

## VIEWPOINT

# Rapid Onset Functional Tic-Like Behaviors in Young Females During the COVID-19 Pandemic

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## Background

Since the beginning of the COVID-19 pandemic, our colleagues working at eight different Tourette syndrome (TS) clinics globally have witnessed a parallel pandemic of young people aged 12 to 25 years (almost exclusively girls and women) presenting with the rapid onset of complex motor and vocal tic-like behaviors.<sup>1</sup> In most cases, these behavioral patterns are consistent with a functional neurological disorder. There have been striking commonalities in the phenomenology of these tic-like behaviors observed across our centers in Canada, the United States, the United Kingdom, Germany, and Australia. The aim of this viewpoint is to help clinicians recognize patients with this disorder and distinguish them from patients with TS. We begin by describing the clinical phenomenology and demographic characteristics of youth with rapid onset functional tic-like behaviors (FTLBs) using illustrative data from the Tic Disorders Clinical Registry at the Calgary Tourette and Pediatric Movement Disorders Clinic. We then discuss our shared experiences across our eight centers and

provide preliminary viewpoints on the pathophysiology and treatment of this complex disorder.

## The Calgary Tic Disorders Clinical Registry

This registry enrolls participants at their first clinic visit into a prospective cohort study assessing long-term outcomes in youth with tics. The registry is approved by the Calgary Health Research Ethics Board, and all participants provide informed consent. Baseline data elements include age, sex, age at tic onset, current medication use, tic disorder diagnosis, Yale Global Tic Severity Scale (YGTSS) score, presence of comorbid attention deficit hyperactivity disorder (ADHD) and symptom severity on the Conners 3, obsessive-compulsive disorder and symptom severity on the Children's Yale Brown Obsessive Compulsive Scale (CYBOCS), anxiety disorder (including generalized anxiety disorder, social anxiety disorder, or panic disorder) and symptom severity on the Multidimensional Anxiety Scale for Children version 2 (MASC2), major

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**Key Words:** tics; Tourette syndrome; functional movement disorders; COVID-19 pandemic

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depressive disorder and symptom severity on the Child Depression Inventory version 2 (CDI2), and autism. Possible tic disorder diagnoses recorded in the registry included TS, persistent motor tic disorder (PMTD), persistent vocal tic disorder (PVTD), and provisional tic disorder (PTD). The diagnosis of FTLBs was added to the registry in 2020. Using this registry data, we contrasted clinical features present at the first clinical visit of participants diagnosed with primary tic disorders and those diagnosed with FTLBs. Children categorized with primary tic disorders met DSM-V criteria for TS, PMTD, PVTD, or PTD. Children categorized with FTLBs had rapid onset of complex tic-like behaviors, with escalation to peak severity within hours to days. All diagnoses were performed by movement disorders specialists with expertise in tic disorders. Continuous variables were compared between groups using a 2-sample *t* test, and categorical variables were compared using the  $\chi^2$  test.

Data from 290 registry participants collected between 2012 and June 30, 2021, were analyzed, comprising 270 with a primary tic disorder (215 TS, 28 PMTD,

4 PVTD, and 23 PTD) and 20 with FTLBs. Of the 20 patients with FTLBs, 17 had no history of previous tics, whereas 3 had mild simple tics earlier in childhood that were never detected. Rapid onset of FTLBs occurred in all participants during the pandemic period (after March 1, 2020), and all endorsed exposure to influencers on social media (mainly TikTok) with tics or TS. With respect to the phenomenology of tic-like behaviors, 18 of 20 had complex vocalizations consisting of the repetition of random words or phrases (eg, knock knock, woo hoo, beans); 11 of 20 engaged in the repetition of curse words, or obscene, offensive, or derogatory statements; 13 of 20 had complex arm/hand movements (clapping, pointing, sign language, or throwing objects); and 14 of 20 had complex behaviors in which they would hit or bang part of their body, other people (typically parents), or objects.

Table 1 summarizes the demographic and clinical features of registry participants. Participants with FTLBs were more likely to be female, were older at first visit, were older at symptom onset, had higher YGTSS total tic and impairment scores, were more likely to have an

