



# Self-reported emotion regulation in adults with Tourette's syndrome



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## ABSTRACT

Recent work has reported mild impairments in social and emotional processing in Tourette's syndrome (TS), but deliberate attempts to use specific emotion regulation strategies have not been investigated previously. In the present study, adult participants with TS and no comorbidities (TS-alone) were compared to healthy control participants on several self-report measures assessing habitual use of reappraisal and suppression emotion regulation strategies. There were no group differences on measures of reappraisal, but the TS-alone group reported using suppression more frequently than the control group and this was true across a range of negative emotions. The groups did not differ on symptomatology scores of anxiety or depression, although more frequent use of suppression was associated with higher depressive symptomatology for the TS-alone group only. Further work is needed to examine potential factors that may influence emotion regulation in TS, including increased emotional reactivity or expertise in applying strategies to suppress tic symptoms.

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## 1. Introduction

Recent research into Tourette's syndrome (TS) has suggested mild impairments in social and emotional processing in this neurodevelopmental disorder on various tasks assessing social cognition (see e.g. Eddy et al., 2011) and emotional processing (see e.g. Drury et al., 2012). Socially inappropriate behaviour and emotional dysfunction including explosive outbursts and social difficulties have been reported in children and adults with TS and may be linked to emotional regulation, potentially as part of wider issues with impulse control (see e.g. Budman et al., 2000; Freeman et al., 2000; Mathews et al., 2004). Despite recent interest in social-emotional processing in TS, deliberate use of specific emotion regulation strategies has not previously been examined. Depression and anxiety are also relatively common in TS (see e.g. Freeman et al., 2000) and these disorders have been independently associated with differences in emotion regulation (e.g. Aldao et al., 2010). In addition, impulse control difficulties such as rage attacks and self-injurious behaviours are thought to be more common in those with TS and commonly co-occurring disorders such as attention-deficit hyperactivity disorder (ADHD) and obsessive-compulsive disorder (OCD) (see e.g. Budman et al., 2000; Freeman et al., 2000; Mathews et al., 2004). In order to evaluate the extent

to which TS is associated with differences in emotion regulation, it is therefore important to examine performance in those with TS and no comorbid disorders (TS-alone).

An influential model of emotion regulation (see Gross and John (2003)) distinguishes between different emotion regulation strategies based on their targets for intervention: antecedent-focused strategies which influence experiential, behavioural and physiological responses to emotion cues prior to these responses being fully activated, and response-focused strategies which are implemented once emotional responses are already underway. Gross and John (2003) contrast two commonly used strategies: the antecedent-focused strategy of reappraisal (thinking about an emotional event in a way that alters its impact) and the response-focused strategy of suppression (inhibiting emotion-expressive behaviour). They suggest that as reappraisal is used early in the emotion-generative process, it should affect both experiential and behavioural components of emotion, whereas suppression may influence the behavioural expression of emotion but not more experiential aspects, which may therefore continue to be experienced by the individual. Gross and John (2003) suggested that more frequent use of reappraisal and less frequent use of suppression may be more adaptive, and found self-reported habitual use of this pattern of emotion regulation to be associated with enhanced interpersonal functioning, and psychological and physical well-being. A recent meta-analysis of self-reported emotion regulation in clinical disorders revealed the converse pattern, with less frequent use of reappraisal and more frequent use of

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suppression associated with increased anxiety and depression symptomatology (Aldao et al., 2010).

Ochsner and Gross (2007) highlighted several ways in which emotion regulation may be abnormal, including individual differences in knowledge of how and when emotions can be regulated, differences in baseline emotional reactivity, habitual use of specific strategies in everyday life, and ability to implement particular strategies. Little research has yet investigated these factors in TS, although there are reports of hyperactivity of the amygdala to emotional faces in TS (Neuner et al., 2010); similar differences in emotional reactivity have also been reported in other clinical disorders associated with emotion dysregulation, including depression and anxiety disorders (see e.g. Goldin et al., 2009). Those with TS also report increased personal distress when faced with others in emotional crises, which could indicate increased emotional reactivity (Eddy et al., 2015). Taking a broader perspective on hyperactivity, neurological models of TS (e.g. Albin and Mink, 2006) suggest that tics may result from hyperactivity of striatal neurons leading to disrupted inhibition of basal ganglia-thalamocortical circuits. It has also recently been suggested that dopaminergic hyperactivity of subcortical structures such as the basal ganglia may also be linked to subtle differences in emotion recognition reported in TS (Mermillod et al., 2013). The present study therefore explored emotional reactivity in addition to emotion regulation, since increased reactivity and more intense experience of emotions may increase the demand for emotion regulation (Ochsner and Gross, 2007).

