchers could attempt to replicate the study, and they also provided sufficient information describing the participants included in their study. According to the Task Force's criteria, these features satisfy the requirements necessary for a treatment to be denoted *probably efficacious*.

#### **Treatments Not Satisfying Evidence-Based Criteria**

*Cognitive Behavior Therapy.* Like ERP, only one study was obtained that employed cognitive behavior therapy (CBT) to reduce tics (O'Connor, Gareau, & Borgeat, 1997). The cognitive component of the intervention consisted of mentally challenging and restructuring the way participants evaluated their expectations and actions in high-risk situations related to frequent ticcing behavior. Analysis of this study revealed that CBT produced reductions in tics tantamount to that produced by an HRT comparison condition. However, there were two major shortcomings of this study. First, the study did not have a large enough sample ( $n = 14$ ) to allow one to have confidence in generalizing the results of the investigation. Second, the CBT condition was partially confounded with the HRT condition, because they shared a common treatment component that constitutes a key element of HRT: awareness training exercises to increase control over the tic-affected site. As a result, it is difficult to determine whether the reductions in tics are due to the cognitive behavior intervention or the awareness

training, because both interventions produced comparable results. Owing to these shortcomings, CBT is currently a promising treatment and not a probably efficacious or well-established one.

*Massed Negative Practice.* Massed negative practice (MNP) is based on the notion that over-rehearsal of the target tic by the patient leads to the disappearance of that tic through a process called reactive inhibition (see Evers & van de Wetering, 1994). Analysis of the studies evaluating the efficacy of MNP on tic symptoms revealed that the data were not sufficient to support a classification of MNP as an evidence-based intervention. Indeed, in a randomized control trial comparing MNP to HRT, MNP failed to produce reductions in tics comparable to that produced by the HRT condition (Azrin, Nunn, & Frantz, 1980). In addition, although MNP is one of the most frequently employed behavioral treatments for tics, the majority of studies did not meet the methodological inclusion criteria (e.g., Nicassio, Liberman, Patterson, Ramirez, & Sanders, 1972; Tophoff, 1973). Moreover, only three of the four single-case experimental design studies examined supported the efficacy of MNP as a treatment for tic symptoms. Owing to the above limitations, we were confident in concluding that MNP is not a well-established or probably efficacious treatment at this particular juncture. This conclusion is consistent with those provided by other researchers (King, Scahill, Findley, & Cohen, 1999; Robertson, 2000).

*Self-Monitoring.* Examination of the treatment studies on the application of self-monitoring (SM) tactics to reduce the frequency of tics indicated that SM holds promise as a putative evidence-based treatment. According to Shapiro and Cole (1994), self-monitoring strategies capitalize on awareness and systematic monitoring strategies so that the individual is better able to change and maintain his or her behavior. The difference between these SM studies and the awareness training embedded within the HRT studies is that SM required time-based monitoring and ongoing, systematic recording of tic frequency. Overall, only five single-case experimental design studies including a total of nine participants met inclusion criteria. In one of these, the authors were unable to demonstrate that the efficacy of SM was equal to that of the HRT condition (Peterson & Azrin, 1992). Given the limited