**TABLE 1** Calgary tic disorders registry comparison of clinical and demographic features

Variable	Primary tic disorder N = 270	Rapid onset functional tic-like behaviors N = 20	P-value
Female sex, proportion	58 (21%)	19 (95%)	<0.0001
Age at first clinical visit (mean and 95% CI)	10.5 y (10.1, 10.9)	14.3 y (13.5, 15.0)	<0.0001
Age at tic onset (mean and 95% CI)	6.4 y (6.1, 6.8)	13.9 y (13.1, 14.7)	<0.0001
YGTSS total tic score	18.4 (17.4, 19.5)	33.3 (28.7, 38.0)	<0.0001
YGTSS impairment score	15.8 (14.2, 17.3)	28.6 (23.1, 34.1)	0.0001
ADHD diagnosis, proportion	120 (44%)	5 (25%)	0.09
Conners 3 Inattention Subscale T score	65.2 (63.3, 67.1)	68.9 (61.1, 76.8)	0.16
Conners 3 Hyperactivity Subscale T score	67.9 (66.0, 69.9)	64.8 (57.3, 72.3)	0.21
OCD diagnosis, proportion	51 (19%)	1 (5%)	0.12
CYBOCS score	5.1 (4.1, 6.1)	2.7 (0.9, 13.1)	0.22
Anxiety disorder diagnosis, proportion	51 (19%)	15 (75%)	<0.0001
MASC2 total T score	57.4 (55.3, 59.5)	71.0 (64.6, 77.4)	<0.0001
Depression diagnosis, proportion	11 (4%)	11 (55%)	<0.0001
CDI2 total T score	58.0 (55.5, 60.4)	74.3 (68.2, 80.5)	<0.0001
Autism diagnosis, proportion	16 (6%)	0 (0%)	0.26
$\alpha$ -Agonist treatment, proportion	55 (21%)	7 (35%)	0.13
Antipsychotic treatment, proportion	40 (15%)	3 (15%)	0.99
Selective serotonin reuptake inhibitor (SSRI) treatment, proportion	44 (16%)	9 (45%)	0.002
Stimulant treatment, proportion	56 (21%)	3 (15%)	0.53

Calgary Tic Disorders Clinical Registry comparison of clinical and demographic features of primary tic disorder cases with rapid onset functional tic-like behaviors. Abbreviations: CI, confidence interval; YGTSS, Yale Global Tic Severity Scale; ADHD, attention deficit hyperactivity disorder; OCD, obsessive-compulsive disorder; CYBOCS, Children's Yale Brown Obsessive Compulsive Scale; MASC2, Multidimensional Anxiety Scale for Children version 2; CDI2, Child Depression Inventory version 2.

anxiety disorder or major depressive disorder diagnosis, and had significantly higher total symptom scores on the MASC2 and CDI2 (all  $P < 0.0001$ ). Logistic regression controlling for age and sex demonstrated a significant association between the diagnosis of FTLBs and the diagnosis of an anxiety disorder (odds ratio [OR] 4.42, 95% confidence interval [CI] 1.22, 16.00,  $P = 0.02$ ) or major depressive disorder (OR 4.92, 95% CI 1.29, 18.83,  $P = 0.02$ ). Linear regression controlling for age and sex demonstrated a significant relationship between the diagnosis of FTLBs and total tic severity on the YGTSS, with a coefficient of 10.60, 95% CI 5.89, 15.30,  $P < 0.0001$ .

## Viewpoint

Although FTLBs have certainly been described by others in the past,<sup>2-4</sup> until now these cases have represented a small fraction of referrals to TS/tic disorder clinics.<sup>2,3,5</sup> Table 2 provides the estimates on the percentage of new referrals for which functional tics were the primary problem both before the pandemic and in the first half of 2021, and the average annual number of referrals for tics or movement disorders, across five of our centers. Although after the pandemic started referral volumes increased in three centers, remained the same in one center, and decreased in one center, all centers experienced a dramatic increase in the proportion of referrals for FTLBs. Although in the past we have managed children with TS with functional tics in addition to tics related to TS, and

observed a small number of functional tic patients each year as the primary diagnosis, it is the unprecedented increase in new referrals of young females with the rapid onset of tic-like behaviors since the pandemic started that has been so unusual. This has allowed us to record new observations and gather insights into this specific presentation. Many of these rapid onset patients have no definite history of previous tics. They experience the rapid onset of complex tic-like behaviors that escalate in frequency and severity over a period of hours to days, prompting emergency department visits and even hospital admission. Their presentation is notable for complex motor tic-like behaviors and vocalizations, with a relative lack of classic simple motor and/or phonic tics and the absence of the expected rostrocaudal progression at onset,<sup>6</sup> characteristic of primary tic disorders. Common manifestations include large-amplitude arm movements, hitting objects, hitting/punching self or family members, clicking, whistling, repeating a wide range of random and/or bizarre words or phrases, and blurting out obscenities or offensive statements. In many cases, a premonitory urge before these tic-like behaviors is endorsed, as are distractibility and suggestibility. However, suppressibility of tic-like behaviors is more limited and variable between individuals. The magnitude of functional disability and level of parental distress caused by the tic-like behaviors are extreme. Family functioning is often dramatically affected and disrupted. Moreover, many of these young people can no longer attend school or work due to symptom manifestation but are able to perform some activities of daily living