Emotion regulation in TS may also potentially share links with suppression of tic symptoms, which many adults with TS are able to do for short periods of time (Banaschewski et al., 2003). Suppression of tics or emotional expressive behaviour both involve inhibition of motor movements in situations where there may be a strong bias towards responding, and similar brain regions have been implicated in both. In particular, prefrontal cortex (PFC) is thought to be involved in suppression of both tics and emotional expressive behaviour, although the regions modulated by the PFC vary depending on whether tics (caudal nuclei and basal ganglia) or emotion expression (amygdala and insula) are the target of suppression (Goldin et al., 2009; Peterson et al., 1998). Several studies using self-reports of tic frequency found that sustained periods of anxiety and stress were associated with increased tic severity (see Conelea and Woods (2008) for a review). Relatively few studies have used direct observations of tic frequency to explore the influence of emotional states on tic expression. Wood et al. (2003) found that tic severity was highest during periods associated with anticipation, resolution of emotional changes, and lower concentration; and lowest during short-term periods of anger and happiness. Decreased tic frequency has also been observed during stress induction tasks (Buse et al., 2016; Conelea et al., 2014) although one study found no effect of stress induction on tic frequency (Conelea et al., 2011). Mixed results have been reported for tic suppression, with Conelea et al. (2011) reporting that stress induction disrupted tic suppression, whereas Buse et al. (2016) found that tic frequency in suppression conditions was similarly low in the stress condition compared to baseline conditions. Buse et al. (2016) suggest that these differing findings may be accounted for by the type of stress induction used, such that maths tasks likely to involve greater cognitive and attentional effort may reduce tic suppression whereas free speech tasks which may be more relevant to everyday emotional situations do not. One intriguing possibility is that these associations between emotional experience and tic severity could potentially reflect the operation of suppression on both tics and emotional expressive behaviour in the short-term.

The present study used self-reported measures of emotion regulation, since these permit broader assessment of real-life behaviour including possible long-term consequences of using

particular emotion regulation strategies compared to more circumscribed situations assessed in behavioural studies. In addition, measures of explicit attempts to regulate emotions have been more widely researched than implicit emotion regulation and may be more amenable to intervention, since they are associated with some level of insight and awareness (see e.g. Gyurak et al. (2011) for a review). The aims of the study were to examine whether or not individuals with TS reported differences in the use of re-appraisal and suppression as emotion regulation strategies, and the extent to which use of these emotion regulation strategies related to symptomatology measures including anxiety, depression, and tic severity. It was predicted that participants with TS-alone would report less adaptive use of emotion regulation relative to the control group, with more frequent use of suppression and less frequent use of reappraisal. The relationship between use of different emotion regulation strategies and measures of anxiety and depression symptomatology was also examined. However, it should be noted that symptomatology scores were expected to fall within a limited range, since the exclusion criteria for this study included diagnosis of mood disorders.

## 2. Methods

### 2.1. Participants

Participants with TS-alone were recruited from a specialist clinic and met DSM-IV-TR (American Psychiatric Association, 2000) criteria for TS. Thirty-one adults with TS were sent a written invitation to take part in the study; 5 of these did not respond and 4 declined to take part. The remaining 22 participants were tested for the study; 2 were excluded due to comorbid ADHD, leaving a final sample of 20 participants with TS-alone (15 male, 5 female). Power calculations based on previous studies (e.g. Joormann and Gotlib, 2010; Swart et al., 2009) found that sample sizes of 4–20 per group would provide 80% power to detect effects of similar magnitudes to those found for other clinical disorders at  $p=0.05$ . Twenty healthy control participants (15 male, 5 female) matched for age, years of education, and Full Scale IQ as measured by the Wechsler Test of Adult Reading (Wechsler, 2001) also took part in the study and were recruited from a participant recruitment website. All participants gave written informed consent in accordance with Ethics Approval granted by the Joint University College London/University College London Hospital Committee on the Ethics of Human Research. Eighteen of the 20 participants with TS-alone (13 male, 5 female) and 14 of the 20 control participants (10 male, 4 female) also took part in an unrelated study examining cognitive inhibition (reported in Drury et al. (2013)). All participants were screened for comorbid psychiatric disorders including ADHD, OCD, depression, anxiety disorders, and psychosis using the Structured Clinical Interview for DSM-IV-TR (First et al., 2002), with the addition of questions relating to DSM-IV-TR criteria for diagnosis of ADHD, which is not addressed by this measure. Exclusion criteria included a history of learning disability, physical illness or injury that might have affected brain function, or major psychiatric illness other than TS (e.g. ADHD, depression, OCD or other anxiety disorders) based on DSM-IV-TR criteria. Inclusion criteria were fluency in English, age between 18 and 60 years, and a Verbal IQ score of 80 or above on the Wechsler Test of Adult Reading (WTAR; Wechsler, 2001). Participants with TS-alone were assessed on the Yale Global Tic Severity Rating Scale (Leckman et al., 1989); tic severity ratings including impairment scores had a mean of 43.15 (SD=21.15). Of the 20 participants with TS-alone in the study, 7 (35%) were taking prescribed medication for management of their TS symptoms at the time of testing. Five were taking antipsychotic preparations alone, and 2 were taking an SSRI

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