Table 1. Characteristics of primary studies included in evidence-based analysis

Treatment	Study	Age diagnosis	Gender breakdown	Medication status	Follow-up data collected	Missing data analysis
<i>HRT</i>						
	Azrin, Nunn, & Frantz (1980)	16–62	HRT 8 m, 2 f	10% of HRT participants	3-month FU	No missing data procedure specified
	Azrin & Peterson (1989)	CTM	MNP 9 m, 3 f	25% of MNP participants	2-year FU	N/A
	Azrin & Peterson (1990)	9	1 f	No medication	No FU	No missing data procedure specified
	Carr & Bailey (1996)	8–36	7 m, 3 f	Yes 30% (3) participants taking medication	1-month FU	N/A
	Carr, Bailey, Carr, & Coggin (1996)	9	1 m	No medication	No FU	N/A
	*Carr, Sidener, Sidener, & Cummings (2005)	TS	2 m	Yes 50% (1) participant taking medication	No FU	N/A
	Clarke, Bray, Kehle, & Truscott (2001)	8 & 12	2 m	Yes 75% (3) participants taking medication	Up to 1-month FU	N/A
	Finney, Rapoff, Hall, & Christopherson (1983)	11–16	4 m	No medication	5- & 12-month FU	N/A
	Miltenberger & Fuqua (1985)	11 & 12	2 m	N/P	1- and 6-month FU	N/A
	Miltenberger, Fuqua, & McKinley (1985)	CTM	1 f	Yes 22% (2) participants taking medication	1-, 3-, 7-, and 15-week FU	N/A
	O'Connor, Gareau, & Borgeat (1997)	12–60	3 m, 6 f	No medication	2-year FU	No missing data procedure specified
	O'Connor et al. (2001)	23–49	CBT 3 m, 3 f	No medication	2- and 6-month and 2-year FU	Listwise deletion of missing cases
	Ollendick (1981)	CTM	HRT 4 m, 3 f	N/P	3-, 6-, and 12-month FU	N/A
	Peterson & Azrin (1992)	9–11	2 m	Yes 12.5% (1) participant taking medication	No FU	N/A
	Sharenow, Fuqua, & Miltenberger (1989)	10–40	6 m	No medication	1-, 5-, and 9-month FU	N/A
	*Verdellen, Keijsers, Cath, & Hoogduin (2004)	32 & 66	2 m, 1 f	41% of HRT participants	3-month FU	Intent-to-treat analysis
	*Wilhelm et al. (2003)	CTM	HRT 17 m, 5 f	38% of ERP participants	10-month FU	Analysis comparing dropouts-no differences
	Woods, Miltenberger, & Lumley (1996)	7–55	ERP 17 m, 4 f	43.8% of HRT participants	3-month FU	N/A
	*Woods & Twohig (2002)	Mean = 36	HRT 10 m, 6 f	53.8% of SP participants	3-month FU	N/A
	*Woods, Twohig, Flessner, & Roloff (2003)	TS	SP 6 m, 7 f	N/P	3-month FU	N/A
		8–12	3 m, 1 f	N/P	3-month FU	N/A
		7, 9, & 16	3 m	N/P	3-month FU	N/A
		10–12	5 m	Yes 20% (1) participant taking medication	3-month FU	N/A
		TS				

Table 1. *Continued*

Treatment	Study	Age diagnosis	Gender breakdown	Medication status	Follow-up data collected	Missing data analysis
MNP	Azrin, Nunn, & Frantz (1980)	16–62 CT	MNP 8 m, 2 f HRT 9 m, 3 f	10% of HRT participants 25% of MNP participants	3-month FU	No missing data procedure specified
	Canavan & Powell (1981)	24 TS	1 f	Yes current medication (poor treatment adherence)	1-month FU	N/A
	Knepler & Sewall (1974)	20 CTM	1 m	N/P	3- and 6-month FU	N/A
	St. James-Roberts & Powell (1979)	45 CTM	1 m	N/P	No FU	N/A
	Turpin & Powell (1984)	27, 27, & 36 TS	1 m, 2 f	No medication	1-month to 3-year FU	N/A
SM	Billings (1978)	17 CTM	1 f	No medication	No FU	N/A
	Hutzell, Platzek, & Logue (1974)	11 TS	1 m	Yes past medication	1.5- and 12-month FU	N/A
	Peterson & Azrin (1992)	10–40 TS	6 m	Yes 12.5% (1) participant taking medication	No FU	N/A
	Thomas, Abrams, & Johnson (1971)	18 TS	1 m	Yes current medication	No FU	N/A
	Wright & Miltenberger (1987)	19 CTM	1 m	No medication	1-, 2-, and 4-month FU	N/A
CM	Roane, Piazza, Cercone, & Grados (2002)	22 TS	1 m	Yes current medications (none effective)	No FU	N/A
	Wagaman, Miltenberger, & Williams (1995)	9 TS	1 m	No medication	3- and 5-month FU	N/A
ERP	Verdellen, Keijsers, Cath, & Hoogduin (2004)	7–55 TS	ERP 17 m, 4 f HRT 17 m, 5 f	41% of HRT participants 38% of ERP participants	3-month FU	Intent-to-treat analysis
CBT	O'Connor, Gareau, & Borgeat (1997)	23–49 CTM	CBT 3 m, 3 f HRT 4 m, 3 f	No medication	2-year FU	No missing data procedure specified

Notes: \* = studies not included in Carr and Chong's (2005) evidence-based review. CBT = cognitive-behavioral therapy. CM = contingency management. CTM = chronic tic disorder motor. CTM&V = chronic tic disorder motor and vocal. CTV = chronic tic disorder vocal. ERP = exposure and response prevention. FU = follow-up data. HRT = habit reversal training. MNP = massed negative practice. N/A = not applicable to single-case experimental design studies. N/P = no information on medication status of participants provided. SM = self-monitoring. SP = supportive psychotherapy. WLC = wait-list control.