**TABLE 2** Estimated proportion of referrals for FTLBs and average annual new patient referrals for tics/movement disorders, pre- and post-COVID-19 pandemic

Center	Pre-pandemic: estimated percentage of referrals for FTLBs as the primary problem	January–June 2021: estimated percentage of referrals with FTLBs as the primary problem	Pre-pandemic: average number of referrals received per year for tics/movement disorders	2020–2021: average number of referrals received per year for tics/movement disorders
Calgary Alberta Children's Hospital Tourette Clinic	1–2	30	186	290
Sydney Children's Hospital at Westmead Tic Clinic	2–5	35	82	116
Tic and Neurodevelopmental Movements (TANDeM) Evelina London Children's Hospital Guy's and St. Thomas' (GSTT) MD	2	30	300	600
Cincinnati Children's Movement Disorders Clinic	1	20	600	600
UCLA Child OCD, Anxiety and Tic Disorders Program	2	20	92	71

Abbreviations: FTLBs, functional tic-like behaviors; OCD, obsessive-compulsive disorder.

**TABLE 3** Side-by-side comparison of phenomenological presentation of tics and rapid onset FTLBs

	Typical TS tics	Rapid onset FTLBs
Age of onset	Childhood	Adolescence or early adulthood
Symptom onset	Gradual	Abrupt/acute
Initial type of tic	Simple motor	Complex motor or complex vocal
Sex	Male predominance	Female predominance
Most common tics	Eye blinking Head movements Sniffing Throat clearing	Large-amplitude arm movements Self-injurious movements (eg, hitting self or family members) Wide range of odd words or phrases Obscene words or phrases
Most common comorbidities	Attention deficit hyperactivity disorder Obsessive-compulsive disorder	Anxiety disorders Depressive disorders
First-line treatment approach	CBIT Exposure and response prevention $\alpha$ -Adrenergic agonists	Psychoeducation, cognitive behavioral therapy, CBIT, with particular emphasis on the functional interventions—identification and management of antecedents and consequences of FTLBs

Abbreviations: FTLBs, functional tic-like behaviors; TS, Tourette syndrome; CBIT, Comprehensive Behavioral Intervention for Tics.

(eg, utilization of smartphones, computers, creative projects).

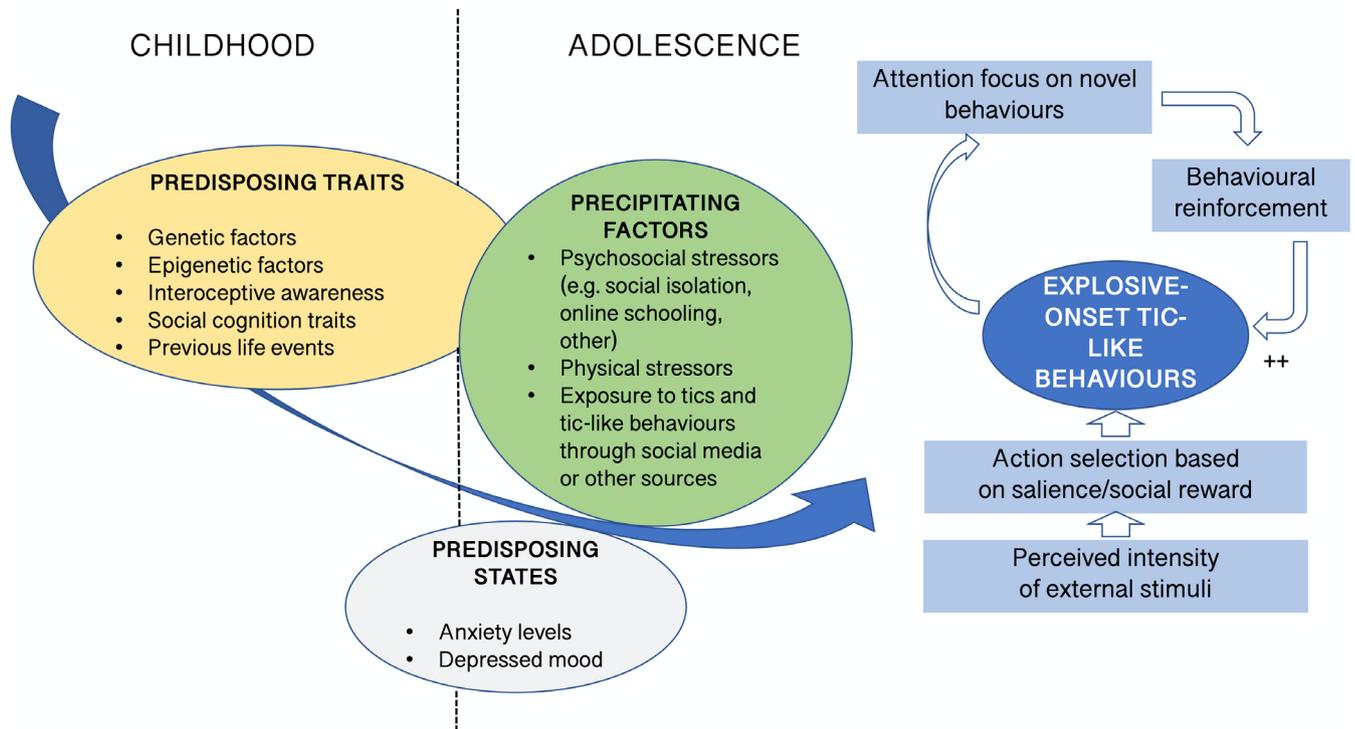
The phenomenology of these rapid onset cases represents a noticeable departure from the usual demographic and natural history of TS (see Table 3). Tic onset in TS typically occurs between ages 4 and 7 years. Boys are disproportionately affected, by a ratio of over three to one.<sup>7</sup> Tics typically begin insidiously, with young children usually having a few different tics at a time that wax and wane and evolve in character. In early years, tics are mostly simple, for example, eye