**Table 2.** Evidence-based review of psychosocial treatments for tics

Treatments	Study	Dependent measure(s)	Study design (sample size)	Results of the study
<i>HRT</i>				
	Azrin, Nunn, & Frantz (1980)	Self-report of tic frequency	Group RCT design with MNP control group (22)	At six months, HRT group tics decrease by 99% and significantly more than negative practice group. At long-term follow-up, 8 of the 12 subjects in the HRT group had secondary tics also disappear.
	Azrin & Peterson (1989)	DO of tic frequency	Single-case withdrawal design (1)	The girl's tics reduced to zero during the first six weeks of the treatment and remained at zero at the two-year follow-up.
	Azrin & Peterson (1990)	DO of tic frequency in the home and clinic setting	Group RCT design with waitlist control (10)	Mean reduction in tics across all 10 subjects was 93% at home and 93.5% at clinic. Participants in the initial HRT condition improved significantly over the waitlist control group.
	Carr & Bailey (1996)	DO of tic frequency	Single-case alternating treatment with withdrawal design (1)	The participant's tics were reduced by approximately 70%. The change produced by treatment was maintained at one-month follow-up.
	Carr, Bailey, Carr, & Coggin (1996)	DO of tic frequency	Single-case alternating treatment design (2)	No significant reductions in tic frequency were reported for each of the participants. Authors noted that treatments were not carried out as planned.
	*Carr, Sidener, Sidener, & Cummings (2005)	DO of target tic frequency	Single-case multiple baseline design across participants (2)	Both students demonstrated clinically significant reductions in target tics. Parents reported satisfaction with the treatment.
	Clarke, Bray, Kehle, & Truscott (2001)	YGTSS and DO of tic frequency in the classroom	Single-case A/B/B+C multiple baseline across subjects design (4)	Three of the four students showed substantial reductions in tics (Mean reduction = 70%). At follow-up, three of the participants maintained an average tic reduction of 52%.
	Finney, Rapoff, Hall, & Christopherson (1983)	DO of tic frequency in the home	Single-case multiple baseline across subjects and behaviors design (2)	Both participants experienced rapid decrease in tics at end of the treatment, and results were maintained at one-year follow-up.
	Miltenberger & Fuqua (1985)	Self-report of tic frequency	Single-case multiple baseline across behaviors (habits) (1)	HRT program produced significant decrements in the mean response level for participants.
	Miltenberger, Fuqua, & McKinley (1985)	DO of tic frequency in clinic	Single-case multiple baseline design across subjects (9)	All but one subject showed marked reductions in tics, which were maintained all the way through follow-up.
	O'Connor, Gareau, & Borgeat (1997)	Self-report of tic frequency and degree of control over tic	Group RCT design with HRT control (13)	CBT group showed clinically significant reductions in tic frequency and increased degree of control over tics, and produced comparable results to the HRT group.
	O'Connor et al. (2001)	Self-report of tic frequency and measures assessing social functioning	Group non-RCT waitlist control design (47)	Individuals with chronic and motor tics demonstrated significant improvements compared to a waitlist control group of similar participants.
	Ollendick (1981)	DO of tic frequency	Single-case multiple baseline across settings design (2)	Both children demonstrated significant reductions in tics. For one child the self-monitoring aspect of HRT was sufficient to reduce tics, but for the other child both self-monitoring and competing response practice were necessary for tic reduction.
	Peterson & Azrin (1992)	DO of tic frequency in clinic	Single-case multielement withdrawal design (6)	On average, tics were reduced by 55% in the habit reversal phase relative to baseline, which was more than any other element (self-monitoring and relaxation training).
	Sharenow, Fuqua, & Miltenberger (1989)	DO of tic frequency	Single-case multiple baseline across behaviors and participants design (2)	Significant reductions from pretreatment levels of tics were noted. Social validity data indicated that consumers viewed the treatment as acceptable.
	*Verdellen, Keijsers, Cath, & Hoogduin (2004)	YGTSS, DO of tic frequency in the clinic and home	Group RCT design with exposure-response-prevention control (43)	Patients in the HRT group showed significant reductions in tics on the YGTSS and direct observations of tic frequency in the home and clinic comparable to the ERP group.
	*Wilhelm et al. (2003)	YGTSS and Clinical Global Impression improvement scale	Group RCT design with supportive psychotherapy control group (29)	HRT group improved significantly better than supportive psychotherapy group. HRT group also maintained significant improvement over baseline at 10-month follow-up.
	Woods, Miltenberger, & Lumley (1996)	DO of tic frequency in the home	Single-case multiple baseline across subjects design (4)	Tics were reduced to near-zero levels after implementation of HRT components. Social perception of participants' tics by reviewers suggested that they were less present and problematic following HRT.
	*Woods & Twohig (2002)	DO of tic occurrence in the home	Single-case multiple baseline across subjects design (3)	Two of the three participants' tics were reduced by an average of 25%. Authors noted that all caregivers viewed the treatment as highly acceptable.

Table 2. *Continued*

Treatments	Study	Dependent measure(s)	Study design (sample size)	Results of the study
MNP	*Woods, Twohig, Flessner, & Roloff (2003)	DO of tic frequency in the home	Single-case multiple baseline across subjects design (5)	Four of the five children treated showed clinically significant reductions in their vocal tics. On average, tics were reduced by 82%.
	Azrin, Nunn, & Frantz (1980)	Self-report of tic frequency	Group RCT design with HRT control group (22)	At six months, MNP group decreased tics by 33%, but HRT produced significantly greater reduction in tics than MNP. Only 2 of the 10 participants in the MNP group showed substantial reductions compared to 8 out of 12 in the HRT group.
	Canavan & Powell (1981)	DO of tic frequency in clinic	Single-case alternating treatment design (1)	There was no lasting therapeutic change triggered by the massed practice condition or the enhanced massed practice condition. In fact, in the enhanced massed practice condition, tics were increased.
	Knepler & Sewall (1974)	DO of tic frequency in analogue setting	Single-case ABA withdrawal design (1)	By six-month follow-up, massed practice produced almost total remission of the facial tic.
	St. James-Roberts & Powell (1979)	DO of tic frequency in analogue setting	Single-case alternating treatments design (1)	Clinically significant therapeutic change was produced in the massed practice condition above and beyond the relaxation training condition, with an average reduction of 1.5 fewer tics per minute across the massed practice conditions.
	Turpin & Powell (1984)	DO of tic frequency in clinic	Single-case alternating treatment design (3)	The massed practice condition produced moderate reductions in nonverbal tics, but produced little to no reduction in verbal tics. Cued relaxation training appeared to produce larger reductions in tics than massed practice.
SM	Billings (1978)	DO of tic frequency in clinic	Single-case multiple baseline across behaviors design (1)	SM was found to reduce both the frequency and intensity of both tics targeted in the treatment.
	Hutzell, Platzek, & Logue (1974)	DO of motor and vocal tic frequency in clinic	Single-case multiple baseline across behaviors design (1)	SM produced reductions in both head and vocal tic symptoms that were maintained at one-year follow-up and generalized to the natural environment.
	Peterson & Azrin (1992)	DO of tic frequency in clinic	Single-case multielement withdrawal design (6)	On average, individuals' tics were reduced by 44% in the SM phase compared to baseline estimates. These reductions were not superior to the HRT phase, but were superior to the relaxation phase.
	Thomas, Abrams, & Johnson (1971)	DO of motor and vocal tic frequency in clinic	Single-case multiple baseline across settings design (1)	SM produced instantaneous clinically significant behavior change in vocal tic frequency and also produced changes, albeit less dramatic, in minor vocal tics and neck tic.
	*Wright & Miltenberger (1987)	DO of tic frequency in clinic and generalization settings	Single-case multiple baseline across behaviors design (1)	Subject demonstrated significant reductions in both head and facial tics and effects were generalized to a nonclinic setting.
CM	Roane, Piazza, Cercone, & Grados (2002)	DO of vocal tic frequency in clinic	Single-case alternating treatment design (1)	Initially, lower rates of vocal tics were noted in noncontingent reinforcement conditions; however, overall response rates were highly variable and therefore not conclusive.
	Wagaman, Miltenberger, & Williams (1995)	DO of motor and vocal tic frequency in clinic	Single-case A/B/C withdrawal design (1)	Study showed that differential reinforcement was able to reduce the frequency of tics to near zero. Treatment effects were maintained after fading reinforcement at 50-week follow-up.
ERP	Verdellen, Keijsers, Cath, & Hoogduin (2004)	YGTSS, DO of tic frequency in the clinic and home	Group RCT design with HRT control (43)	Patients in the ERP group showed significant reductions in tics at home and in the clinic and on the YGTSS comparable to the HRT group. Also, roughly 74% of individuals in ERP demonstrated clinically significant outcomes.
CBT	O'Connor, Gareau, & Borgeat (1997)	Self-report of tic frequency and degree of control over tic	Group RCT design with HRT control (13)	CBT group showed clinically significant reductions in tic frequency and increased degree of control over tics, and produced comparable results to the HRT group.