blinking, nose wrinkling, facial grimacing, sniffing, throat clearing, or coughing. Complex tics may emerge later, over a period of months to years, but typically after simple tics have been present for some time. Tics often worsen in preadolescence (ages 10–12 years) and improve in late adolescence.<sup>8</sup> Other typical characteristics of tic disorders, such as the report of premonitory sensations or urges to perform tics, subsequent relief of urges after the tic, suggestibility, and distractibility, can be present in association with both tics (more so in adolescents than in children<sup>9,10</sup>) and FTLBs and may therefore be less useful in differentiating between these two groups of patients. At difference, an ability to suppress or postpone tics at least briefly is usually demonstrated in older children with “typical” tics, whereas suppressibility of FTLBs appears to be less efficient. The associated psychiatric comorbidity pattern in these rapid onset cases also differs from TS. The most common comorbid disorders in children diagnosed with TS are ADHD and OCD.<sup>11</sup> In the rapid onset cases, there is a higher representation of anxiety disorders and major depression.

Although most young people with this rapid onset of tic-like behaviors have not reported any history of previous tics, we have witnessed several young patients with a history of mild simple tics who reported an explosive onset of complex tic-like behaviors during the same period. Age, sex distribution, phenomenology, and type of onset in this less-represented subgroup are similar to the majority of youth with rapid onset of complex tic-like behaviors without previous history of tics. This similarity intriguingly suggests the possibility of shared predisposing factors in these two subgroups. This presentation differs substantially also from other acute syndromes in which tics or tic-like movements are predominant. In particular, we did not notice any association with recent upper-respiratory/pharyngeal infections or acute obsessive-compulsive spectrum symptoms (eg, those observed in pediatric acute onset neuropsychiatric syndromes), and the phenomenology was not consistent with acute drug-induced movement disorders.

Another relevant characteristic of this new clinical presentation is the association with specific psychosocial stressors, the exposure to which may have increased substantially during the COVID-19 pandemic in this age group. A proportion of these patients reported family-related emotional distress linked to tensions between parents or other family members, which may have been exacerbated by the lockdown. Other patients have described a temporal association between symptom onset and increased stress levels related to “virtual schooling,” meeting academic expectations, and navigating school-home transitions that are accompanied by several academic challenges.

What could be at the origin of this specific, explosive presentation of tic-like behaviors, and why is it