Notes: \* = studies not included in Carr and Chong's (2005) evidence-based review. ABA is a single-case design that includes the following sequence: (A) baseline-(B) treatment-(A) return to baseline. CBT = cognitive-behavioral therapy. DO = direct observation. ERP = exposure and response prevention. HRT = habit reversal training. MNP = massed negative practice. RCT = randomized clinical trial. SM = self-monitoring. YGTSS = Yale Global Tic Severity Survey.

number of single-case experimental design studies and the absence of randomized control studies, SM lacks the necessary evidentiary support, at this time, to be deemed a probably efficacious treatment.

*Contingency Management.* Two single-case experimental design studies were found that used a strict operant method of contingency management to reduce tic frequency (Roane, Piazza, Cercone, & Grados, 2002; Wagaman, Miltenberger, & Williams, 1995). The results from these studies were equivocal. In the study by Roane et al. (2002), participants' responses were highly variable and results were inconclusive in their support of the efficacy of the operant approach to reduce tics. Whereas, Wagaman et al. (1995) reported that a differential reinforcement intervention was able to reduce tics to near-zero levels, and the results were maintained all the way up to a 50-week follow-up observation. Despite the empirical support reported by Wagaman et al., the contradictory findings reported by Roane et al. and the insufficient number of studies prevent the category of contingency management treatment of tics from meeting criteria as an evidence-based treatment.

## DISCUSSION

The general aim of this research was to identify psychosocial treatments that have sufficient evidence in support of their consideration as evidence-based treatments to reduce tics. In so doing, we were first able to confirm partially the result from Carr and Chong's (2005) investigation by demonstrating that HRT met the Task Force's criteria to be recognized as an evidence-based treatment. However, contrary to Carr and Chong's conclusion, which suggested that a label of probably efficacious for HRT was most appropriate, we found, based on additional evidence from primary studies not included in Carr and Chong's study, that HRT satisfied the necessary requirements to be deemed a *well-established* treatment. In addition, we were able to find that the treatment of ERP met the standards set by the Task Force for consideration as a probably efficacious treatment. Although treatments of SM and CBT currently lack the quantity and quality of research necessary to receive an evidence-based classification, our evaluation of the studies examining their application to reduce tics suggests that they offer particular promise for persons with tics. Future research

using rigorous methodology will ultimately reveal the answer regarding the evidence-based status of SM and CBT treatments.

It is noteworthy to describe why we arrived at a similar but *different* conclusion on the evidence-based status of HRT than that determined by Carr and Chong (2005). According to Carr and Chong, HRT did not merit a classification as a well-established treatment for two reasons: (a) lack of manualized treatment protocols/treatment integrity and (b) insufficient description of participant characteristics. However, in our inspection of the studies analyzed in their study, in addition to six other studies not included in their study, we found that (a) four of the studies included explicit reference to one or both of the seminal Azrin and Nunn (1973, 1974) articles describing the original HRT treatment protocol, (b) 11 included a description of HRT in such detail that the article could serve as a sufficient protocol for replication, and (c) two cited the use of a pre-existing treatment manual. The remaining four articles on HRT did not include information in enough detail to permit replication. Nonetheless, we were confident in concluding that, in 81% of the studies, the components of HRT were sufficiently described to allow for future replication.

With regard to Carr and Chong's (2005) statement reflecting the general weakness across the studies to describe participant characteristics, our analysis of the primary studies on HRT revealed that 18 out of the 21 studies clearly specified participants' characteristics. These studies included information about the age, gender, symptom diagnosis, and other comorbid conditions of the participants. Again, we were confident in concluding that HRT met the criterion from the Task Force's evidence-based standards that states that characteristics of the client samples must be clearly specified. Overall, we diverged from Carr and Chong's claim of HRT as a probably efficacious treatment by concluding that it merits classification as a well-established treatment based on the aforesaid data. Several implications arise out of this study.

## Clinical Implications

In light of the current zeitgeist of evidence-based practice, this research contributes to the growing body of evidence-based treatments for psychopathological conditions. This research provides clinicians interested in treating persons

with tics with a summary of treatments with the highest levels of evidentiary support. Although there is likely to be continued discussion about which treatments are or are not effective, it is important to keep in mind that sound empirical research is the only way in which certain treatments can objectively “prove” themselves in the clinical arena. From a social validity standpoint, which focuses, in large part, on the social significance of the effects produced by a treatment, why would one risk implementing an unproven treatment when there are treatments available that are empirically supported to work? If research is to truly inform practice, then treatments supported by the highest-quality scientific evidence should be selected and implemented over other, less empirically supported treatments. In addition, the identification of ERP as a probably efficacious treatment is particularly encouraging considering the high rates of comorbidity between tic disorders and obsessive-compulsive disorder (OCD). One might argue ERP was found to work in the study by Verdellen et al. (2004) because the sample was especially comorbid (i.e., TS and OCD), which could result in the tics targeted by the ERP treatment being misinterpreted as tics rather than compulsions. However, analysis of the sample characteristics reveals that only six (14%) of the participants had symptoms meeting a clinical diagnosis of OCD. Owing to the fact that prior reviews have identified ERP as a well-established treatment to reduce symptoms of OCD (Abramowitz & Schwartz, 2003; Chambless & Ollendick, 2001), the use of ERP holds promising psychotherapeutic benefits for people who experience comorbid tic and OCD symptoms. However, researchers should explore whether ERP is capable of producing desirable, simultaneous reductions in these symptoms.

It is also quite interesting to consider why HRT and ERP would work similarly, despite encouraging seemingly different approaches to tic urges. HRT emphasizes sensitivity to tic sensations and the execution of a more appropriate competing response. ERP is an exposure-based treatment that focuses on the process of habituation. Although these treatments appear to be quite different on face value, closer inspection reveals that they both appear to share a common treatment component. That is, central to both treatments is the process of awareness training, which gets individuals to focus on and become more aware of the antecedent conditions that precede

the occurrence of tics. Thus, awareness training may constitute a vital ingredient to any psychosocial treatment designed to reduce tics. However, such a conclusion is only speculative at this point. An alternative explanation for the similar effects found for both treatments is that they share the common mechanism of habituation. Ultimately, a component analysis of the two treatments would help discern whether awareness training or habituation is the component driving the positive effects found for both treatments. Moreover, determining whether individuals with certain characteristics (e.g., comorbidity, concurrent medication) would respond more favorably to one of these treatments over the other is another potentially important route to take for future research.

It is important to acknowledge that this study only paints part of the picture for a number of individuals with tics, as many present multiple symptoms that impair everyday functioning. As a result, directing a treatment to address only the tics will likely not achieve the end goal of relatively normative functioning for the patient. In this instance, a multimodal treatment will likely be the best approach to treatment. The importance of targeting specific treatments to specific symptoms (e.g., tics) was aptly noted by Robertson and Stern (2000): “There is not evidence to suggest any form of treatment with the exception of surgery is any more than symptomatic in the long term. Management must therefore focus on specific symptoms and be targeted by an analysis of psychopathology and associated behaviors in individual patients” (p. 164). In lieu of the overlapping clinical features of people with CT or TS, it must be realized that a “silver bullet” treatment does not exist. An understanding of the following limitations will help provide a better context for the development of treatment programs designed to reduce tics.