**FIG. 1.** Possible pathophysiological mechanisms for the functional tic-like behaviors (FTLBs) exhibited by this group of patients. As recently proposed in the context of FTLBs,<sup>19</sup> a combination of *predisposing traits* (encompassing, among others, genetic and epigenetic factors and previous life events), *predisposing states* (eg, raised anxiety levels and related low mood), and *environmental precipitating factors* (increase in media exposure to tic-like behaviors, different stressors driven by the pandemic) may prompt an excess of behavioral alterations, such as recurrent tic-like behaviors. In specific groups of people like those whom this viewpoint is focusing on, the environment might be providing the individual with overabundant external stimuli that may be discerned as highly salient (ie, attractive and “popular” tics or tic-like behaviors). Such behaviors will be selected and reinforced, and the individual will, particularly at an initial learning stage, allocate an excess of attention to them, thereby enhancing their probability of recurrence reinforcement. [Color figure can be viewed at [wileyonlinelibrary.com](http://wileyonlinelibrary.com)]

occurring now? Recently, there has been a growth in online video material of youth manifesting tic disorders, shared on social networks. In some cases, these videos were pooled under thematic hashtags focused on TS and yielded exponentially increasing popularity at the beginning of 2021. Interestingly, we and others<sup>1,12,13</sup> have noticed a phenomenological similarity between the tics or tic-like behaviors shown on social media and the tic-like behaviors of this group of patients. In some cases, the patients specifically identified an association between these media exposures and the onset of symptoms, although, with some of the younger children, the social media use was disclosed only after careful questioning. The COVID-19 pandemic has been a major source of stress and anxiety for people globally, resulting in increased mental health symptoms and demand for mental health services.<sup>14-18</sup> Increased social isolation and the widespread utilization of social media may have contributed as precipitating factors in a relevant proportion of these patients. External factors like watching popular social media personalities’ videos portraying tics or tic-like behaviors may have instilled a belief that “tics” may catalyze peer acceptance or even popularity. This exposure to tics or tic-like behaviors is a plausible trigger for the behaviors observed in at least

some of these patients, based on a disease modeling mechanism. However, this specific social media exposure to tic-related videos, although reported in all patients in the Calgary series, was not reported in every patient treated at all the other centers, suggesting that it cannot be considered a prerequisite or necessary causative factor. There is a need for systematic investigation of the relationship between symptom onset, severity, and amount of social media exposure. The explosive behavioral pattern exhibited by these young people could also share pathophysiological mechanisms with the general population of people with FTLBs, as proposed in greater detail in Figure 1.

A comprehensive interview of patients, families, and relevant informants is a first, necessary step to understand the antecedents and triggering factors involved, which will allow deeper understanding of this clinical picture and guide personalized management decisions. Comparisons to historical precedents of similar outbreaks at a more local level are also useful. For example, a regional outbreak of tic-like behaviors was documented in adolescent girls in 2012 in Le Roy, New York, which was attributed to a combination of conversion disorder and mass psychogenic illness.<sup>19</sup>

As our familiarity with this behavioral pattern increases through clinical experience, we need to explore in depth the psychopathological profile of these patients, as well as identify recurrent predisposing family- and peer-related stressors. It would also be relevant to investigate social and adaptive functioning as well as social cognition domains, particularly the processing of socially salient stimuli, their perception, and integration of reward mechanisms related to social cues. Finally, a striking characteristic of this behavioral pattern is its “epidemic” diffusion over a relatively short time, which differs from the slower pace of referral to specialists’ attention of FTLBs and indicates the involvement of suggestibility and behavioral modeling. In this respect, it would be useful to explore whether abnormalities in sense of agency and action monitoring, similar to those observed in people with other functional neurological disorders, are a consistent trait also in these patients or whether performance on these domains is more variable.

We wish to bring neurologists’ attention to this emerging disorder and highlight the important phenotypic differences these cases have from typical cases of TS. A prompt diagnosis and expert review to clarify the phenomenology when necessary is recommended. We also acknowledge that diagnostic labeling may be difficult when childhood onset simple tics and the more complex types of rapid onset FTLBs, coexist in the same patient.<sup>20</sup> Our initial, anecdotal experience is that these patients do not respond typically to conventional pharmacotherapies for tics, either showing dramatic improvement within hours or days of starting an  $\alpha$ -agonist (suggestive of a placebo response) or having no response whatsoever to antipsychotic medications with demonstrated high efficacy for tics.<sup>21</sup> Behavioral treatment approaches, including personalized psychoeducation, seem more appropriate to initiate a therapeutic process. Intuitively, function-based therapeutic strategies,<sup>22-24</sup> including mitigating potential triggering exposures, particularly social media content associated with tics, initiating stress management interventions related to other identifiable psychosocial stressors, reducing social reactions to symptom expression, and addressing comorbid anxiety and depression, could be confirmed as high-yield strategies by future observations. Our prediction is that cognitive behavioral therapies, particularly when including components of the Comprehensive Behavioral Intervention for Tics,<sup>25</sup> might have a considerable chance of success to treat this type of repetitive behavior. ■

### Data Availability Statement

The data that support the findings of this study are available on request from the corresponding author.

The data are not publicly available due to privacy or ethical restrictions.

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