#### **Limitations**

One of the most noticeable pitfalls of the current research base that prevents a more specific and accurate conclusion about the efficacy of certain treatments is the lack of child-, adolescent-, or adult-only samples to determine whether age or developmental period moderates the effectiveness of certain treatments. For instance, it is within reason to hypothesize that cognitive approaches would be more efficacious for adolescent or adult patients,

because they are at a period of development in which they are more capable of understanding and putting into action cognitive strategies. Furthermore, the field lacks adequate information on the contexts in which the treatments are delivered, which would help determine whether individuals are more likely to respond favorably to treatments in some contexts as opposed to others. Moreover, analyses of person-centered factors that relate to treatment response are generally not included in the psychosocial treatment literature for tics. More detailed descriptions of the contextual and individual-level factors surrounding the implementation of treatments for tics in future research will ultimately help to develop an understanding of whether certain environmental and/or individual-level variables mitigate the impact particular treatments have on individuals.

Readers should keep additional limitations of this review in mind. First, the classification of ERP as a probably efficacious treatment on the basis of a single study is questionable. Although all the requirements put forth by the Task Force were met when classifying ERP, the use of a single outcome study (Verdellen et al., 2004) challenges the generalizability and robustness of the finding. Additional group or single-case experimental design studies employing ERP to reduce tics will ultimately help buttress the evidence supporting or refuting the conclusion made by Verdellen et al. It is worth mentioning that in our review of the literature, we found an additional study that evaluated the use of ERP for four individuals with TS. But, due to the use of a simple AB case study design, which lacks experimental rigor, we did not include it in our analysis. Despite the case study design, data from this study indicated that ERP was effective in improving ticcing behavior, with reductions in tics ranging from 50% to 100% for the four cases with TS. This study should be interpreted with caution, though, because it did not use any methods to control for potential confounds. This is especially crucial in the case of tic research where results could be simply due to the waxing and waning nature of tics.

Second, studies examining the effects of combining psychopharmacological treatments with psychosocial treatments under rigorous research designs could not be found. Perhaps an approach to evaluating the effects of psychosocial and psychopharmacological treatments similar to that performed in the Multimodal Treatment

Study of Attention Deficit Hyperactivity Disorder (MTA Cooperative Group, 1999), which compared the psychotherapeutic benefits produced by psychosocial only, psychopharmacological only, and combined treatment conditions, would be useful. Having these data would better allow clinicians the capability of articulating the costs and benefits associated with each type of treatment with their clients.

Finally, another limitation of psychosocial treatments in general, and not necessarily this study, is the latency period between onset of the treatment and noticeable improvement for the client (Peterson & Azrin, 1993), although HRT has been shown to have a relatively short latency to effect (Carr et al., 2005; Miltenberger & Fuqua, 1985). Consequently, individuals who seek instantaneous relief from their symptoms may not want to settle for a psychosocial treatment over a psychopharmacological one. A potential advantage of psychopharmacological treatments, then, is that they demand less time from the clinician to implement and less commitment and effort on behalf of the patient (Peterson & Azrin, 1993). However, even in this case, a clinician should consider implementing a psychosocial treatment as an adjunct to the psychopharmacological treatment in order to engender coping strategies and behaviors that enable the individual to better manage his or her symptoms. Such a comprehensive intervention approach would likely benefit other family members, who might experience stress related to the person with CT or TS (Carter et al., 2000).

## CONCLUSION

In summary, the extant research base supported the identification of evidence-based psychosocial treatments to reduce tics. There have been remarkable advances in the treatment of individuals with CT and TS over the past three decades, and it is our hope that this analysis will stimulate additional research to unveil alternative evidence-based treatments for people with tics. The need to improve and expand the ways in which individuals with CT or TS are treated calls for additional research delineating the environmental and within-child factors that are related to successful treatment response and programming (Kazdin, 2001). Additionally, the evidence-based treatments for tics identified in this research need to be further studied in terms of their *effectiveness* to determine whether the positive findings

typically found in contrived, analogue settings can generalize to other, more applied settings (Chambless & Ollendick, 2001).

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- \* = studies that met inclusion criteria.
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